

Valhalla Wilderness Society

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SUMMARY OF INITIAL ECOLOGICAL INVENTORIES OF AN INTACT VALLEY WITH ANCIENT INLAND TEMPERATE RAINFOREST



Douglas Noblet

by Anne Sherrod and Amber Peters

**Based on the professional reports and assessments shared with VWS by biologists
Dr. Toby Spribille, Curtis Björk, Wayne McCrory/Amber Peters, and Tyson Ehlers;
and terrain reconnaissance by Douglas Noblet, Josh Henschell and Craig Pettitt**

For 16 years, a fragment of primeval Inland Temperate Rainforest along five kilometres of the Incomappleux River and its tributary, Battlebrook Creek, stood alone—the only example of rainforest this old and rich in species that people knew in the Columbia-Kootenay region of the Interior Wetbelt. Most of the huge “big trees” in this and nearby valleys had been cut down, or reduced to such small patches that they had lost many sensitive species. So the remnant Incomappleux old-growth had biodiversity that dwarfed that in other forests of the region, even very old ones with big trees.

But then, in 2017 there emerged, previously hidden in plain sight, not far away as the crow flies, the possibility of a sister valley —unlogged, without roads, accessible only by crossing a lake. This possibility inspired a rare team effort by five biologists, a professional photographer, and an environmental group to investigate and record its giant trees, biodiversity, geological wonders and scenic beauty. They had to backpack several days in wilderness rainforest to do so. Several funders, recognizing the significance of the proposed exploration, sponsored their efforts, which went on throughout the summer and fall of 2018. The information recorded herein, and much more, is backed up by professional reports provided to the Valhalla Wilderness Society by the biologists. All photographs in this report, with the exception of the western toad, were taken in the Frisby and Rainbow Valleys by various members of the team, many of them by well-known Kootenay professional photographer Douglas Noblet.

PREFACE

In 2017 Dr. Toby Spribille notified the Valhalla Wilderness Society (VWS) that he had located, using satellite imagery, two unlogged valleys with low-elevation, old-growth forest in our region. These characteristics suggested the possibility of a rare type of very wet, very old Inland Temperate Rainforest known for exceptional biodiversity.

It had been 13 years since VWS first took Dr. Spribille to see the Incomappleux Valley. The giant trees, extraordinary biodiversity and species new to science had made the Incomappleux famous, putting samples of its lichens in laboratories all over the world.

But, despite the years that VWS and Spribille had spent searching for another forest like it in the Kootenay-Columbia region, the Incomappleux remained in a class by itself in the southern half of BC's Interior Wetbelt: an unprotected and isolated fragment left over from another world that was lost forever due to clearcut logging.

So few examples of such high-biodiversity forest have survived clearcutting in the interior of BC that even one major new body of it could be a significant increase in the refuge for certain rare species in the southern Interior Wetbelt region; but it might last only if it could be



*Frisby Valley is very long. This photo shows just a portion near the mouth of the creek. The bright green in the centre is a major wetland.
Drone photography by Douglas Noblet.*

discovered and protected. Thus arose the need for a joint expedition of scientists and environmentalists.

VWS's final grant reports on the project, which will hopefully be available in late February, will include park proposal boundaries and GIS analysis. In the meantime, this interim report summarizes the initial species inventories and habitat assessments of Dr. Spribille, Professor of Symbiosis at the University of Alberta, and Curtis Björk, two of Canada's leading lichen taxonomists; biologist Tyson Ehlers, and VWS Chair and professional wildlife biologist Wayne McCrory, RPBio. Antoine Simon, a Ph.D. student, assisted Dr. Spribille and VWS biologist Amber Peters worked with McCrory—both providing important photos as well..

Organization of the research expeditions was by VWS director Craig Pettitt and Amber Peters. Curtis Björk waived fees set aside for him, and Dr. Spribille waived his travel expenses, enabling VWS to provide small recompense for three trail assistants who became integral to our team. Professional photographer Douglas Noblet donated a treasure trove of photographs and, with Josh Henschell (both members of Search & Rescue), penetrated dense vegetation to photograph and report on areas others could not reach. Rob Martin took on extra weight to lighten the loads of the researchers and enhance safety in the rugged wilderness terrain.



Amber Peters

VWS directors Craig Pettitt (left) and Wayne McCrory (right), inspect a black bear den in Frisby Valley.

