The University Of Northern British Columbia
Quesnel River Research Centre
Likely, British Columbia

Keefer Ecological Services Ltd
Cranbrook, BC

Royal Roads University
Centre for Non-Timber Resources
Victoria, British Columbia
And
The Likely Xat'sull Community Forest
Likely, British Columbia

An Assessment of the Effects of the Mountain Pine Beetle on Non Timber Forest Resources in the Likely Xat'sull Community Forest

Final Report- 2009

Project No.: 000007009

March 2010

Report prepared by Erin Robinson, Mike Keefer, Randy Moody and Pascale Gibeau

for

Western Economic Diversification Canada

Table of Contents

List of Tables

Project team:

Wayne Henke, Likely/Xat'sull Community Forest
Tel: 250-790-2487
Email: ccsilvic@wlake.com

Richard Holmes, Quesnel River Research Centre (UNBC)
Tel- 250-790-2331
Email: carenvir@lakenet.ca

Mike Keefer, Keefer Ecological
Tel- 250- 489-4140
Email: mike@keefereco.com

Randy Moody, Keefer Ecological
Tel- 250- 421-7910
Email: randy@keefereco.com

Erin Robinson, Quesnel River Research Centre (UNBC)
Tel- 250-790-2331
Email: robinsoe@unbc.ca

Henry Sellars, Xat'sull First Nation
Tel-250-989-2323

Many thanks to:

- **Wendy Cocksedge, Centre for Non-Timber Resources**
- **Robin Hood, Manager of LXCF**
- **Chief Bev Sellars, Xat'sull First Nation**
- **Sally Sellars, Xat'sull First Nation**
- **Thomas Phillips, Xat'sull First Nation**
- **Nancy Turner, University of Victoria**
- **Ray Coupé, MOFR for data and field services**
- **All of the participants at the workshops, for your input and guidance.**
- **The Western Economic Diversification Canada for their financial support.**

Executive summary

Forest ecosystems produce a wide variety of valuable resources beyond conventional timber and fibre products. Non-timber values include wild foods such as berries, mushrooms, fiddleheads, greens, and honey, as well as essential oils, floral greenery, and specialty wood products. In 2009, a research team from the University of Northern British Columbia's Quesnel River Research Centre, Keefer Ecological Services Ltd., Royal Roads University's Centre for Non-Timber Resources, Likely/Xat'sull Community Forest (LXCF), and the Xat'sull Nation collaborated with members of the communities of Likely and Xat'sull to examine the use of non-timber forest products (NTFPs) in the context of economic diversification and ecosystem based management.

The objective of this research project was to work with community members to determine which plants within the LXCF have the potential for sustainable, ethical commercialisation. Once the species were identified, the team developed a predictive inventory to model the habitat potential for the distribution, abundance, and quality of the NTFPs in the area to ensure sustainability of the resources. The research team collaborated with the LXCF board of directors and manager to explore how compatible management may optimise production of both timber and non-timber resources. The research team applied and tested an NTFP inventory methodology developed in previous projects. Although the application and predictive modelling developed in this project is specific to the LXCF, the lessons can be applied to other areas of British Columbia.

There were two main components to this project:
1. *Qualitative research including community interviews and workshops*. The purpose of the interviews was to collect local input on how to diversify the local economy, as well as to assess local knowledge on the effects of the mountain pine beetle on the NTFPs in the community forest. A preliminary workshop preceded the sampling session and identified 18 species of interest. The final workshop in Likely and the meeting with the Xat'sull Chief and Council were used to disseminate research findings and give the community members a chance to provide input, voice any concerns, and decide the next steps for their community forest planning.

2. *Development of a predictive NTFP map for the LXCF area*. The team conducted 10 days of field sampling in July 2009. Sampling included quality and cover of target species, as well as cover of indicator species and site and stand variables such as soil condition, aspect and crown cover. One hundred plots were sampled. The field team sampled areas of known high quality, as well as other areas, to field test previously developed quality coding and develop correlations of habitat conditions with high quality presence. Based on both local knowledge and data analysis, an attribute table was developed to enable spatial mapping of predictive areas of high quality presence for seven NTFP species within the Community Forest.

This project has also generated a series of broader-level results, including furthering the development and testing of methods for NTFP inventories, collecting information about the impact of accelerated timber harvest on the quality and quantity of culturally and economically important non-timber forest species, and increasing the understanding and data on

correlations between habitat and species' quantity and quality, which will enable predictive models for resource management.

Introduction

Both the Likely and the Xat'sull communities are rural, resource-dependent settlements in the Cariboo region of British Columbia where forestry has been the predominant industry in the area. The two communities have worked together to incorporate the Likely Xat'sull Community Forest (LXCF), which is a partnership between the two Aboriginal and non-Aboriginal communities. The Likely/Xat'sull Board of Directors manages the Community Forest and are trusted with practicing sound forest management by focusing on cultural, ecological, and economic principles. The board aims to minimize the detrimental impacts of forestry on other resource values, such as non-timber resources.

Community participation in forest planning is integral to the functioning of a community forest, as the LXCF has identified that it is creating a multi-use forest that is used and valued for resources beyond standing timber (Robinson 2005). The recognized value of the forest includes timber production, but also encompasses other uses for the forest such as spiritual and aesthetic qualities, a healthy ecosystem for living and recreating on, and maintenance of the diversity of NTFPs that the forest has to offer (Anderson and Horter 2002).

The land-base on which the LXCF now sits, as well as the surrounding area, has been heavily logged in the past through the industrial forest tenure system with little or no replanting done by major licensees until the 1980's. Previous research has indicated that in a few decades there will not be sufficient standing timber to support the current volume of logging in the surrounding area (Anderson and Horter 2002). This situation has been exacerbated by the current mountain pine beetle (MPB) infestation, which is forecast to cause significant financial losses for forestry-based communities, as their timber supplies decrease over time (BC Government 2005).

In the LXCF, all accessible beetle-wood over 15 cm diameter at breast height (dbh) has been harvested (Robin Hood, General Manager LXCF, pers. comm. 2010). The resulting reduction in available mid- to long-term timber will ultimately affect the number of jobs available in the forest sector, and thus also long-term stability and viability of the community. There has been a burgeoning focus in recent years towards how the MPB infestation is affecting sawlog production and other high-value commercial products, however there is little known about the impacts on NTFPs. There may be positive interactions, such as increased light available to understory plants and resulting increased growth or berry production. This potential positive response of NTFPs in light of a potentially declining forest sector combines well with the increased need for economic diversification and the recognition of a diverse array of resource opportunities required for stable livelihoods.

