Contract Report

Pine Mushroom Habitat Mapping - Vicinity of Cranberry Sustainable Resource Management Plan Area

Ministry of Forests, Lands and Natural Resource Operations
Skeena - Stikine Forest District
March 29, 2012

Prepared by: Jodi Friesen & Rick Trowbridge
Jodi Friesen Ecological Consulting
5950 Silver Standard Rd, Hazelton, BC. V0J 1Y1
Email: jodijane@hotmail.ca

Prepared for: Laura Bolster, RPF
Regional Planning Projects Manager| Learning Organization Practitioner
Ministry of Forests, Lands and Natural Resource Operations - Skeena Region
3726 Alfred Avenue, Box 5000, Smithers, BC. V0J 2N0
Tel. 250.847.7758 | Fax 250.847.7347
Email: Laura.Bolster@gov.bc.ca

Summary

Overview pine mushroom habitat mapping was carried out on 60,300 ha along the Cranberry, Kitwanga and Kiteen River valleys and in the northern Kispiox valley below elevations of 600 m. Many locations are well known and highly regarded by pickers for the productivity and abundance of pine mushroom habitat. The overview air photo polygon line work will provide the basis for the completion of an informative pine mushroom habitat map. This map and data base will be used in forest harvest planning in order to meet goals and objectives of resource management plans, for example, to maintain a minimum of 50% pine mushroom habitat in a mature forest age class across the management area.

The study area consists of ICHmc2, ICHmc1 and CWHws2 subzones up to a 600-m elevation. One hundred and fifty nine air photo pairs were reviewed for the potential of pine mushroom habitat, and identified as either *Type 1* or *Type 2* polygons. Keeping in mind that *Type 2* polygons may be equally productive as *Type 1* polygons in terms of mushroom production or number of "patches, plants or shiros" that exist in each given area.

The northwest Cranberry section of the study area was found to have the highest concentration of pine mushroom habitat, mainly located on morainal veneers over undulating or elongated bedrock controlled features. The Kalum area had a moderately high concentration of 01b habitat with a particularly large glacial fluvial terrace east of the Kiteen River bridge which has been identified for further field investigation. The lowest concentration of pine mushroom habitat was found along the lower and toe slopes of the steep, narrow reaches of the CWHws2 subzone in the upper Kitten River valley.

Based on our experience, collective knowledge and the teamwork approach we used in the mapping process, we achieved a high level of confidence in the accuracy of line work. However, we recommend that field checking be undertaken in some areas to ensure the highest level of quality and reliability for the final map production. These areas include:

- fire regenerated and seral stands
- glacial fluvial landforms
- subdued bedrock controlled terrain in the west section of the study area
- east and northeast of Gitanyow village
- northern reaches of the upper Kispiox

An outline of our recommendations for follow-up and mapping completion is provided in Section 7.1.

The pine mushroom habitat air photo line work and subsequent maps are intended to be used as a tool for management purposes. While pine mushrooms may be found on sites other than the ICHmc/01b and CWHws2/03 site series, particularly those sites that are transitional to mesic sites or drier and poorer ecosystems, pine mushroom habitat identified in this project represents the "most productive" sites based on local and current

ecological research. As with any interpretive map, on-site inspections and local knowledge must always be applied in making land based operational decisions.

Acknowledgements

We would like to thank Laura Bolster, Bobby Love and Marty Kranabetter of the MoFLNRO for project initiation and support; Dave Amirault (MoFLNRO) for GPS support and forest cover map production; and Scott Hicks of the Kalum Forest District for assisting in the compilation of air photos.

Contents

Figures

Tables

Cover photo of pine mushrooms by Jodi Friesen.

Totem poles at Gitanyow (Kitwankul). Photo by G.T. Emmons, 1910. Accessed online on March 15, 2012 at http://www.sfu.ca/content/sfu/brc/virtual_village/tsimshian.html.

1 Background

The pine mushroom (*Tricholoma magnivelare* [Peck] Redhead) is a valuable forest product found in the Gitanyow House Territories of the Skeena/Stikine and Kalum Forest Districts in northwest British Columbia. It is a prized edible and commercial mushroom species that provides a seasonal source of income and recreation for local residents and tourists every year. The most highly productive pine mushroom habitat, identified in research carried out by Kranabetter et al. (2000), was found to occur on the submesic phase of the mesic site series (01b) in the Interior Cedar-Hemlock moist cool (ICHmc) subzone, and the submesic site series (03) in the Coastal Western Hemlock wet submaritime subzone (CWHws) (Banner *et al*. 1993). Because the 01b and 03 site series have a distinct air photo signature, air photo interpretation can be applied to help identify and delineate the most highly productive pine mushroom habitat, providing a useful mapping tool for forest planning purposes.

Although the study area along the Cranberry and Kitwanga River drainages has long been recognized by pickers for its productivity and the abundance of pine mushroom habitat, it had yet to be mapped for pine mushroom habitat.

2 Objective

The objective of this project was to provide air photo interpretation and overview polygon line delineation of highly productive pine mushroom habitat in the vicinity of the Cranberry Sustainable Resource Management Plan area of northwestern British Columbia. No field checking was included in this phase of the contract.

Once digitized, this information will provide the basis for the completion of an informative pine mushroom habitat map that can be used in discussions and planning for harvesting schedules and cutblock layout. This will contribute to meeting the goals and objectives of resource management plans. For example, one objective of the draft Cranberry Sustainable Resource Management Plan (2012) is to maintain a minimum of 50% pine mushroom habitat in a mature forest age class (80 to 200 years) across the management plan area.

The deliverables for this project included:

- photocopies of air photographs of the study area with submesic ecosystems of the ICHmc1 and ICHmc2 (01b), and CWHws2 (03) outlined as polygons, and

- this contract report, in hardcopy and electronic formats, outlining objectives, methodology, and results, including areas of concern and requirements for follow-up.