REASONS AND GOALS FOR THE PROJECT

Since 2001 VWS has been working to increase protection of Inland Temperate Rainforest. A glance at recent international headlines will tell why:

- ◆ **“Stop biodiversity loss or we could face our own extinction, warns UN”** — *The Guardian*
- ◆ **“Habitat loss threatens all our futures, world leaders warned”** — *The Guardian*
- ◆ **“Biodiversity experts say mass extinction of wildlife is as big a danger as climate change”** *Guardian*
- ◆ **“Scientists say halting deforestation 'just as urgent' as reducing emissions”** — *The Guardian*
- ◆ **“Five Reasons the Earth’s Climate Depends on Forests”** — 40 scientists

In the past many scientists and the UN held that the major carbon emissions from forests came from the burning of tropical forests, and that industrialized nations need not worry because the forests they cut down are replanted. This never-credible fallacy is at last being refuted by scientists. In reality, every cubic metre of trees logged is carbon in the air, and a seedling or sapling can’t store the carbon of a 500 year old giant. The ancient Inland Temperate Rainforests of BC’s Interior Wetbelt are amongst the most carbon-rich forests in the world.

Simultaneously another environmental crisis poses

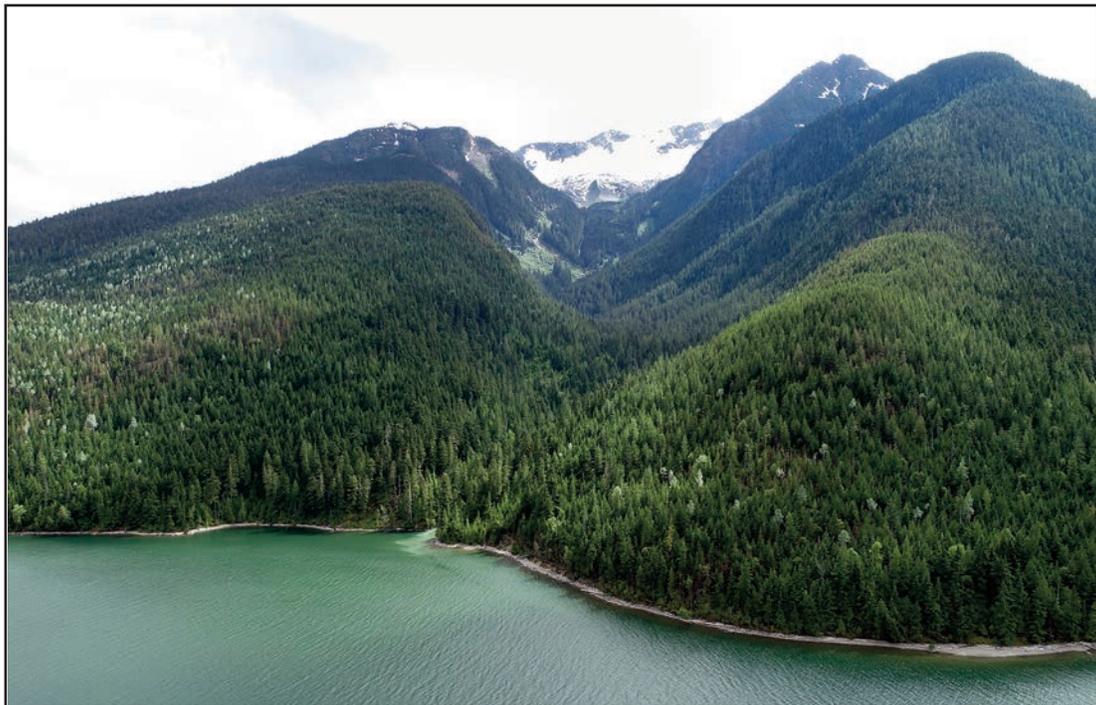
a threat to human survival: in a *New York Times* article this year, renowned biologist Edward O. Wilson speaks of our current massive species loss as “removing Earth’s foundational, billion-year-old environmental support system.” He stated that “The formula widely agreed upon by conservation scientists is to keep half the land and half the sea of the planet as wild and protected from human intervention or activity as possible.”

According to Wilson, an estimated 80% of species on Earth are as yet undiscovered. He calls for biologists to get “boots on the ground” to discover the highest biodiversity areas so that they can be given priority for protection.

This is what VWS began doing 40 years ago. Our past explorations of Inland Temperate Rainforest have led us to propose two high priority park proposals: the Selkirk Mountain Caribou Park proposal and the proposed Quesnel Lake Wilderness. Now a third proposal is in the making that would include the two pristine valleys of this project. But even if all three were protected, they would represent only a few, relatively small, examples of these oldest and highest-biodiversity Inland Temperate Rainforests.

Biodiversity in the Interior Cedar-Hemlock Forests

BC’s Inland Temperate Rainforest (ITR) is the only one of its kind in the world. Its scientific definition is the wet and very wet types of Interior Cedar-Hemlock (ICH) forest.