It is therefore important for communities to be able to diversify into other areas of potential livelihoods, such as non-timber forest products, which can provide not only economic income, but also food security and cultural maintenance. However, as the economic importance of the industry increases, so does the significance of monitoring and regulation (Ehlers and Keefer 2007).

The harvest of NTFPs has risen dramatically over the last few decades for a myriad of reasons, which include increased global market demand, rural communities requiring

alternatives for economic diversification, increased awareness of health and nutraceutical benefits, and a growing interest in cultural revitalisation (Cocksedge 2006). At the community level, both rural Aboriginal and non-Aboriginal peoples have relied on the forest for goods and for employment.

The Likely-Xat'sull Community Forest has a mandate to use a percentage of the profits to create employment opportunities in areas that are attuned with the community goals, as well as community-based local initiatives (Robinson 2005). These include fisheries enhancement, recreation, tourism, infrastructure, non-timber forest products, research and education. In 2004, a two-day workshop called "Seeing the Forest Beneath the Trees" was held within the community to provide information to community members on how to utilize NTFPs for business opportunities. Importantly, NTFPs may provide employment opportunities for Aboriginal Peoples that would be in line with traditional ecological knowledge and provide a viable income (Turner and Cocksedge 2001).

Project Purpose

"They should manage the logging around what is already there, the other values. They should identify all the products that will grow after the site is harvested and manage for the whole ecosystem." Interview participant

This research project sought to develop tools to assist with the incorporation of NTFPs into forest management, which can in turn assist with the use of NTFPs as livelihoods opportunities. Methods to adequately incorporate NTFPs into standard inventory methods and models are still somewhat at the research stage. This project builds on previous research which combined western scientific knowledge with local and traditional knowledge to understand species' quality, and what stand attributes support the required quality and cover[1].

Specifically, the project objectives included the following:

- Develop a predictive model for NTFP habitat for the LXCF through:
  - Identification of focal species important to the community;
  - Assessment of the distribution of the focal species and landscape trends;
  - Application and testing of the coding criteria for assessing quality for the identified species. These codes were previously developed based on local knowledge and;
  - Development of baseline inventories to direct predictive modelling for the LXCF and similar ecosystems.

- Assess potential impacts of development, mass disturbance events, and climate change on NTFP species through local knowledge.

- Develop a participatory research approach which respectfully includes local knowledge, and builds on community interests and aspirations while addressing potential concerns.

[1] FIA-FSP Y093318. Assessing cultural use species in mountain pine beetle affected areas.

Project Logistics

Start date: April 1, 2009
End date: March 1, 2010
Location: Likely, British Columbia

Table 1. Project indicators.

	Indicator	Start date for indicator	Baseline number	Benefit measurement date	Target number	Number achieved
1.	# of seasonal jobs created	June 2009	0	October 2009	4	4
2.	# of individuals increased capacity	May 2009	0	March 2010	15	22
3	# of NTFP inventory methods developed	April 2008	0	March 2010	1	1
4.	# of habitat-species correlation models developed	May 2008	0	March 2010	1	1
5.	# of species able to be introduced into management	April 2008	0	March 2010	12	18

All of the indicators were completed as planned, on time. There were a greater number of people with increased capacity due to local interest shown and corresponding participation in the project. There was a slightly greater number of target species able to be introduced into management as many management practices such as forest thinning benefit many NTFP species.

There were no major unexpected outcomes during the project. A minor unexpected outcome was positive, and was the identification and removal of noxious weeds within the Community Forest.

We would rate the project as at least a ‘2’ – met expectations. We feel that the project went as planned, with solid, applicable results, and with good involvement from the communities.

Methodology

Study Area

The Likely-Xat'sull Community Forest came into inception in 2002 as a collaborative effort between the communities of Likely and Xat'sull. The community forest encompasses a 12,230 ha area consisting of a diversity of biogeoclimatic ecosystem classification (BEC) zones, including: 10% Engelmann Spruce – Subalpine Fir Cariboo Wet Cool (ESSFwk1); 40% Interior Cedar – Hemlock Horsefly Moist Cool (ICHmk3); 30% Interior Cedar – Hemlock Thompson Moist Cool (ICHwk2); 10% Sub-Boreal Spruce Blackwater Dry Warm (SBSdw1), and; 10% Sub-Boreal Spruce Moist Warm (SBSmw). The annual allowable cut (AAC) for the LX community forest is approximately 25,000 m^3.

Public Input

Often, participants in the NTFP sector lack a voice in land use planning, resource management, and political and market considerations (Cocksedge 2006). Thus we sought to follow the principles of participatory research, wherein communities and researchers come together to explore an issue of shared interest, with active involvement and recognition of all partners in the research process (modified from McKennitt & Fletcher 2007). Such collaborative initiatives are better positioned to enable Aboriginal communities to control the research questions and issues that are examined on their territory, the methods used to investigate them, and the sharing and ownership of the resulting knowledge. This contrasts with much of the conventional research involving Aboriginal communities, wherein outside practitioners have initiated, carried out, and profited from the knowledge generated (Royal Commission on Aboriginal People 1996; Weir & Wuttunee 2004). In these cases the research purposes and practices have usually been alien to the community, and all too often the outcomes have been misguided or harmful (Brant-Castellano 2004).

By developing and implementing this research collaboratively, we anticipated that the project would be more relevant to the communities, that it would be stronger by drawing on the local and traditional knowledge of community members, and that research outcomes would be more likely to benefit all partners involved. By jointly developing protocols for how we do our research and share our results, by drawing on the knowledge, perspectives, and skills of a range of partners, and by continually assessing the project's progress, we sought to make this research as valuable as possible to project partners while providing an example of collaborative research, and lessons learned, for interested individuals and agencies outside of the project area. Further, commercialisation initiatives that include the local people have the best chance of success because the harvesters continue using NTFPs, while instilling sustainable management techniques at the local level (Thadani 2001).

The methodology was therefore designed to incorporate local knowledge while remaining sensitive to community information and management needs, such as balancing privacy with access of information. Ethics approval was obtained through the University of Northern British Columbia and Royal Roads University. In accordance with the Ethics Board mandate,

all information was kept confidential and the interviewees were informed that they could withdraw from the research at any time.