3 Study Area

The study area occupies 60,300 ha along the Cranberry, Kitwanga and Kiteen River valleys, at elevations below 600 m, and an area in the northern Kispiox Valley (Figure 1). The southern boundary of the study area is located just north and northwest of the village

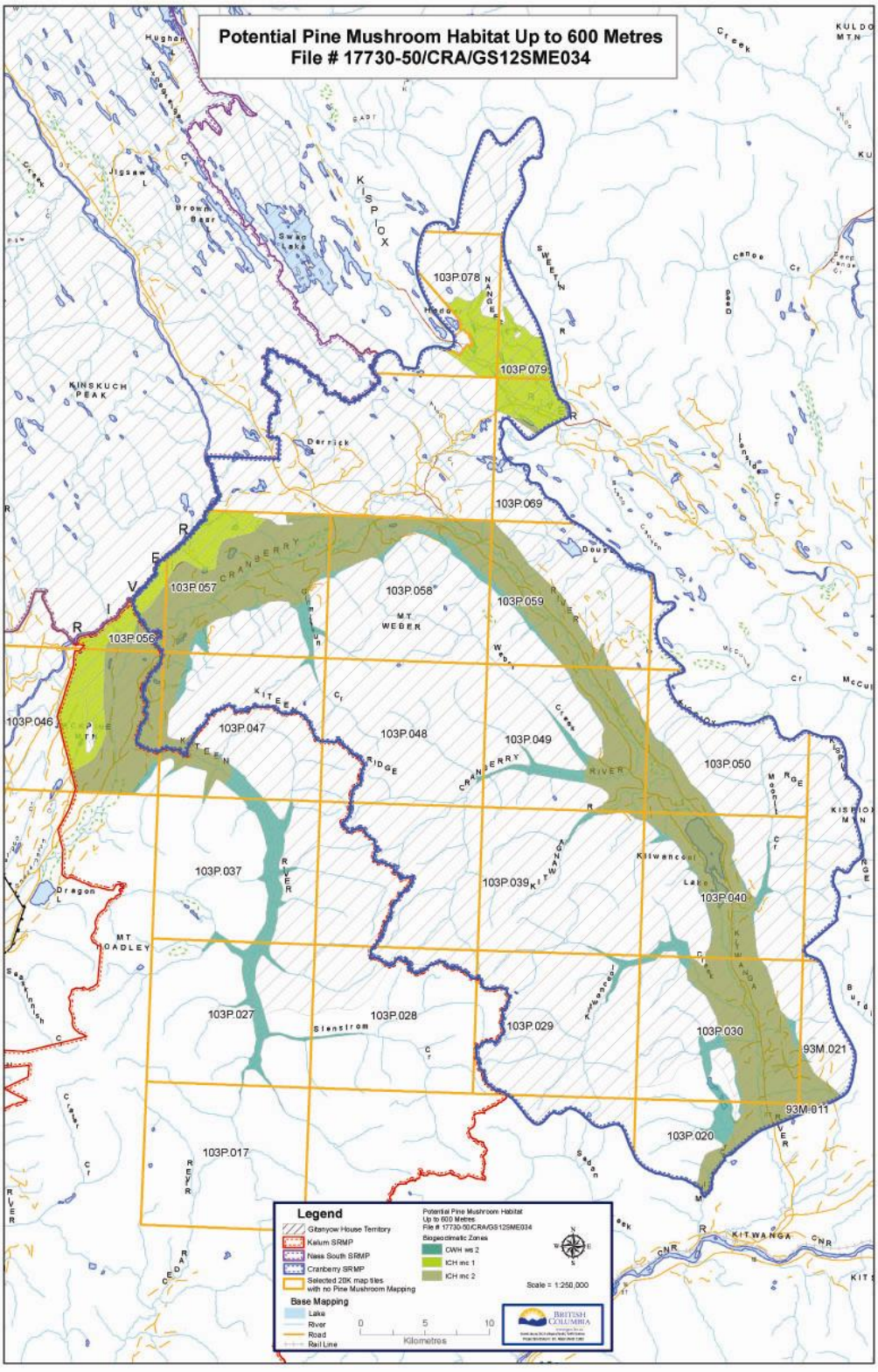


FIGURE 1. Study area.

of Kitwanga and extends northward along Highway 37 encompassing the Kitwanga River and Kitwcool Lake area, and continues in a northwest direction along Highway 37 reaching the Cranberry River to its confluence with the Nass River. The north boundary of the study area reaches the Cranberry Junction. The northwest boundary is located near the confluence of the Cranberry and the Nass River encompassing Jackpine Mountain and the main lower channel of the Kiteen River as it extends south to Stenstrom Creek. An additional area included in the study area is located in the upper Kispiox Valley along the Kispiox and Nangeese River area between Hodder Lake and the Sweetin River.

The Interior Cedar-Hemlock Moist Cool Subzone, Hazelton Variant (ICHmc2) is found at lower elevations between 100 and 600 meters along the Cranberry and Kitwanga Rivers (reaching up to 750 meters in nearby drainages) and consists of 41,321 ha in the study area below the 600 meter elevation boundary. The ICHmc2 has fairly moist warm summers and light to moderate snow packs in the winters. Cold air ponding occurs in major valleys and summers can have periods of significant drought (Banner *et al.*1993).

The Interior Cedar-Hemlock Moist Cool Subzone, Nass Variant (ICHmc1) occurs in the northwest portion of the study area at elevations between 350 to 950 meters along the Nass River and Jackpine Mountain as well as the most northern section of the study area in the upper Kispiox Valley. The ICHmc1 consists of 10,375 ha in the study area below the 600 meter elevation boundary. The climate is cooler and moister than the ICHmc2 and also has a shorter growing season (Banner *et al.*1993).