Douglas Noblet

The adjacent intact valley to Frisby Valley. It was christened “Rainbow Valley” by the exploration team.

ICH itself is not common. It exists in only two regions of Canada: the Interior Wetbelt and the Kispiox regions of British Columbia. The wettest types of ICH are more rare; the old-growth rarer still.

Frisby Valley lies in mountains that are home to the full range of native large carnivores, including grizzly and black bears, cougars, wolves and wolverines, and most of the native hooved animals: deer, elk and moose. Additionally, these mountains have the only deep-snow mountain caribou in the world.

But all of these large species survive at or near the top of a food pyramid which, at its base, is composed of thousands of smaller species. Leading biodiversity experts warn that this is where ecosystems are most in danger of collapse due to a massive, ongoing loss of small species.

The key importance of the ICH to biodiversity is that it occupies the low and middle elevations of rugged mountains, which is the warmest zone with the longest growing season. The highest biodiversity is thus at the low elevations.

In the wettest types of ICH, lengthy fire return intervals and good soil in the valley bottoms allow trees to grow older and larger. Their shade, coolness and moisture give shelter to many species that can't otherwise survive; but the only way to save these species for the future is to save the forests that harbour them. Unfortunately, the features that give these forests the highest biodiversity have also led to their massive decimation by logging.

Before three taxonomists, Dr. Spribille, Curtis Björk and their colleague Trevor Goward, began their work on lichens, it was widely believed that these northern conifer forests were simply low in biodiversity. Today we know that northern conifer forests can harbour higher levels of biodiversity than had been expected. However, whereas tropical forests may have high numbers of animal species, much of the biodiversity of inland rainforest is in small forms such as lichens, mushrooms, and bryophytes (mosses, liverworts et al.).

In Inland Temperate Rainforest, trees, logs and woody debris are often encrusted, carpeted or hung with numerous other forms of life. In Frisby-Rainbow Valleys, this covering rivals the richest areas of the Inland Rainforest Region.



Douglas Noblet

Moss on Rainbow Valley old-growth trees gives the rainforest an aura of antiquity.



Amber Peters

A biodiversity salad of lichens and moss on a log.



Antoine Simon

A lush carpet of Frisby Valley liverworts.

ADVENTURES IN THE LOST FOREST

by Amber Peters, VWS staff biologist

After Dr. Spribille informed VWS of a potentially pristine old-growth rainforest in the Frisby Valley, he led graduate student Gulnara Tagirdzhanova and myself into the wild, unroaded rainforest valley to confirm his findings.

Our team referred to this as the lost forest, because there were no records of scientific exploration or recent human activity whatsoever. However, the first two kilometres were 60-80-year-old forest that had been disturbed by wildfire and shake bolting (the cutting of dead trees for roofing material) in past decades.

Then we reached the old-growth and we were awestruck by the giant cedars. Although we had barely scratched the surface of this vast wonderland of rainforest treasure, we had to turn back before dark. We excitedly returned from our brief reconnaissance, already announcing the discovery of rare lichens. Knowing that very few places like this still exist in the world today, we made plans for further exploration.

The Expedition

To say the least, there was a lot that went into preparing for this adventure. We had to map out the areas we hoped to access where there was potential for high species diversity, and then be physically prepared to get there and back safely. I had never backpacked before, so I worked out for months to be able to carry my share of the weight for a 3-day bushwhack into a rugged wilderness.

In the spring of 2018 Craig and I took a preliminary trip to locate the best foot-access into the valley's old growth. To save money, we used Craig's boat rather than hire a commercial operator to get across Revelstoke Reser-



From left: Rob Martin, Craig Pettitt, Curtis Björk, and Toby Spribille

Amber Peters

voir. We worked on the initial 2 kilometres of the route to make it safer. I planned food for everyone, and we set up a base camp at a campground where the boat would be launched.

Satellite imagery had given us an idea of what we would face on the ground when we commenced our backpack expedition in June, but we far under-estimated the time it would take to traverse the rest of the valley. The thorny Devils Club and

thick-brushed avalanche chutes slowed us down, but we relentlessly plowed through to get to the wet areas of species richness. Toby and Curtis conducted inventory of the biodiversity along the way.

We didn't make it as far on the first day as we had predicted on our aerial maps. The terrain was just too rugged and the night began to fall. We made our way into a beautiful ancient cedar grove where we camped. The next

day, while Toby and Curtis sampled, I took hundreds of photos of the valley, aiming to capture the beauty in front of me so I could share it with the world and campaign to protect it. It was a hot day, and as butterflies circled around us I felt like I was in paradise. As we made our way back we noticed caves up in the cliffs that should be checked for bats.