Species list development
In 2009, the research team worked with members of the communities of Likely and Xat'sull to determine the species of focus. Community members selected species of focus through two methods: taking part in an interview and/or attending the preliminary workshop.

Workshops
*Preliminary workshop***:** The purpose of this workshop was to introduce the project and gather experiential data on species habitat and quality requirements for either cultural or commercial harvest. The research team hosted the workshop in Likely on July 22, 2009. The project partners developed the workshop collaboratively. The event was informal and open-ended to maximize discussion. All team members were present at the workshop in order to respond to and assist with the proceedings.

*Final workshop***:** This final workshop provided an opportunity for community members to provide input, comments, and concerns about the project. The workshop in Likely was held on February 16th 2010 at 7pm in the Likely community hall. This meeting was advertised in the LXCF newsletter, posters, and the local newspapers from Williams Lake. Each of the interviewees was personally invited to the workshop.

Interviews
Twelve community members from Likely were interviewed using semi-structured and open-ended questions (Appendix 1) to determine what species have potential for commercialisation. The interviews were also used to discover community members' ideas about how to diversify the local economy beyond timber and to assess people's perceptions of the effects of the mountain pine beetle on the NTFP in the LXCF. This questionnaire was modified from Keefer (2005) and Cocksedge (2009). People were identified using the "chain referral selection", which was done by asking the participants to identify people who possess the characteristics being studied , i.e. people who are avid harvesters and knowledgeable about NTFPs (LeCompte et al. 1999). Interviewees guided this process, and only disclosed information with which they felt comfortable. Information from the interviews can be found in the results section of this report. To further the community focus, Wayne Henke, a local forest technician and a member of the LXCF board of directors acted as a guide for the team of ecologists conducting the ecosystem-mapping work

Field Data Collection

From July 20-31, the team conducted 10 days of field sampling. The field team included Michael Keefer, Randy Moody, Wayne Henke, and Henry Sellars. Two Likely community members came into the field to share their expertise and help the researchers for one day on July 24. To build the inventory, the team sampled 100 plots (Appendix 2). Plot information assessed included cover and quality of target species and cover of indicator species, as well as site variables such as soil conditions, aspect, elevation and crown cover. As this was a

one year project, the information collected in the summer of 2009 is considered base-line data rather than monitoring data.

Stratification was done using Biogeoclimatic Ecosystem Classification (BEC) maps of the tenure in combination with local expertise (Wayne Henke) to determine potential sampling locations. The main criteria for stratification and selection of the survey locations included BEC subzone, logging history, slope position, aspect, and known quality of NTFP sites. In the interest of being able to examine the potential impacts of the MPB infestation, attempts were made to locate plots in adjacent logged and unlogged stands whenever available. See Appendix 2 for a representation of where the BEC zones are located in relation to the plots.

Ecosystem information was collected using the BC Ministry of Forests and Range 'Site Visit Form' (FS 1333) (Appendix 3). Site and stand variables were recorded, as well as full lists of vascular plants and their percent cover. The assessment of the 18 identified NTFP target species included both cover and quality of the species.

Quality was assessed using a modified version of quality coding criteria which were previously developed using local and scientific knowledge (Cocksedge 2009; 2008). For this project, a four-point scale was used to assess quality; low, moderate, high, and very high. The four-point scale for huckleberries is provided in Table 4. The original seven-point scale for standardized quality coding is appended (Appendix 7; also available at www.royalroads.ca/cle).

Work by Keefer Ecological Services Ltd. on huckleberry productivity based in the East Kootenay found that shrub height was a valuable determinant for berry productivity, thus approximate average plant height was recorded (unpublished data, FIA-FSP / Habitat Conservation Fund project "Huckleberry Abundance and Productivity Study" 2009).

Predictive Model Creation and Mapping

Existing inventory protocols are limited because they record the presence of a species but say nothing of its quality or usability, which is crucial information to an NTFP harvester. For example, a VRI may show that the shrub cover in an area is high, and the corresponding ecosystem map (i.e. TEM) may show that conditions in that area are appropriate to support a certain shrub community, such as black huckleberry. With this information we can predict that black huckleberries may be present over a large part of this area. Although this is a good starting point, it does little to indicate whether the high *cover* of black huckleberry converts to high *quantity* or *quality* black huckleberries that people would want to harvest. An inventory must therefore include an assessment of plant quality, which may be linked to site conditions, in order to be useful to NTFP harvesters.

Two sets of independent variables were considered separately for the analyses: 1) environmental variables, and 2) vegetation resource inventory (VRI) variables. Models were developed to predict quality and cover of huckleberry, and partial analysis was completed on a further seven of the identified species. Quality of the berries was described with a qualitative

ordinal variable while cover was quantitative. Because of the nature of the dependent variables and the available data, different techniques were used to build the various models.

To predict the quality of huckleberry, ordinal logistic regressions were used. Ordinal logistic regression is an extension of logistic regression to cases when the dependent variable has more than two classes, and when these classes can be ordered. To predict cover of huckleberry, multiple regression models and ordinal logistic regressions were computed. Multiple regression models yielded predictions that were negative, and thus, cover was classified in three to four groups and ordinal regressions were developed in order to achieve meaningful predictions.

Independent qualitative variables were recoded as dummy variables so they could be included in the logistic and multiple regression models along with the quantitative variables (Legendre and Legendre 1998). In that procedure, the multi-state qualitative variables with s states were recoded into s-1 binary variables (one binary variable for each state of the qualitative variable).

Multicollinearity among independent variables in regression models is to be avoided as it increases the variance of the regression parameters and increases the instability of the models (Legendre and Legendre 1998). Multicollinearity among all independent variables was therefore tested with variance inflation factors (Zuur et al. 2007). Variance inflation factors (VIF) were computed by taking the inverse of the correlation matrix of all independent variables. The variance inflation factor for each variable is high when the variable is very collinear (that is, correlated) with the other ones. Highly correlated variables were removed, and VIF recomputed for all other variables, until multicollinearity was reduced to an acceptable level. All variables with VIF lower than 10 were kept for analyses. The distribution of the remaining variables and the presence of outliers were assessed with scatterplot diagrams prior to the analyses.