The remaining 8,604 ha of the study area consists of the Coastal Western Hemlock Wet Submaritime Subzone, Montane variant (CWHws2). Generally located above elevations of 600 meters (Banner *et al.*1993), in the study area it is found on north facing slopes below 600 meters and in some of the cooler valleys including the Kiteen River drainage. The study area is located within the following 1:20,000 scale forest cover map sheets, listed by general mapping area:

<u>Area 1 - Cranberry NW</u>
103P.056, 103P.057, 103P.058,

<u>Area 2 - Cranberry NE & Cranberry SE</u>
103P.059
103P.048, 103P.049, 103P.050
103P.039, 103P.040,
103P.029, 103P.030, 93M.021,
103P.020, 103P.011

<u>Area 3 - Upper Kispiox</u>
103P.078, 013P.079
103P.069

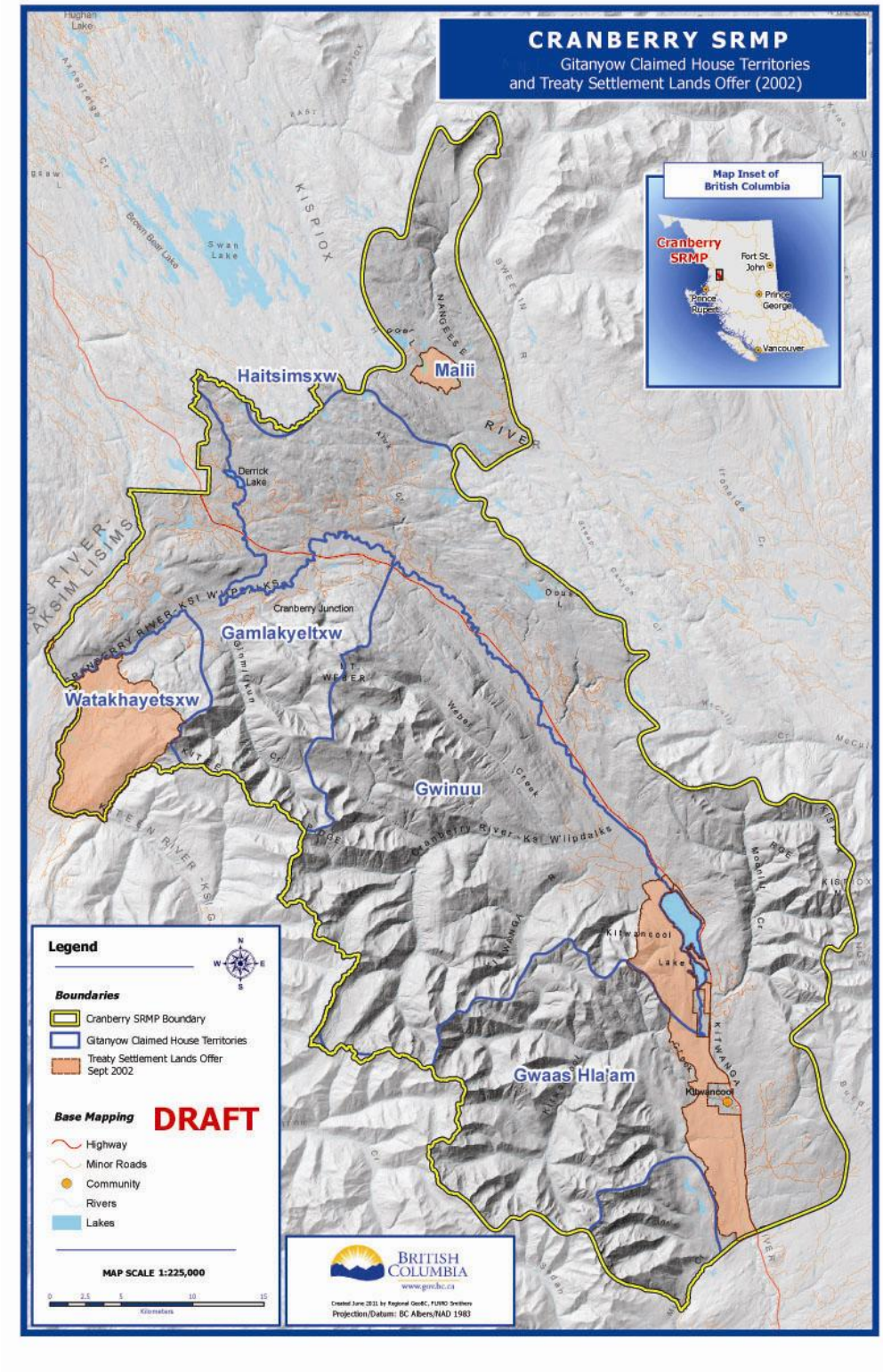
<u>Area 4 - Kalum TSA</u>
(103P.056),
103P.046, 103P.047,
103P.037,

103P.027, 103P.028,
103P.017

The area is managed under the Cranberry Sustainable Resource Management Plan (SRMP) and the Kalum SRMP of the Ministry of Forests, Lands and Natural Resource Operations. It lies within the Gitanyow Territory (Figure 2), which is divided into six individual House Territories. The Chiefs representing each of these Territories are identified in Table 1 (adapted from Gitanyow (2002) and Marsden (2006).

TABLE 1. Gitanyow House Territories

Clan	House	Territorial Region
Lax Gibuu (Wolf Clan)	Gwaas Hla'am (Phillip Daniels)	9 Mile; Gitanyow Village; Upper Cranberry
	Malii (Glen Williams)	Sweeten River; Brown Bear & Kwinageese River
	Haitimsxw (Ken Russell)	Swan Lake Area
Ganeda (Frog Clan)	Gamlaxyeltw (Edgar Good)	North of Cranberry River & West Nass area
	Gwinuu (Godfrey Good)	Upper Cranberry River and 26 Mile area
	Watakhayetsxw (Gabrielle Bright)	Eastern Kiteen River



.