Douglas Noblet

Rainbow Valley — the magical one.

On the third day, we set out to explore a much smaller valley directly north of the lost forest valley. Although it is completely intact, it lies on the edge of a vast stretch of clearcut logging. The valley has no name on maps, but we had seen a rainbow over it when crossing the lake, so we christened it "Rainbow Valley".

We were joined by photographer Douglas Noblet who had caught up with us the night before at our base camp. Before even entering the valley, Toby and Curtis found an abundance of *Nephroma arcticum*, the arctic paw

lichen, a species that is uncommon in the Kootenay-Columbia Region, where it is at the edge of its range.

When we made it across the mountainside, we found a stunning forest with a soft moss and fern understory. This was nothing like the thorny fields of Devils Club we experienced in the adjacent valley. We crossed the main creek which channeled extensively into slow trickling streams like a peaceful Japanese rock garden. Besides giant cedar trees, we also found an “elfin” forest — old, gnarled hemlocks, probably hundreds of years old, that are stunted because of growing on rocky ground. Toby and Curtis found a lichen listed as threatened under the *Species at Risk Act*, *Lobaria retigera*, in abundance on these trees. We all agreed that this valley is a gem that complements the adjacent Frisby Valley.

Reaching the Heart of the Frisby Old Growth

After Toby and Curtis went home to work through their collections, we were aware that the largest body of old growth was still left unexplored. Given the jungle-like conditions of the undergrowth and the difficult terrain, only bush-experienced, very fit people could go forward to ascertain what really was at the heart of the valley’s low-elevation forest. Luckily, Douglas and his friend Josh from Search and Rescue, who had undertaken similar excursions on their own, were up for it.

In late July, Craig and I guided Josh and Douglas into the wild Frisby Valley to bring back photo evidence of its ecological significance. Craig and I stayed within the first few kilometers of the valley mouth to set up remote wildlife cameras and survey the landscape for park potential. This area is easy walking and a great place for a trail to the first magnificent old-growth forest with trees up to three metres in diameter.

Josh and Doug travelled seven kilometres. Although most of it was very easy walking, they had to bushwhack through a dense elderberry avalanche chute, braving thousands of mosquitos and black flies, to make their way deeper into the valley. They eventually came upon a gorgeous waterfall supplying glacial-blue waters to a tributary of the main creek channel. While they trekked through 10-foot tall Devils Club and Jurassic skunk cabbage swamps, Craig and I found two high use wildlife trails in perfect locations to install our wildlife cameras. Further back in the valley, the explorers found a deeply-rutted wildlife trail so well-travelled that it looked like a park trail. Perhaps in time it will be.

The four of us kept in contact by radio and met on our way out of the valley. Josh and Douglas were gone for two days and returned with beautiful photographs of cedars up to 3.5 meters in diameter, as well as reports of abundant bear and ungulate sign. Leaving the valley, I was sorry to leave because of the colorful array of mushrooms popping up. But we were not yet finished.

On the day of the full Harvest Moon, VWS’s wildlife biologist,

(continued on next page)



Amber Peters

Douglas Noblet at work on the gnarled trunk of an old hemlock in the elfin forest of Rainbow Valley.



Josh Henschell

Jurassic Skunk Cabbage, *Tyrannosaurus Devil's Club*



Douglas Noblet

Adventures in the Lost Forest (continued)

Wayne McCrory came to assess the wildlife habitat, accompanied by Craig and I. He, too, was amazed at the incredible growth of mushrooms.

Wayne's habitat assessment drew on his past experience of conducting wildlife surveys for Parks Canada in nearby Mt. Revelstoke and Glacier National Parks. The Frisby survey included grizzly and black bear habitat potential transects with evaluation for bear foods typical of the Columbia Mountains.

Wayne found that wildlife habitat values in the first two kilometres of 60-80-year-old fire-disturbed forest were low. However, avalanche tracks and wetlands had important habitat potential for both grizzly and black bears. There was evidence in the old cedar forests of bears feeding on Devil's Club berries. We found an ancient hollow cedar that a black bear had made home, and it reminded me of the harm we cause when we fall one of these ancient giants. The older cedar-hemlock-Devil's Club forest type has large areas of impressive, older 1-2.5 metre diameter old-growth trees. This area was rated as High potential for black bear dens.

Craig and I retrieved the memory cards from the cameras and came home to find videos of many critters using these trails. Seeing videos of a mother black bear and her two cubs in our study area was like waking up on Christmas morning. The wildlife cameras also picked up moose, a marten or fisher, and what was likely a cougar or lynx. Moose and a black bear were actually seen by the researchers. I heard a pika calling and diverse bird songs.