Finally, prior to computing the regression models, a selection of the variables was performed to simplify the models and reduce the amount of independent variables to be included in them. A stepwise procedure was used, which includes one by one the variables in the models, and test at each step whether the other variables included in the model remain significant or not (Legendre and Legendre 1998). The selection was performed in the R language (version 2.9.2) with a function built specifically for multiclass qualitative response variables (stepclass of library klaR) or for multiple regression models (library packfor). A maximum of 10 variables were kept for inclusion in the regression models. The regression models were then computed, and the significance of the variables included further assessed with the Wald statistic (Zuur et al. 2007). Wald statistics correspond to estimated regression parameters divided by their standard errors, and they are compared to a reference t-distribution. If the absolute value of the statistics are larger than 1.96, then the regression parameter is statistically significant at $\alpha = 0.05$ (Sokal and Rohlf 1995). Non significant variables were removed from the models, and the model re-run until all variables included were statistically significant. Models were then used to spatially predict the values of quality and/or cover in the whole mapped area (> 150 000 pixels of 50m by 50 m).

All models were computed in the R language (version 2.9.2). The ordinal logistic models were tested by AIC, and the multiple regression models by permutations (99999 permutations).

Communications and Extension

The final report (excluding any sensitive information) will be available on data bases at the University of Northern British Columbia and Royal Roads University. The report may also be accessed on-line through either Royal Roads University (http://cle.royalroads.ca/node/219) or the Quesnel River Research Centre (http://www.unbc.ca/qrrc/publications.html) . Additionally, the project has been tracked and described in the Likely Xat'sull Community Forest monthly newsletter, and presentations were given to both the community of Likely and to the Xat'sull First Nations community of Soda Creek. The project was presented at the 2009 UNBC Quesnel River Research Centre's annual Open House and Research Symposium. With approval from the LXCF board of directors, information from this research may be published in an academic journal.

Chief and Council meeting

On February 16 2010 Michael Keefer and Erin Robinson attended the Chief and Council meeting in Soda Creek, where a 15-minute presentation was given to discuss the project results. The Chief requested a one-day workshop be held for community members to learn about this project and other agro-forestry topics relevant to Xat'sull.

The research team provided a final NTFP inventory and report, mapping data and the community summary to the LXCF board of directors and Chief and Council on March 1, 2010.

Results and Discussion

Public Input

Species list development

The interview and workshop participants identified 18 focal species for this project (Table 2). This list served as a guide for the field data collection. Due to the limited field sampling time, not all species could be fully sampled.

Table 2. Focal species selected by interview and workshop participants.

Secwepemcstin	***Common name***	***Scientific name***
wenéx	Black huckleberry	*Vaccinium membranaceum*
s7éytsqwem	Red raspberry	*Rubus arcticus*
tqǐtq'e	wild strawberry	*Fragaria sp.*
sesép	lowbush blueberry/bilberry	*Vaccinium caespitosum*
set'eke7	highbush blueberry/velvet-leaved huckleberry	*Vaccinium myrtilloides*
yegm'in	Oval leaved blueberry	*Vaccinium ovalifolium*
speqpeq7uw'l	Saskatoon	*Amelanchier alnifolia*
t'nisellp, t'nis	high-bush cranberry	*Viburnum edule*
sketúcwe7, seketúcwe7, e sketúcw	bog cranberry	*Vaccinium oxycoccus*
pekllén	pin/bitter-cherry	*Prunus emarginata*
no name known	arnica	*Arnica cordifolia*
sts'als, sts'élse	Oregon grape	*Mahonia repens*
sekwél	wild rose (rose hips)	*Rosa acicularis, R. nutkana*
no name known	ferns (fiddleheads)	*Athyrium filix-femina*
owllinllp	birch	*Betula papyrifera*
ts'exmém'llp	stinging nettle	*Urtica dioica*
secwsqéqxe7ten	Labrador tea	*Ledum groenlandicum*
qá7p'ucw	hazelnut	*Corylus cornuta*

Mushrooms were identified during the interviews; however, they were removed from the inventory for logistical reasons due to data collection occurring in July. The commercially valuable mushrooms fruit either in the spring (morels) or in the late summer to fall (boletes, porcupine mushrooms, and others).

Workshops

Preliminary workshop

There were five attendees from Likely (total town population was 250), and one Xat'sull community member.

Final workshop
The LXCF manager as well as nine community members, three of whom are members of the Likely Community Forest Society, attended the final meeting, and a summary handout was provided (Appendix 5). The manager requested that a community briefing note accompany the final report for quick reference, which was therefore developed and is appended (Appendix 6). Erin Robinson's presentation covered the overview of the project and the interview results. Michael Keefer's presentation dealt with the ecological mapping and predictive inventory, as well as topics of economic diversification and ecosystem based management. The audience asked questions about starting community greenhouses both in Likely and Soda Creek. Likely members expressed interest in having food grown in community greenhouses, as well as nursery plants for stream, mining and other ecological restoration. The point was made that Soda Creek, having a longer growing season and a milder winter, would be an ideal place to have LXCF greenhouses to grow food, tree seedlings, and other plants for restoration work. A participant identified a major community concern that the Mount Polly Mine is using restoration species such as pine trees and alfalfa grasses, as well as using fertilizer (which is sewage waste product trucked as back-haul from Vancouver). Another concern brought up about the mine was the effluent that is being released into Hazeltine Creek. Addressing this concern may include planting sedges and other wetland species along the creek and constructing wetlands to remediate the effects of the effluent. Growing native NTFPs in the context of mining reclamation is a subject that needs to be investigated further.

The use of fertilizers for trees was a question raised to Mike Keefer, and he responded that there may be other ways to enhance tree growth such as thinning and pruning that will not compromise the other values in the ecosystem. The recommendation is to use pruning and spacing as well as compatible management techniques to achieve increased timber and non-timber resource production.

Creating a secondary industry by pruning trees for wreath and garland-making as well as essential oils was a diversification option the attendees discussed. This would be a compatible management option, in that the pruning would result in economic opportunities through the boughs, and would also open up the canopy to allow more light to reach the understory species (e.g. huckleberries and blueberries), while at the same time producing better merchantable timber. To develop this option, the community forest could purchase an essential oil press and a wreath-making machine for community enterprise promotion.