FIGURE 2. Map of Gitanyow House Territories (Cranberry SRMP Draft, 2012).

4 Ecological Description of Highly Productive Pine Mushroom Habitat

Collective knowledge and research using experienced pine mushroom harvesters indicates that the most productive pine mushroom habitat is generally associated with the ICHmc/01b and ICHmc2/01b site series phases and the CWHws2/03 site series in mature forests (80+ years). However, it is important to note that not all ICHmc/01b or CWHws2/03 sites series will contain the pine mushroom "plant, patch, or shiro" (Trowbridge, 2006). Furthermore, pine mushrooms may also be found on other sites in addition to these, particularly those that are transitional to site units that are slightly drier and poorer.

4.1 Interior Cedar-Hemlock Moist Cool Subzone, Hazelton Variant (ICHmc2)

In the ICHmc2, the submesic phase of the Western hemlock - Step moss site series (01b) is generally dominated by western hemlock (*Tsuga heterophylla*) and a minor component of lodgepole pine (*Pinus contorta*). There is very little shrub cover, few herbs, and feathermoss cover is high. It occurs on upper slopes and ridge crests, generally covered in thin morainal or colluvial deposits over bedrock, and on coarse textured sands and gravels of glacial fluvial deposits. The 01b phase is defined by a submesic soil moisture regime and a relatively poor nutrient regime. Tree growth is poorer than the typical mesic phase (01a) with more lodgepole pine. In comparison, the drier 02 - Western hemlock - lodgepole pine - Kinnikinnick - Cladonia site series, which occurs on the most xeric to submesic site conditions, consists of poorly growing pine-dominated stands (Banner *et al*. 1993).

4.1.1 Seral association of the 01b site series (51)

Younger stands (generally less than 80 years) occupying the same soil moisture and nutrient regime as the 01b site series are identified by the 51 seral association ($PlHw – Feathermoss). These stands are dominated by lodgepole pine, have western hemlock in the understory and may also have a small component of trembling aspen (*Populus tremuloides*) or paper birch (*Betula papyrifera*). They have a moderately developed shrub layer of soopolallie (*Sheperdia canadensis*), saskatoon (*Amelanchier alnifolia*), thimbleberry (*Rubus parviflorus*), black huckleberry (*Vaccinium membranaceum*) and false box (*Paxistima myrsinites*). There is also a moderately diverse herb layer consisting of a mixture of dry and mesic site indicators. Without disturbance, these stands will eventually develop into the 01b site series (Banner *et al*. 1993). For the objectives of this mapping project they are combined with the 01b mapping unit where appropriate soil moisture and nutrient regimes were photo- interpreted.

4.2 Interior Cedar-Hemlock Moist Cool Subzone, Nass Variant (ICHmc1)

In the ICHmc1 the submesic phase of the Western hemlock - Step moss site series (01b) is dominated by dense western hemlock and a minor component of lodgepole pine with poorly developed shrub and herb layers and a moss layer dominated by feathermosses. It generally occurs on moisture shedding or rapidly drained upper slopes and crests positions covered by shallow morainal or colluvial deposits over bedrock, and on coarse textured sands and gravels of glacial fluvial deposits. Soil moisture regime is submesic with a relatively poor nutrient regime.

The 01b site series has more lodgepole pine than the typical mesic phase of the 01 site series which, in contrast, has forests of moderately good growth consisting of western hemlock, subalpine fir (*Abies lasiocarpa*) and to a lesser extent Roche spruce (*Picea glauca x sitchensis*). The drier 02 - Western hemlock, lodgepole pine - Kinnikinnick - Cladonia site series occurs on rocky crests with exposed bedrock and very thin soils with open, stunted stands of lodgepole pine and western hemlock. Seral associations for the submesic phase of the 01b may include fire originated pine stands or other similar seral associations to that described for the ICHmc2 (Banner et al. 1993).

4.3 Coastal Western Hemlock Wet Submaritime Subzone, Montane variant (CWHws2)

In the CWHws2 the Western hemlock, lodgepole pine – Feathermoss site series (03) is found on dry ridge crests and upper slopes with coarse and/or shallow morainal or colluvial deposits and xeric to submesic soil moisture regimes with very poor to medium soil nutrient regimes. The tree composition consists mainly of small diameter western hemlock, lodgepole pine, and amabilis fir with sparse shrub and herb layers in the understory. Feathermosses dominate in the moss layer (Banner et al. 1993). The zonal 01 - Western hemlock, amabilis fir - Bramble site series, in comparison, consists of western hemlock and amabilis fir (*Abies amabilis*) stands of moderately good growth. The drier 02 - Lodgepole pine - Kinnikinnick site series is rare and limited to only very few dry upper slopes and ridge crests with thin soils and is dominated by stunted lodgepole pine stands (Banner *et al*. 1993).

5 Methodology

5.1 Project Development

In the initial stages of the project, Jodi Friesen and Rick Trowbridge worked closely with the Ministry of Forests, Lands and Natural Resource Operations (MoFLNRO) personnel to define the study boundaries, priority mapping areas and aided in the identification of aerial photographs, maps and relevant mapping layers required for the project.