By now, the forest floor was covered with mushrooms and when we got home Wayne contacted mycologist Tyson Ehlers, who was eager to help. So I entered again, realizing this forest has become somewhat of a temple for me, a place for mental reset. Tyson was overwhelmed with the biodiversity. It was just too large a task for one mycologist to inventory so many species. In five hours he recorded 112 taxonomic groups and species.

Lichen Researchers Reach Upper Middle Valley

The final excursion of the season was in late October. By now, very low water in the creek enabled Toby Spribille and Ph.D. student Antoine Simon to walk along exposed gravel bars and access a previously unexplored tract of old growth, farther up the valley than Josh and Douglas had been able to reach. They saw very big trees, and large colonies of a rare old-growth dependent lichen species, a significant finding that is telling of the importance of this rainforest ecosystem.

—Amber Peters



Craig Pettitt

Frisby Valley old-growth: a refuge for humans from daily cares; Amber Peters and dog Rona.



Douglas Noblet

Craig Pettitt and Amber setting a wildlife camera.



Amber Peters

Pacific Chorus Frog — subject to habitat loss

Craig and Amber found a Western Toad and a Pacific Chorus Frog near a small wetland. Such wetlands are especially important to amphibians because they don't have fish, which feed on them. McCrory says the wetlands should be checked for other amphibian species.

FRISBY AND RAINBOW VALLEY SPECIES AT RISK

Five kinds of Frisby/Rainbow lichens have been assessed as Species at Risk



Curtis Björk

THREATENED: *Lobaria retigera*



Toby Spribille

SPECIAL CONCERN: *Nephroma occultum*

The lichens shown here are listed under Canada's *Species at Risk Act* (SARA). Both are strongly associated with old-growth rainforest and threatened because of the extensive and ongoing logging of old-growth forest. They are rare and at risk even in their most common habitat, Coastal Temperate Rainforest. They have been found at very few sites in the Interior Wetbelt. Three other Frisby/Rainbow lichens are "blue-listed" (threatened) in BC.

ENDANGERED: Mountain Caribou

Mountain caribou are Endangered under Canada's *Species at Risk Act* (SARA). The federal Minister of Environment and Climate Change has declared their recovery to be imminently threatened by habitat loss. From the 1980s through to 2005, radio-collar data on government maps showed mountain caribou in Frisby, Rainbow and Upper Jordan Valleys. They were also present along the Columbia River in early winter; and in summer and late winter in subalpine and alpine habitat along Frisby Ridge.

Frisby and Rainbow Valleys have no logging or roads, but in 1986 the Revelstoke Dam wiped out a stretch of valley-bottom forest along the Columbia River that included the mouths of Frisby and Rainbow Valleys. Over the last 20 years, snowmobiling, heli-skiing and use of

ATVs on the Frisby Ridge have displaced the caribou even from that habitat. As a result, there are only ten animals left in the Frisby herd as of the last census in 2013.

The VWS wildlife biologist did not see sign of caribou, although some of our team reported a potential scat. McCrory rated the habitat in the lower valley as poor for caribou. However, even after the dam was built, radio-collar signals came from Frisby Valley, and the points suggest that there may be good habitat in the upper valley that our researchers could not reach. The valley may have provided a travel route from the alpine ridge down to the river. In case the valley is still being used, we have left the wildlife cameras in place for the winter.

High Conservation Values in the Wetlands

"Besides the old redcedar forest, a small ephemeral wetland was also one of the more important habitats identified. The study team found one juvenile Pacific Chorus Frog and one adult Western Toad in the vicinity of a perched wetland, suggesting that it may be a locally important breeding area for both amphibian species and possibly others. Loss of numerous valley-bottom wetlands and old cedar-hemlock forests from damming the Columbia River to make Revelstoke Reservoir makes these findings significant and confirms the value of the Frisby study area as a potential provincial park."

— Wayne McCrory, RPBio

Due to dams the Columbia Basin lost 26% of its wetlands, so remaining wetlands are extremely important in the Columbia Basin. Amphibians are declining worldwide and governments across North America are starting to monitor their populations. In a recent study in the neighboring



Isaac Carter

SARA SPECIAL CONCERN: Western Toad

Arrow-Boundary Forest District, only 15 of 38 wetland sites had two species of amphibians present like the Frisby wetland where this toad was found. Only 42.5% had Pacific Chorus Frogs, and only 27.5% had Western Toads.