A question was raised regarding the need for permits in order to sell raw berries and berry preserves commercially. To sell raw berries, a permit is not needed, however to sell jams and jellies in a store, a permit would be required (for more information see the BC Ministry of Agriculture website, "Small Scale Food Processing", at http://www.ssfp.ca/index.html). The community talked about the possibility of having a certified community kitchen to produce inspected products. Another audience member talked about making specialty wood products such as wood toboggans and sleighs. Feasibility studies should be conducted for any of the suggested business enterprises prior to initiating.

Interviews
Through the interviews, participants discussed various factors affecting their use of NTFPs and their observational knowledge relating to the plants. They identified potential issues,

noted below under “access/conflict/competition”. They also discussed impacts and management of the resources, including both local practices (below under “local techniques to manage plants”), as well as affects from industry and government (below under “brushing”, “salvage logging”, and “management/ regulation”). There was also discussion about changes seen which may be related to climate change.

Access, conflict, and competition

None of the interviewees had experienced conflict while harvesting, but some people mentioned competition and some secrecy around productive harvesting sites. Two interviewees mentioned the potential for conflict if the LXCF starts managing sites (i.e. compatible management to improve the berries) for community use. For example one person said, “If we managed a certain area close to town, a couple of people will come and pick all of the berries. There will be too much competition if we manage them.” Another respondent said, “If too many people are harvesting, there might be too much competition”.

The overwhelming factors that people considered when going to harvest was proximity to home and access, both of which underline the importance of managing for these species close to communities rather than assuming abundance over the landscape. Other factors mentioned by participants included the quality and quantity of the berries or plants. Two individuals mentioned road deactivation as a hindrance to accessing plants.

Local techniques used to manage plants

We asked if individuals were aware of any traditional or contemporary techniques to manage the harvesting sites, and if they utilised the technique. A number of respondents were both aware of, and practicing, techniques to enhance the plants. For example, responses included; “After logging, leaving debris on the roadside so that berries can get started”; “Leave some of the most vigorous plants behind for seeds - we don’t always consider this because we are using for personal use, however if we start harvesting more, we will need to consider this”; “Not harvesting every plant in an area. For example, false box wood, if you are harvesting this for floral arrangements, you wouldn’t want to pick every plant”; “When I pick fiddleheads, I only pick 2 or 3 per clump. When I pick nettles, I only take the tops, this is mostly because the tops are the tender part, but it also keeps the plant producing.”, and; “Take the minimum amount that you need and leave the rest intact. Leave some of the plants for regeneration. If it is a perennial, make sure the leaves stay intact.”

Brushing

Participants were asked to identify any changes in the plants that they have noticed over time (e.g. the quantity of the plants and berries). The interviewees talked about berry patches being productive for a time and then becoming hindered by brush, which blocks out the light. One person said, “The places I used to go are all brushed up now.” Participants also discussed how the increase in MPB salvage logging has opened up the canopy, resulting in a flourishing of certain plants, such as blueberries and huckleberries. An interviewee who owns a woodlot stated, “...in some areas where the canopy is opened up the shrubs have exploded. I was in my woodlot and on the open west slopes there are lots of blueberries and huckleberries.” Another respondent stated, “...where the land has been logged, the berries are in abundance, but they are good for a few years, and then it brushes up again.” The LXCF has harvested all of the financially accessible beetle killed trees within the original

Community Forest boundaries. From the interview responses, it appears that the resulting extra light is influencing berry production in accessible harvesting sites.

Salvage logging

We asked several questions about salvage logging to determine how people perceived the management option that allows for fewer large clear-cut sections of land. When asked about how the plants will respond to salvage logging, an individual responded, "The plants will respond well, I used to salvage log with small machines- we would use old skid trails, put all the old stumps and debris and pile it on the trail for plants. Also, we would drag an excavator across the trails to make site disturbance." Most people interviewed mentioned that they perceive logging as greatly benefiting the berries, but that some species, including berries, required some amount of shade for high quality. In the LXCF, one logging contractor has made some piles of dirt and debris so that raspberries can get started on the sites. Another interviewee said, "The plants do better [after logging]. Up the 8900 road, the logging slash that was cut down the year before last, is producing so many raspberries and strawberries. Berries are a ground cover out there, it was incredible, all the new growth. We pulled out a bunch of Rhododendron, currants and lupines for our yard."

When asked about suggestions on how the LXCF should salvage log, one person stated, **"**It may have to go back to the small contractors with small equipment, or even better, someone with horse logging. Back, a number of years ago, they used to have small contractors, before the big licensee came in." Three of the twelve people interviewed discussed how a clear-cut method should not be carried out; they talked about the value of leaving the small trees for regeneration: "Don't take out all the little trees, use the arm of the buncher from the small trails. Don't cut the 20-30 year old spruce," another person said, "The logging benefits the plants. My husband is a logger and he leaves all of the old 10-15 year old spruce and fir. You have to leave the little trees and some wildlife trees" and the third person made the statement, "They should leave some of the trees and try to maintain the 20-30 year old trees for the next harvest." One individual mentioned evaluating the other values in the ecosystem prior to logging; he said "One thing to be considered is to not damage the soil. Keep the other values in mind rather than the money. Don't ruin the soil and it will keep producing other organisms which will help the trees. There isn't much point in salvaging unusable timber and destroying other plants."

Management and regulation

When asked about management, five of the twelve interviewees brought up the topic of regulation. They are concerned that management will lead to regulation and the need for a permit to harvest NTFPs. It is important to note that the interviewer did not ask about *regulation*, however people appear to perceive management and regulation as synonymous. When questioned about the need for management, one interviewee said, "...we have such an abundance of berries, if we start managing we might need permits - we don't have a problem yet". On the same topic, another individual stated, "I believe that we should possibly regulate if things are being over harvested - only regulate where necessary".

A long time Cariboo resident and woodlot owner made the following recommendations when asked about management of NTFP, "We can manage by leaving resources during logging. Harvest sensitive sites during the winter. Combine NTFP management sites with wildlife tree patches. Just make it part of the overall part of the maintenance. If we consider wildlife tree

patches, they are now seen as a loss of revenue, but they could be potentially, a source of revenue for someone else in the community".

The following long quote is from an individual who has lived in Likely their entire life and worked in Silviculture for 15 years.