The MoFLNRO supplied the full size paper and digital files of 1:20,000 forest cover maps and copies of these maps on 11 x 17 paper with the following information applied:

- study area boundary / 600 m elevation boundary
- forest cover labels
- base mapping information, including water, roads, and prominent features
- topographic contour lines
- biogeoclimatic subzone boundaries
- air photo flight lines (further described below)
- location of completed pine mushroom habitat mapping polygons

5.2 Data Compilation

The majority of the available flight lines in the Skeena/Stikine Regional office database that were applied to the forest cover maps did not correspond to the air photos that were

available in the Skeena/Stikine or Kalum District offices. This required further inquiry to the online GeoBC Digital Imaging Service and the GeoBC Basemap Online Store to determine possible available air photo coverage. Flight line maps located in the district office were then also used in combination with the forest cover maps to obtain the most updated, in colour (if available), and scale appropriate air photo flight lines associated with the study area located in the district offices.

There were no air photos located in the Skeena/Stikine District office for any portion of the Kalum West section of the study area, including, or in part, mapsheets 103P.017, 103P.027, 103P.028, 103P.037, 103P.046, 103P.047, 103P.056 and 103P.057. The majority of these photos were located in the Kalum District office in Terrace. The Cranberry portion of 103P.047 also had missing photos for portions of the Skeena/Stikine District 1994 flight lines. The photos that were not located in the MoFLNRO inventories were ordered as digital TIFF files and printed out to photo scale. Colour contrast and/or resolution of these printouts were inferior to the copies of the original photos. The available air photos were laser copied and the originals were returned to the district offices.

Of the total 391 individual air photos in the study area, approximately 1/3 of the photos were colour and of 1:10,000 scale, specifically those of the Cranberry NW section including mapsheets 103P.056 (east portion), 103P.057 and 103P.058. The remainder of the photos in the eastern section of the mapping area were colour and approximately 1:20,000 scale, and the majority of the photos in the Kalum District were black and white photos of approximately 1:15,000 scale.

5.2.1 Review of previous mapping projects

Previous pine mushroom habitat mapping projects in the area were reviewed in preparation for mapping, including nearby areas of the Cranberry to the north of the study area (Trowbridge, 2006), Brown Bear / Upper Kispiox (McLennan, Friesen, 2000), West Skeena (Friesen, 2004) and the Shedin / Babine Watershed (Friesen, 2002).

5.3 Air Photo Organization and Preparation

A total of 159 air photos were prepared (boxed) for typing by indicating the north orientation and marking the centre point of each photo with an "x", serving as the centre of an approximate 15cm x 15cm box in the central portion of the photo. This box identifies the unique portion of each air photo that is viewed for interpretation. Project boundaries including the study area and subzones boundaries were applied to the photos based on the 1:20,000 forest cover maps provided by the MoFLNRO. Air photo preparation was carried out by Jodi Friesen.

Air photos were organized generally by forest cover mapsheet and documented in our air photo organizational chart for future reference, to aid in the location of missing photos, to keep track of work progress and to document areas of concern.

Each of the 159 boxed air photos covering the study area was reviewed using a stereoscope to identify and outline pine mushroom habitat polygons. The Cranberry NW section was the first area to be mapped due to the approximate 1:10,000 mapping scale

(an easier scale to work with to identify features) and the corresponding pine mushroom habitat mapping polygons that were applied to the maps from the adjacent flight lines to the north (Trowbridge, 2006). The second priority area followed the Cranberry NE & Cranberry SE sections from north to south which consisted of colour 1:10,000 photos. The Upper Kispiox was the third priority area to be mapped (colour, 1:10,000 photos), followed by the forth priority area of the Kalum area which consists mainly of 1:15,000 black and white photos.

5.4 Approach to air photo delineation of pine mushroom habitat

Due to time and budget restraints, the Ministry of Forests, Lands and Natural Resource Operations requested an abbreviated approach be applied to this initial phase of the mapping project. Contract specifications were to provide overview typing of polygon line work for pine mushroom habitat based on previous mapping experience and compilation of available resources. There were no ground reconnaissance or field checking components prior to or during this air photo line work process.

Google Earth 2012 was used as a tool to view issues or questions raised during the typing, particularly on photos that were of smaller scale (1:15,000 - 1:20,000), in order to obtain an additional, moderately accurate, 3 dimensional view. Initial polygon line delineation was carried out by Jodi Friesen.

5.4.1 Minimum polygon size

The minimum polygon size of 0.5 ha outlined in the contract specifications applies to 1:10,000 scale air photos. With the use of air photos between the scales of 1:10,000 and 1:20,000, the following minimum polygon size and related ground area would apply (RIC Standards, 2000) according to Table 2 below.

TABLE 2: Minimum polygon size

Data Capture / Scale	Minimum Area (page units) /	Minimum Area (map units)
1:20,000	0.5 sq cm	2 ha
1:10,000	0.5 sq cm	0.5 ha

5.4.2 Type 1 and type 2 polygons

Two types of pine mushroom habitat polygons were distinguished based on pine mushroom habitat classification outlined in Kranabetter et al. 2002. *Type 1* being most floristically and edaphically characteristic to the target site series, ICHmc1/01b, ICHmc2/01b, and the CWHws2/03; and *Type 2* being a complex of the target site series with 20% or less inclusion of alternate site series (commonly mesic 01/01a to slightly moister sites) or transitional to the mesic 01/01a or dryer 02 site series (refer to Table 3 below, adapted from Trowbridge, 2006). All remaining areas not delineated would be considered low productive potential for pine mushroom habitat. It is important to note that *Type 2* polygons may be equally productive as *Type 1* polygons in terms of mushroom production or number of "shiros, patches or plants" that exist in each given area.