Douglas Noblet



Antoine Simon

Right: One of the most spectacular lichen finds in the Frisby Valley was a substantial population of the Methuselah’s Beard lichen, *Usnea longissima* .

WHY LICHENS?

Many lichens require high humidity and cool temperatures, so it’s no accident that lichens are characteristic species of temperate rainforest ecosystems. Previous to about 20 years ago, many lichen species in BC were known only in the Coastal Temperate Rainforest, which catches rainfall from the ocean. The discovery of some of these lichens growing in the Interior Wetbelt, as much as 500 km inland, first alerted scientists to the fact that there is rainforest in the interior of BC — ecosystems found nowhere else in the world, with unique assemblages of species.

With BC’s forests facing climate change, the preservation of the wettest old-growth forests, which are often the forests with the most carbon sequestration and storage, is critical. And many of the species harboured in these forests are threatened by climate change-related drought, fires and insects.

The researchers documented an abundance and species diversity of lichens in Frisby/Rainbow Valleys that is equalled (or surpassed) in only 3 other known locations in the Interior Wetbelt. These are all old-growth forests, but many of the surviving old-growth stands do not have such a profusion of lichen species. They may have lost species due to nearby logging, may not be old enough, or may never have had the necessary climatic conditions.

In the search for the highest biodiversity Inland Temperate Rainforests, lichens are key.

Antoine Simon



Dr. Spribille documented over 300 lichen species in the Incomappleux Valley, by far most of them in old-growth with 1,800 year old trees. The number of tree-dwelling lichen species alone equalled or exceeded that of all plant species combined.

The presence of hundreds of species of lichens means a greater abundance of all those organisms, from bacteria to snails and insects, to flying squirrels and mountain caribou, that eat lichens or use their structures for habitat. Lichens absorb nutrients from the air and, through leaching by rain water, or when they are eaten or die, pass it on to the forest soil and other species. If abundant, lichens may contain a substantial percentage of the total nutrients in an ecosystem. Some are nitrogen fixers — the nitrogen they absorb from the air is broken down into a form that can fertilize the forest.

The Plant and Lichen Inventories

Specimens not identifiable in the field were collected for various tests, and then will be deposited at the University of BC herbarium. Species with low populations were not collected. Curtis Björk identified a total of 368 plant species,

Antoine Simon





Antoine Simon

Above: Many common species like these *Sphaerophorus* lichens are lavishly abundant in Frisby/Rainbow Valleys. *Sphaerophorus* and many others fix nitrogen that finds its way into the forest soil, so their abundance likely means a significant contribution to the fertility of the forest.

including 49 species of mosses, 101 species of lichens and 183 species of vascular plants. This does not include Spribille’s lichen collection, which will require considerably more time to identify. Thirty-three plant, bryophyte and lichen species noted by Björk were characteristic of coastal rainforest.

The gross number of lichen species found in Frisby/Rainbow Valleys cannot accurately be compared with other known lichen hotspots, which (for one thing) have had more survey time. However, Dr. Spribille’s report provides a list of 25 species that are rare in the interior, at risk, or indicative of very wet forests. Of these, Frisby-Rainbow is now known to have 20. The Incomappleux Valley, with far more survey time, is known to have 19. It is clear that, as a result of this expedition, a fourth hotspot of rare inland rainforest lichens has been found.

Old-growth Dependent Lichens in Frisby/Rainbow

Amongst the lichens identified so far, at least seven are known to be associated with old-growth forest. One reason for their rarity is the destruction and degradation of their habitat by logging. Several can also be killed by air pollution. Their reproduction and dispersal mechanisms may be poor and depend upon stable environmental conditions over hundreds of years to become well established. They include:

Lobaria retigera (Smoker’s Lung Lichen). This SARA-listed Threatened species was found mostly on elfin hemlock trees in the Rainbow Valley, where it was spread over several hectares. Elsewhere in the interior of BC only a few specimens have been found. According to COSEWIC it is a “flagship species for a suite of rare and uncommon lichens and bryophytes,” and is threatened by extensive logging. (Photo on pg 7)

Nephroma occultum (Cryptic Paw Lichen) is in both Rainbow and Frisby Valleys. It is listed “Special Concern” under Canada’s *Species at Risk Act* (SARA). In Canada it is found only in BC, and only the wettest old-growth inland rainforests have this lichen. It is in progressive decline in Canada, primarily due to extensive logging, and two documented populations are known to have been wiped out by logging.

Usnea longissima (Methusela’s Beard) — once common in old-growth *coastal* rainforest, it is declining and is now threatened and/or extirpated over much of its historic range, due to habitat loss and degradation by logging. Previous to this expedition only two fragments had been found in widely distant locations in the *inland* rainforest.