> "We have to ask ourselves, what objective we have. If we want to start making money off of the berries, we should start managing for them. Huckle, raspberries and thimbleberry would thrive if managed. We could start identifying sites where berries grow within the blocks before logging is carried out. We could start writing it in to the SP [silviculture prescription or site plan]. The forestry obligations would still have to be fulfilled, so this would have to be done during the cruising or beetle (survey). We could write it into the SP to harvest the area around these plants, and then not replant them. Why not try to maintain some sites as community picking sites. Right now people don't pay attention to these things, so contractors could have to look for other factors- such as berries. It would be way more labour intensive because they would have to look for different plants. Also, it would be a bit of a gamble, because we could put money out and not see any return (not like with timber). We don't have a guaranteed revenue. It would be about finding a balance between timber and NTFP values. Not replanting the area around the plants would cut into timber revenue down the road".

Climate change

Responding to the question, "Do you notice changes in when you can harvest?", there was a mixed response. Some respondents noted an increasing tendency of extremes, and some didn't notice any trends. All responses indicated the presence of cyclical, or annual, variation (see Appendix 4 for full interview responses). One individual stated, "Things change based on the seasons; on specific factors related to specific seasons." Another person stated, "We are not affected as much here by climate change because it is a wet area, maybe in the areas that are hotter and drier they feel climate change more. Also, we have a very diverse ecology here, i.e. ICH, SBS, and ESSF. However, the MOF [Ministry of Forests and Range] has changed the elevation specifics as to where we can plant certain seed lots. In the past we couldn't take a specific seed lot up past 1000ft, and now we can take them from 1200ft".

Predictive Models

We completed a full analysis and predictive model for black huckleberry, and a partial analysis for a further seven of the focal species. For the partially analysed species a full model was not produced, however a summary of general site characteristics for each species was created based strictly on the presence of the species.

Due to the short sampling session, it was not possible to complete a full analysis on all of the species identified by workshop and interview participants. The lack of variation in dependent variables did not permit analysis on the homogeneous response data. For example, all red raspberry quality observations scored as either low or absent; the data regarding these observations could be used to characterize low quality sites but it remains unknown if these same characterizations extend to higher quality sites or if the descriptors of these sites

differed. Thus, attempting to effectively sample for 18 focal species would require that dedicated sampling sessions be implemented for each species; achieving a sampling strategy of this level was not within the scope of the project.

A total of 104 plots were sampled. Plots with missing values and outliers were removed, producing a reduced matrix of 77 plots which was used to compute the regression models with environmental variables. The models developed which included the vegetation resource inventory (VRI) variables contained a total of 95 plots.

Full analysis: huckleberry

After screening for missing values, multicollinearity and presence of outliers, a total of 27 variables (both discrete and continuous) were used to predict quality and cover of huckleberry. They are presented in Table 3. Discrete variables that were not present in more than five plots were removed from the analyses. All variables had a variance inflation factor of less than 8, thus indicating a low degree of collinearity (i.e. correlation) among them.

Table 3. Variables included in the computation of predictive models.

Variables	Nature	Units
Elevation	continuous	meter (m)
Slope	continuous	%
Aspect	continuous	degree (˚)
Crown Closure	continuous	%
Site index	continuous	#
Live stems	continuous	#
Moisture regime	discrete	2, 4 and 5
Nutrient regime	discrete	B and D
Dominant species	discrete	AT, BL, FD, PL and S
Co-dominant species	discrete	CW, FD, PL and S
Age	discrete	1, 4, 5, 6 and 8
Height	discrete	2 and 4

Huckleberry quality

Table 4 identifies how huckleberry appeared throughout the samples based on a sample size of 95 plots.

For the purposes of our analysis, we combined values of cover with quality to some degree, and broadened the ratings for modeling (see Appendix 7 for original quality codes). A stronger model would benefit from a larger sample size per quality rating than was able to be obtained within this project.

Table 4. Number of plots within each of the modified quality code categories for huckleberry.

Coding	Description	Number of plots
1 low	Few to no fruit structures present OR berries are generally not fit for consumption. Ability to harvest only 125 mL (1/2 cup) in 10 minutes in the area.	17
2 moderate	Sufficient fruit per plant, on average, to warrant personal collection OR a few individuals with high fruit abundance and a few individuals with no fruit. Fruit and plants are of medium to high vigour and appearance. Possible to harvest 250 mL (1 cup) in 10 minutes in the area.	23
3 high	Sufficient fruit per plant, on average, to warrant significant collection. Fruit and plant are of medium to high vigour and appearance. Over 50% of new shoots hold 1-2 berries (which gives the overall appearance of approximately 3-8 berries per 10 cm of branched stem). Possible to harvest 650 mL -750 mL (2.5 - 3 cups) in 10 minutes in the area OR about 500 mL (2 cups) from each bush. Plant distribution is not patchy; low competition from other shrub species.	18
4 exceptionally high	Most of the plants have impressive levels of fruit production - the “motherlode”. Fruits and plants are of exceptional high vigour and appearance.	6
Total		**64**

Out of the 95 plots, 64 plots had a presence of huckleberry. Where presence of huckleberry was recorded, a corresponding quality code was assigned based on the modified 4-point scale. The unequal number of plots within each code category (for example, code 4 had only 6 occurrences) resulted in a less rigorous model, however this could not be avoided as sampling was based on current conditions. This fact may have impeded the capacity of the models to yield strong predictions of quality and cover across the study area.

The following output model was developed based on the four-point quality scale:

Quality = Elevation + Age class 6 + Moisture regime 4 (residual deviance = 217.78)

Results suggest that the quality of huckleberry increased with elevation, and were best in stands of age class 6 and moisture regime 4. Appendix 2 provides predictive maps based on this model. It is common for huckleberry to flourish in younger stands that are well spaced, and in mature high elevation stands the plants also appear to develop high quality berries. The absence of aspect in the model brings up the question of reliability with the current sample number, as normally aspect would be an important variable.

Huckleberry cover

In the field dataset, no values of huckleberry cover were above 50%, which impedes the predictions of the models from being higher than 50%. Multiple regression was first attempted (adj-R2 = 0.41, p=0.0001). It includes three variables: elevation (+), absence of subalpine fir (BL) and presence of stands of age 8. However, the predictions given by the models were sometimes negative, so the cover was instead divided in four and three classes, and models developed by ordinal regressions. It was found that a better representation was found in the following three class model for cover:

1 = absent
2 = very low (0.1 – 5%)
3 = medium (6-50%)

Cover = Site index – Age 5 – Age 7 – Live stems (deviance = 136.39)

The model seems to converge to suggest that cover increased with site index, but decreased with increasing live stems and in the presence of stands of age 5 or 7. It is often observed that the increasing number of live stems will decrease light levels and result in a lower density of huckleberry plant cover. In many cases the stand age has a direct effect due to past disturbances that take the ecosystem back to a pioneering stage where shrub species flourish. As with huckleberry quality it seems a few variables such as aspect and slope may be missing due to a shortfall in samples. See Appendix 2 for a representative map.