TABLE 3. Polygon types and descriptions

Polygon Type (site series [a] and [b])	Spatial representation within polygon area	Ecologically transitional to 01 (01a) or 02 site series	If complex, typical Inclusions
Type 1 (ICHmc1 01b, ICHmc2 01b and CWHws2 03)	> 90% 01b or 03	Not apparent in > 90% of polygon	Up to 10% 01/01a, 02, 03, 04, 05
Type 2 (ICHmc1 and ICHmc2 01b//01a or 1b//02 and CWHws2 01b//01 or 01b//02)	> 80% 01b or transitional to 01, 01a or 02	Common in a regular or irregular pattern	Up to 20% 01/01a, 02, 03, 04, 05

[a] Site series in parenthesis is the dominant site series; // indicates that the first site series is the most floristically and edaphically characteristic, and the second is transitional or subordinate to the first.
[b] May include seral associations not yet described in the Prince Rupert Forest Region Guide and seral units associated with the target site series.

5.4.3 Pine mushroom habitat typing above the 600-m elevation boundary

The 600 meter elevation boundary was set as the upper limit of the study area based on previous research and mapping projects where interviews of experienced pine mushroom harvesters provided their commonly accepted knowledge. This information was then field tested during the pine mushroom fruiting season. The sites previously sampled above 600 m which typically correlated to the 01b site and soil factors were found to produce very little, if any pine mushrooms (Trowbridge, 2006). We believe the cooler climate as well as greater and longer lasting snow packs are the major limiting factors.

Polygons outside the study area along the 600 m boundary were typed out on the photos provided there was the stereo pair for complete viewing and only within approximately 100m horizontal distance to the study area boundary. No additional typing was done outside of the administrative study area boundary.

5.5 Quality Assurance and Line Work Edits

Quality assurance was accomplished by having Rick Trowbridge and Jodi Friesen working as a team, pooling their collective knowledge of photo typing and field experience. This proved particularly helpful when addressing questionable areas. In addition to the forest cover maps and site descriptions, Google Earth 2012 was also used as a tool to address issues that were raised during the typing and editing process. It was through this process that we identified priority areas for future ground truthing.

6 Results

6.1 Morainal and Colluvial Veneers

The majority of pine mushroom habitat polygons were found on morainal and/or colluvial veneers over bedrock located on crest and upper slope positions, along crests of steep gully embankments, and on smaller rocky knoll features. These veneers over rocky

knolls or undulating bedrock were common throughout the study area and were often identified as *Type 2* polygons to indicate the scattered inclusion of 10 to 20% of mesic or subxeric sites. An example of ICHmc2/01b site series on morainal veneer over bedrock is shown in Figure 3.

Numerous elongated bedrock controlled ridges resulting from glacier scouring have also provided larger areas of *Type 1* polygons of pine mushroom habitat.

FIGURE 3: Example of ICHmc2/01b site series on morainal veneer over bedrock.

FIGURE 4: Example of ICHmc2/01b site series on glacial fluvial terrace.

6.2 Glacial Fluvial Deposits

Glacial fluvial terraces and fans found along the Nass, Cranberry, Kiteen, and Kitwanga Rivers and at the mouth of major drainage confluences including the Kiteen River and Ginmiltkun Creek were found to support some large areas of pine mushroom habitat. The soil textures of these glacial fluvial deposits would vary greatly from coarse gravels and sands with high coarse fragment content, to those deposits of sand and sandy loams with very little coarse fragment intermixing. This range in soil texture of glacial fluvial deposits creates potential variability in polygon type from the pure, well represented *Type 1* 01b/03 site series, to those complex *Type 2* sites tending towards mesic or even subxeric soil moisture conditions. An example of the ICHmc2/01b site series on a glacial fluvial terrace is shown in Figure 4.

6.3 Geographical Distribution of Pine Mushroom Habitat in the Study Area

6.3.1 Kalum section

The area southwest of the Kiteen and Cranberry River confluence consists of glacially striated bedrock formations, often oriented northeast to southwest, as well as undulating or irregular ridge formations. These landforms maintain a relatively high concentration of 01b sites on morainal veneers. Glacial fluvial deposits are also present in various formations near the confluence of the Kiteen and Cranberry Rivers. A significant glacial fluvial terrace is found east of the Kiteen River bridge supporting medium to large areas of the 01b site series. This particular area has been identified for further field investigation and polygon boundary confirmation.

In the west most reaches of the study area, north of Jackpine Mountain, a notable area of subdued bedrock controlled terrain was identified to have the potential for productive pine mushroom habitat. However, due to the highly fragmented nature of the terrain, where slight rises in elevation were frequently bisected by small drainage and seepage channels, very few polygons met the criteria of minimum polygon size given the approximate 1:15,000 photo scale. Field investigation has been noted for this area where access is permitting.

Little pine mushroom habitat was found along the lower and toe slopes of the steep, narrow reaches of the CWHws2 subzone in the upper Kitten River valley.

6.3.2 Northwest Cranberry section

A relatively high concentration of 01b habitat is on found on morainal veneers over undulating bedrock in this section of the study area, particularly on the crests of small knolls (most clearly observed in clearcuts), and on upper to crest positions of larger hills and hillocks, elongated ridge features, and on erosional remnants of lava surfaces. Minor areas of glacial fluvial deposits in the form of fans were also found, for example at the confluence of the Ginmiltkun Creek and the Cranberry River.

6.3.3 Northeast Cranberry section

The 01b habitat in the northeast of the study area was mainly found on thin morainal veneers of upper to crest positions on ridges or elongated hills oriented somewhat northwest to southeast. These ridges were found near the valley bottom as well as minor bedrock controlled ridges also oriented northwest to southeast along the west slope of the main valley. Further south along the Cranberry drainage, minor glacial fluvial features were also found along the west slope of the main valley supporting incidental 01b habitat. Along the east side of the valley 01b habitat was also found on minor glacial fluvial deposits in the form of elongated and relatively level kame terrace features.