Species information may expand as collected material is analysed.



Curtis Björk

***Dendricosticta wrightii* is dependent on old-growth forests with pristine air quality. It is in strong decline, with nearly all known Canadian populations in or near logging activity.**



Curtis Björk

***Nephroma isidiosum* — blue-listed in BC, this one is also indicative of very old forest.**



Curtis Björk

***Lobaria linita* var. *tenuior* — this nitrogen-fixing lichen is associated with low-elevation, old-growth forest.**

MUSHROOMS OF THE FRISBY VALLEY

Our last group of species brings up what makes a forest at the deepest levels. Science has long known that the various fungi break down and consume dead wood, returning the nutrients to the soil to feed new trees. But only in the last decade has it become clear how living trees feed mushrooms — and vice versa. VWS-sponsored research in the Inland Temperate Rainforest has found much greater diversity of mushroom species in old forest than in young, and Frisby Valley is no exception, suggesting the underground networks that develop in old-growth forests.

The two lichen hotspots in the Kootenay-Columbia region also have very high diversity of macrofungi, or mushrooms. In the middle Incomappleux Valley, Dr. Oluna Ceska, a prominent BC mycologist, collected 100 species of mushrooms in one day. Biologist Tyson Ehlers recorded 112 species in only five hours in just a small part of Frisby Valley. Many of these have not been recorded in the Kootenays before, and more time will be required to properly identify many of the finds.

Eighty percent of the mushrooms Dr. Ceska listed were from old-growth forest, 20% from a clearcut. Ehlers' list is 71% from old-growth, 15% from mixed age forest, 9% from young forest, and 5% from a riparian area near a small wetland.

Some mushrooms have hair-like mycelia that form underground networks in forest soil that can extend for kilometres and live for hundreds of years. This network connects to the tips of tree roots. Mushrooms and other fungi are constantly delivering water and nutrients, such as nitrogen, to trees. Trees most in need receive the most water and nutrients. In return, the fungi absorb sugars — chemically speaking, carbon — from the living trees. The majority of carbon stored in an old-growth forest is in the soil and much of it is emitted into the air when the soil is disturbed by logging.

The US Forest Service states that 31 wildlife species from eight taxonomic families eat mushrooms in Washington and Oregon. If you would like to see an Ontario caribou go mushrooming, check out <https://www.youtube.com/watch?v=VPIarst9dYo>.



Tyson Ehlers

Clavaria ligula



Amber Peters

Tyson Ehlers recorded over 100 fungal species within about 2 km in 5 hours.



Amber Peters



Amber Peters



Tyson Ehlers

Mycena sp.

A MOSAIC OF UNUSUAL AND DIVERSE HABITATS



Toby Spribille

“One of the few large clearings in the forest canopy in the Frisby Valley is formed by an extensive marsh dominated by primarily (of densest cover) *Menyanthes trifoliata*, *Alnus incana*, *Sphagnum squarrosum*, *Equisetum fluviatile*, and secondarily (lower cover) by *Carex echinata*, *Carex interior*, *Cicuta douglasii*, *Eleocharis elliptica*, *Eriophorum gracile*, *Parnassia sp.*, and *Platanthera dilatata* ... No similar ecological community is noted in the wetland classification (MacKenzie & Moran 2004) or in the BC Species and Ecosystem Explorer (BC Conservation Data Centre.)” (C. Björk, 2018)

Frisby Valley ecosystems have been shaped by numerous natural disturbances including wildfires, huge rockfalls, debris torrents and avalanches. This has created a mosaic of habitats that extends into Rainbow Valley. The researchers reported:

- ◆ Extensive young forest in Frisby Valley created by fire.
- ◆ Very old cedar-hemlock forest, with the largest trees measuring 3.5 m. diameter. Old Western Red Cedar trees with hollow bases offer a high potential for black bear denning.
- ◆ Elfin hemlock forest composed of old, gnarled, stunted

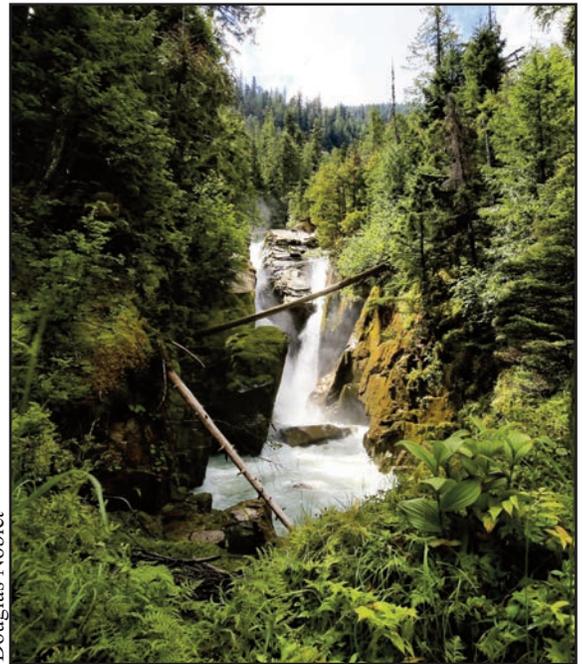
trees on poor growing sites. Occurs mostly in Rainbow Valley and around the Frisby Balch boulderbeds.