Presence analysis: Saskatoon, falsebox, red raspberry, beaked hazelnut, soapberry, oval leaved blueberry, and Sitka valerian

In addition to black huckleberry, a presence analysis was conducted on seven additional species that were field sampled (Table 5). This analysis was conducted based on presence/absence of species. One reason many of these species could not be fully modelled was that the dependent variables of quality or cover were too homogeneous for analysis (e.g. all red raspberry plots had low quality scores). Thus we can describe where the plant is found (somewhat), but cannot create a model predicting low-high quality sites.

Based on the presence analysis, it appeared that most species occurred on gentle slopes and warmish aspects with the exception of oval-leaved blueberry which occurred on steeper cool aspects. All species typically occurred within zonal soil moisture and nutrient regimes, with the exception of soapberry, which occurred on slightly drier sites. In terms of elevation, beaked hazelnut was found on the lowest elevation sites. The cover variables were quite revealing as all species occurred on sites with shrub cover that was greater than tree cover. Herb cover was logically the greatest indicator for the two highest elevation species, one of which is an herb species (Sitka valerian). Of note, Sitka valerian was the highest occurring NTFP within our sampling group.

The range in co-dominant tree species within the plots is indicative of the site types with which each NTFP is associated, and these tree species may be good indicators of NTFP plant occurrence at a coarse scale. Despite correlations with low tree cover, all NTFP species were associated with forest structures, and most were associated with successional forest types. For example, Sitka valerian was most associated with older forests of climax character, likely an artefact of the long disturbance intervals on these high elevation sites.

Although the data for these species was not sufficient enough to create predictive models, these site summaries should provide potential NTFP harvesters with suitable guidelines for locating potential sites in the field.

Table 5. Summary of site attributes for seven NTFP species. Values are mean or median values, standard deviation values are bracketed.

Variables	Saskatoon	Falsebox	Red Raspberry	Beaked Hazelnut	Soapberry	Oval-leaved Blueberry	Sitka Valerian
# of plots present (n)	43	71	28	11	22	12	10
Elevation	966.0 (+-159.3)	1004.5 (+-169.3)	1001.0 (+-158.3)	779.1 (+-119.4)	1004.4 (+-167.8)	1370.0 (+-203.4)	1456.7 (+-49.6)
Slope	17.0 (+-10.8)	18.7 (+-13.5)	14.0 (+-10.3)	7.3 (+-7.4)	22.3 (+-17.4)	22.6 (+-10.8)	27.7 (+-8.2)
Aspect	177.1 (+-82.6)	179.8 (+-92.7)	176.5 (+-91.5)	223.8 (+-111.5)	174.5 (+-81.4)	150.9 (+-120.1)	154.0 (+-134.2)
Coarse Fragments	36.8 (+-21.0)	33.6 (+-20.6)	31.2 (+-20.3)	21.8 (+-24.1)	32.6 (+-19.0)	31.1 (+-21.8)	35.1 (+-28.0)
Cover of Tree	16.4 (+-18.0)	25.9 (+-23.7)	8.6 (+-11.9)	25.5 (+-17.2)	23.1 (+-18.2)	13.5 (+-16.0)	8.4 (+-11.8)
Cover of Shrub	42.0 (+-21.8)	37.6 (+-21.9)	31.4 (+-19.3)	29.5 (+-18.9)	42.2 (+-21.0)	40.2 (+-19.2)	39.2 (+-17.6)
Cover of Herb	26.4 (+-16.2)	26.0 (+- 17.4)	29.9 (+-16.1)	23.1 (+-11.9)	24.0 (+-14.9)	59.0 (+-18.1)	53.8 (+-23.1)
Site index	16.8 (+-5.6)	17.2 (+-3.7)	18.2 (+-3.1)	18.7 (+-1.8)	16.9 (+-3.0)	13.7 (+-3.5)	13.9 (+-3.4)
Basal area	26.7 (+-18.8)	32.4 (+-16.2)	36.2 (+-12.4)	32.2 (+-7.3)	31.6 (+-13.2)	26.9 (+-21.5)	20.2 (+-21.3)
Co-dominant species 1	FD, PL	FD	FD, PL	FD, EP	FD	S, BL	BL
Co-dominant species 2	FD	S, FD	S	EP	S	S	S
Structural Stage	8	10	7	11	10	11	8
Successional Status	3.5	4	3	4	4	7	6
Moisture Regime	3	3	3	4	2.5	4	3
Nutrient Regime	C, B	C	C	C	C	C	C

Recommendations

Maintain habitat for plants that are present but not abundant

Some plants that were identified by participants as important NTFPs were present in the community forest but not in high numbers. Thus, although the total use of these species may be limited, the sites with these species are of particular importance to maintain on the landscape. For example, Labrador tea (*Ledum groenlandicum*) was discussed by participants at both the workshops and within the interviews. Labrador tea was only found in one plot within the sample set, therefore this NTFP should be included in future management plans within the community forest, and specifically within the identified site. Another example of a resource being mentioned as having some potential for commercialisation, but being scarce, was beaked hazelnut. This species was only found downstream from Likely at low elevation sites. Therefore, when working on community forest planning the mangers should consider the prevalence and site conditions required by these NTFPs as their associated habitat may be locally rare.

Implement best management practices to decrease the spread of noxious weed presence

Though not specifically part of the project design, the locations of noxious weed species were recorded on the site visit forms when inside the plots and were looked for incidentally when traveling between sampling locations. Though not currently present at high densities, noxious weeds have the potential to compete with and exclude native species including NTFPs.

Near one of the plots, the field work team found an invasion of marsh plume thistle (*Cirsium palustre*). This site was reported to the Invasive Alien Plant Program database as it is understood to be the first occurrence in the area. Given the concern over this species the Cariboo Regional District invasive plant specialist visited the site. The marsh plume thistle infestation was approximately 0.01 ha in size, and was chemically treated with Tordon 22K (using a hand gun with an application rate of 4.5L/ha). During this visit the specialist found spotted knapweed (*Centaurea biebersteinii*) growing nearby. The spotted knapweed infestation was mechanically treated, and all plants were hand pulled from the site. It is possible that both of these invasive species were brought to this site by machinery that was working in other weed infested areas.