The area north of Kitwancool Lake generally consists of gently sloping and undulating terrain where 01b sites are found on gentle hill crests and upper slopes covered in morainal veneers. 01b habitat is also found to a lesser extent on glacial fluvial materials adjacent to the subtle divide between Kitwanga and Cranberry River drainages. The glacial fluvial deposits found here are on relatively subdued or level slope positions which seem to gently transition into fluvial materials consisting of wetter ecosystems

with a higher deciduous component supported by sub irrigation moisture flow and/or adjacent wetland ecosystems.

The landscape west of Kitwancool Lake expressed moderate to steep sloping terrain with 01b sites occurring on gentle hill crests of relatively thin morainal veneers. Polygons consisted of *Type 2* habitat in complexes and/or marginal to the 01a site, or as *Type 1* habitat on well defined ridges and crest positions. East of Kitwancool Lake, 01b polygons are found on morainal veneers and crest positions.

6.3.4 South Kitwancool Lake section

The area south of Kitwancool Lake consisted of subdued terrain in the wide valley basin, *Type 2* 01b habitat was found in complexes and/or marginal to 01a sites on upper and crest positions. Frequently, the 01b sites were identified on subtle shield-like formations in shedding positions on mid to upper macro-slope positions believed to be relatively thin soils over bedrock.

Glacial fluvial deposits were found near the mouth of Moonlit Creek, where small terraces consisted of *Type 1* and *Type 2* 01b polygons. In addition, a glacial fluvial fan at the confluence displayed relatively prominent area of *Type 1* 01b habitat. Other small but identifiable reoccurring kame terraces and glacial fluvial features in the CWHws2 of the upper Kitwancool drainage were identified as *Type 2* pine mushroom habitat.

6.3.5 East Gitanyow section

A significant forested area to the east and northeast of Gitanyow Village is believed to be a bedrock controlled plateau with a complex of thin to moderately thicker soils, with upper shedding positions as shield-like formations maintaining large *Type 1* and *Type 2* polygons. This area has been noted for further field investigation and polygon boundary confirmation.

6.3.6 South End section

Morainal veneers are found over undulating bedrock features producing complexes of *Type 2* habitat. The landscape then transitions to more glacially striated formations where more *Type 1* 01b habitat is identified along these elongated ridge crests. To the south, outside of the study area boundary, the prevalence of this glacially striated landscape increases and pine mushroom habitat appears to be more abundant; however, being out of the scope of this project the area was not mapped.

6.3.7 Upper Kispiox section

The ICHmc1/01b habitat in the north consisted mainly of *Type 2* polygons being marginal to the 01a or in complexes with the 01a or moister site series such as the 03 HwBl - Oak fern site. Morainal veneers over undulating bedrock or glacially striated bedrock controlled ridges supported the majority of the pine mushroom habitat. Glacial fluvial deposits made up a minor component of 01b sites adjacent to the Kispiox and Nangeese Rivers. In the southern portion of this area, *Type 1* polygons became more common on well-defined bedrock controlled ridges.

6.3.8 Pine mushroom habitat above 600 m in elevation

Crest positions with morainal veneers were fairly common along and slightly above the 600-m elevation / study area boundary. Only those sites with well-expressed topo-edaphic factors, or outstanding features, significant enough to maintain highly productive pine mushroom habitat were typed out. Often these sites were south aspects in combination with the typical submesic factors; however, due to the more prominent influence of the cooler and moister climate, most polygons were commonly *Type 2* being transitional to the modal 01b/03 site series.

6.4 Areas of Concern

We have a high level of confidence in the overview photo typing that was completed for this project. This confidence is based on field work and photo typing that we have completed for similar projects, the considerable amount of terrestrial ecosystem mapping that we have completed in the past, and the team approach that we used during the editing process. However, we have identified some areas that would benefit from field checking. These particular areas of concern were recorded with detailed notes and relevant field check locations. In particular, we would like to confirm the following:

- ***Fire regenerated and seral stands:*** Particularly where fires have occurred, the seral ecosystems are western hemlock and lodgepole pine stands with the same photo signature as the target 01b and 03 ecosystems, thus creating some uncertainty in the boundary between the submesic and mesic sites (specifically on more subtle crest positions and upper slopes or on warm mid convex slopes where morainal veneers are suspected).
- ***Glacial fluvial landforms:*** on more or less level slope positions where glacial fluvial material is suspected, if the soil texture is not coarse enough or tending more towards till, mesic ecosystems would prevail.
- ***Subdued bedrock controlled terrain:*** found in the west-most section of the study area, a series of complex ecosystems were suspected to consist of thin morainal veneers over bedrock where productive pine mushroom habitat may occur but in a highly fragmented pattern.
- ***East and northeast of Gitanyow village***: A notable area northeast of the village is suspected to consist of a rather large landform sequence of morainal veneers over bedrock which were generally identified as *Type 2* pine mushroom habitat, should this area be tending towards deeper tills the 01a site series would be more prevalent.
- ***Northern reaches of the upper Kispiox section:*** Older Western hemlock and sub-alpine fir forests in the ICHmc1 occupying the appropriate topo-edaphic conditions for the 01b site series do not consistently display the classic photo signature of the target site series.

7 Recommendations for Follow-up and Completion of Mapping

7.1 Approach to Complete Pine Mushroom Habitat Mapping

To ensure the quality and reliability of the final mapping product, we strongly recommend that a ground truthing component be added to this project, followed by a final editing of the typing line work. Standards established by the B.C. Resources Inventory Committee (2000) for 1:20,000 to 1:100,000 inventory and ecosystem maps recommend field checking of 25 - 50% of the total number of polygons in the mapped area. The field sampling plan that we are recommending would have us visit several polygons on 49 of the 159 typed photos.

With the completion of field work and required edits, the photos would be ready for monorestitution and polygon line digitizing (see Section 7.3 for instructions for digitizing). Once digitizing is complete and a database with sample draft map(s) have been produced, the polygon line work will be compared to the photos to ensure accuracy. At this stage, the legend for the final map would also be prepared and reviewed.