- ◆ Many cottonwoods along Frisby Creek and a “cottonwood forest” seen by Noblet and Henschell. Cottonwoods host high biodiversity by providing nesting sites for birds, bats, and small mammals.
- ◆ Alder Swamp — The edges of the lower Frisby marsh are filling in with alders that host major lichen diversity including rare coastal lichens. The size and abundance of lichens was extraordinary compared to occurrences elsewhere in the inland rainforest.



Amber Peters

BALCH BOULDER BEDS — “One of the most unusual habitats observed were talus slopes with large boulders the size of small houses extended into the old-growth hemlock forest ... Both of these slopes exhibited unusually strong Balch ventilation effects, in which highly cooled air, possibly associated with remnant ice patches, exits the base of a talus slope from cave-like holes and passages between boulders ... the small, gnarled, “elfin” trees around the Balch ventilation holes were drenched with liquid water. These trees were extraordinarily rich in lichen biomass and diversity. The tops of the boulders were covered in lichens and carpets of moss.” (T. Spribille, 2018)



Douglas Noblet

Three waterfalls divide the lower from the upper Frisby Valley. Their spray creates habitat for two species of lichens found nowhere else in the project area. Collected specimens may contain others.

DISCOVERING A FOREST NO ONE KNEW

Two-thirds of the Incomappleux Valley were logged before anyone knew that rare species were growing there. It has thus been a thrill to learn, through this expedition, that something like the epic native forest still exists intact; and that it harbours all but one of the rare species found in the Incomappleux (plus one that has never been found in the Incomappleux).

But more importantly, no one can protect areas if they don't know about them, or about their biological wealth. Now we know about the Frisby-Rainbow Valleys, and that could make a key difference from the Incomappleux story.

We had speculated that Frisby Valley might offer an ideal, wholly intact version of the Incomappleux. Instead each of the four known hotspots, while having much in common, also have their own unique assets: for Robson Valley so far, the most species of lichens. Old forests that survived clearcutting along the north arm of Quesnel Lake include a salmon-grizzly bear-bald eagle ecosystem supporting a major herd of mountain caribou. But both of these examples have suffered fragmentation by logging.

The Incomappleux remnant is unparalleled in its combination of antiquity, biodiversity, low elevation, and intact area. GIS analysis of Frisby-Rainbow is not yet complete, but the Incomappleux will clearly remain the largest intact body of this high-biodiversity inland rainforest, due to the fact that the Frisby old-growth exists in a mosaic of habitats. But what a mosaic! An unbroken wilderness with an interweave of ancient forest, wetlands, gargantuan boulderbeds, caves, and picturesque, gnarled and dwarfed old hemlocks loaded with rare lichens.

When hundreds of lichens, fungi, mosses and other organisms are present, we have a more complete forest. In these few biodiversity hotspots we have, at last, something resembling a whole forest, with some semblance of the working parts that began building these forests a thousand years ago, all the species aiding each other in a true symphony of structural and biochemical activities. In the face of what scientists warn is a pending disaster of climate



Douglas Noblet

change and species loss, saving these forests should be paramount.

In 2018, through the cooperation and generous contributions of every person on the exploration team, as well as generous funding from several philanthropic organizations and our members, Frisby/Rainbow Valley has received an ecological assessment that all old-growth forests should have, but almost none do.

Considerations for the Future

Still, the area to be covered was so big that Rainbow Valley — the “gem” of the trip — received very little inventory attention. The wetlands merit more inventory as potentially significant breeding grounds for a variety of amphibian species. The fungi cannot receive even a cursory count without visits at multiple times during the year. Some stands of very old, very large trees did not get photographed, while others did not get surveyed. We are designing a park proposal now and hope to continue our research next year.

We know that Rainbow Valley is very vulnerable to logging, because the adjacent valley to the north already has some logging. Fortunately, the need to ferry wood across the lake is an economic discouragement for logging, especially for Frisby, but it will take further investigation to determine how serious the threat is.



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