Table 4 outlines recommended steps for the completion of the pine mushroom habitat mapping project.

TABLE 4. Recommended approach for completing the pine mushroom habitat map

Phase	Description
1. Field ground truthing	Conduct field sampling to verify site series in questionable areas, confirm accuracy of overview typing delineation and assess time frame necessary to complete the line work edits
2. Q/A and line work edits	Conduct internal quality assurance overview of typed photos based on field work results, finalize photo typing and line work edits
3. Digitizing and draft Map production	Assist and support in digitizing line work, legend production and relevant map design for draft map production
4. Edits for final map production	Review and edit GIS line work and presentation for final map production

7.2 Cost Estimate for Field Work and Support for Production of Final Map

A cost estimate has been prepared and can be available on request for the completion of:

- field work
- subsequent photo edits and
- support for the production of the final map.

7.2.1 Time frame

A number of field sampling days could be carried out in early fall of 2012, with photo edits to be conducted during and shortly after the field work sessions. Assistance for digitizing, map production and final map edits would be carried out in consultation with the MoFLNRO before the end of the fiscal year, 2012.

7.3 Instructions for Digitizing

The instructions for digitizing are outlined in Table 5. As a part of this contract, we will be available to have an initial conversation with the personnel involved in the digitizing to further outline and clarify the digitizing instructions.

TABLE 5: Instructions for digitizing

Polygon Type	Description of Line Type	Instructions	Notes
Study area boundary	Black dashed omnichrome	Base lines on existing digital files	
ICHmc1 and ICHmc2 subzone boundary	Yellow solid omnichrome	Base lines on existing digital files	
CWHws2 subzone boundary	Blue solid omnichrome	Base lines on existing digital files	
"*Type 1*" pine mushroom polygons*	Red solid pen line with a number "1" in or adjacent to the polygon	Differentiate these polygons from "*Type 2*" and color inside polygon red	occasionally black/blue pen on photos when abundant previous red omnichrome lines exist
"*Type 2*" pine mushroom polygons*	Red solid pen line with a number "2" in or adjacent to the polygon	Differentiate these polygons from "*Type 1*" and color inside polygon yellow	occasionally black/blue pen on photos when abundant previous red omnichrome lines exist
Polygons from previous mapping project	Red solid pen line with an "x" in or adjacent to the polygon	Do not digitize	
Polygons to field check	Red dashed pen line with no "1" or "2" in or adjacent to polygon	Do not digitize	
Polygons above 600 m	Red solid or dashed pen line outside of the study area boundary with an "x" in or adjacent to the polygon	Do not digitize	

* Total number of Type 1 and Type 2 polygons to digitize on each photo is written on the bottom right side of the photo frame.

7.4 Future Research of Pine Mushroom Habitat in Elevations Above 600 m

During the mapping process, there were areas which were identified as potential pine mushroom habitat above 600 m (further than the 100-m horizontal distance outside of the boundary). Some of these polygons were outlined and marked with an “x” to indicate

that should not be digitized, and some were recorded in our file notes. An investigation into the productivity of these sites and their mapping for pine mushroom habitat is beyond the scope of this project, but would be a topic worthy of discussion.

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. Min. For., Research Br., Victoria, B.C.

Friesen, J. 2002. Pine Mushroom Habitat Mapping in the Babine Watershed. Contract Report. Smithers, B.C

Friesen, J. 2004. Pine Mushroom Habitat Mapping in the West Skeena Area. Contract Report. Hazelton, B.C.

Gitanyow, 2002. Gitanyow's Chief Territories. http://www.kermode.net/gitanyowchiefs/territory_main.htm (Accessed online February 2, 2012)

GeoBC/Digital Imaging Service/Airphotos http://geobc.gov.bc.ca/airphoto_kml/2006.html (Accessed online January-February, 2012)

GeoBC Base Map Online Store http://openmaps.gov.bc.ca/imfows13/imf.jsp?site=idt&request=ortho (Accessed online January-February, 2012)

Kranabetter, J.M., R. Trowbridge, A. Macadam, D. McLennan, J. Friesen. 2002. Ecological descriptions of pine mushroom (*Tricholoma magnivelare*) habitat and estimates of its extent in northwestern British Columbia. For. Eco. and Manage. 158 249-261.

Marsden, E. 2006. BC's Northern Interior Forests: Planning for Sustainability in a Dynamic Landscape, Prince George, British Columbia. http://www.forrex.org/program/con_bio/PDF/Workshops/Dynamic_Landscapes_Workshop/PG/Glen%20-%20Collaborating%20with%20First%20Nations.pdf (Accessed online February 2, 2012).

McLennan, D., J. Friesen, V. Veenstra. 2000. Estimate of Areal Coverage of High Productivity Pine Mushroom Habitat in the Kinskuch and Brown Bear Landscape Planning Units - Kalum Forest District. Contract Report. Hazelton, B.C.

Ministry of Forests, Lands and Natural Resource Operations, Smithers, B.C. February 2012. POST PUBLIC REVIEW DRAFT Cranberry Sustainable Resource Management Plan. http://archive.ilmb.gov.bc.ca/slrp/srmp/north/cranberry/docs/Cranberry_SRMP_2012_POST-PUBLIC_REVIEW_DRAFT.pdf (Accessed online March 15, 2012)

Resources Inventory Committee. 2000. Standard for digital terrestrial ecosystem mapping (TEM) data capture in British Columbia. http://www.ilmb.gov.bc.ca/risc/pubs/teecolo/temcapture/assets/tem.pdf (Accessed March 2012)

Trowbridge, R. 2006. Cranberry Pine Mushroom Habitat Mapping. Contract Report. Smithers, B.C.