Both yellow and orange hawkweed (*Hieracium caespitosum and H. auranticum*) were found extensively throughout the project area in a wide range of sites. These aggressive weeds have such wide distributions in the community forest that chemical treatment is not a viable option.

To reduce the spread and introduction of invasive plants within the LXCF the team recommends that best management practices be developed for logging and road building contractors. Such practices typically emphasise the need to pressure wash machinery when moving between sites, which is particularly important for machines coming from other areas.

Implement strategies for managing conflict

The process of building a NTFP predictive inventory will need to be informed by each of scientific, traditional ecological, and community-based knowledge concurrently. This will ensure a synergistic and reliable template for management strategies that will minimize conflict over the resource base. An important component to this research has been identifying concerns from the communites of Xat'sull and Likely such as zoning within the LXCF to make sure that commercial harvest does not interfere with cultural access. Compatible management activities that could enhance some habitats would be a useful topic to explore further.

Explore projects for economic diversification using NTFPs

Based on the species of NTFPs that were inventoried and incidentally observed during this project, a number of value-added potentials were identified that may help to create business opportunities in the area. These include:

- Bough harvest as floral greenery (raw) or made into wreaths and garlands (e.g. pine, fir)
- Bough harvest for essential oil production
- Berry harvest, for raw or frozen berries, or developed into jams, jellies, and similar preserves
- Various greenery and twig harvest for floral greenery (raw) or made into arrangements (e.g. boxwood)
- Willow harvest for products such as furniture
- Gourmet vinegars
- Beauty products
- Health remedies (e.g. arnica)
- Paper out of different plants

Concluding Remarks

Policy makers and community forest managers are moving from single species resource management to a multi-species, ecosystem-based approach. A key scientific challenge is to create an effective, predictive inventory model for non-timber forest resources. Complicating this effort are rapid changes in the landscape, such as by insect epidemics, fire, and logging, as these factors change the abundance, quality, and the distribution of the target species.

The project team was successful in meeting or exceeding all project indicators, including; creating seasonal employment, increasing capacity, and identifying species that warrant some form of management. The latter two points are of note as increased capacity to harvest and market NTFPs will warrant increased management of these resources.

In 2009 the team succeeded in collecting data on a large portion of the forest types within the LXCF. This dataset was used in the development of a model for black huckleberry and its associated habitat types. This last year was considered by many to be one of the best in recent memory for huckleberry productivity. The plot work confirmed that huckleberry was productive across a wide number of sites in 2009. Local knowledge suggests that many of the 2009 productive sites are not typically productive. The variability of weather and fruiting underscores the importance of temporal repetition in order to decrease the 'noise' of climate and productivity variation, which would help to refine the model.

This project was based upon, and continued the work of, other NTFP inventory projects conducted by Royal Roads University, namely FIA-FSP Y093318, *Assessing Cultural Use Species in Mountain Pine Beetle Affected Areas* and FIA-FSP Y092158, *The Impacts of Accelerated Timber Harvesting on Non-Timber Forest Products (NTFPs) in the Burns Lake Community Forest*. The field team sampled known high quality areas to field test the quality rating system and develop correlations of habitat conditions with high quality presence. This research has expanded the tools required for compatible management and economic diversification, as well as increased our immediate understanding of forest management effects on NTFP. The results from this project are considered baseline data that can provide a contextual background for further NTFP research in this area, such as assessment of preferred habitat correlations in respect to annual weather variations.

A socio-economic assessment would be useful to identify key social and economic impacts and issues regarding management and possibly commercialisation of NTFPs in the context of community forestry. Beyond evaluating the economic benefits and risks, an assessment of this nature could also aid with a community engagement plan. Future research and evaluation could provide a planning tool for managing the operation's social and economic impacts.

References

Anderson, Noba, and Will Horter. 2002 Connecting Lands and People: Community Forests in British Columbia. Victoria: Dogwood Initiative.

Brant-Castellano, M. (2004). Ethics of Aboriginal research. Journal of Aboriginal Health , 1, 98-114

BC Government. 2005. News Bulletin. Special Issue No. 1. October.

Cocksedge, Wendy. 2009. Assessing cultural use species in mountain pine beetle affected areas. FIA-FSP Report Y093318. Royal Roads University. Victoria, BC.

Cocksedge, Wendy. 2008. Impact of Accelerated Timber Harvesting on NTFPs in Burns Lake Community Forest. FIA-FSP Interim Report Y091158. Royal Roads University. Victoria, BC.

Cocksedge, Wendy. 2006. In: Incorporating non-timber forest products into sustainable forest management . An overview for forest managers.

Ehlers, Tyson and Mike Keefer, 2007. Non-timber forest products (NTFP) Review for the Invermere TSA. Final Report.

LeCompte, Margaret D, Jean J Schensul and Stephen L Schensul. 1999. Essential Ethnographic Methods: Ethnographer's Toolkit. Lanham: Rowman and Littlefield Publishers, Inc.

Legendre, P. and L. Legendre. 1998. Numerical Ecology, Developments in Environmental Modelling, Second English Edition. Elsevier, Amsterdam, 853 pages.

McKennitt, D., & Fletcher, F. (2007). Engaging with Aboriginal Communities in Collaborative Research. University of Alberta Health Sciences Journal , 4 (1)

Robinson, Erin. 2005. The Cross-Cultural Culture Collaboration of the Community Forest. Masters Thesis, UNBC.

Royal Commission on Aboriginal People. (1996). Report of the Royal Commission on Aboriginal Peoples. Ottawa, ON: Minister of Supply and Services.

Sokal, R.K., and Rohlf, F.J. 1995. Biometry, the principles and practice of statistics in biological research, third edition. W.H. Freeman and Company, New York, 888 pages.

Thadani, Rajesh. 2001. [Emery, Marla R and Rebecca J. McLain editors]. Non-Timber Forest Products. Medicinal Herbs, Fungi, Edible Furits and Nuts, and Natural Products from the Forest. Food Products Press. New York, USA.

Turner and Cocksedge. 2001. Aboriginal Use of Non-timber forest products in North Western North America: Applications and Issues. In: Non-timber forest products: medicinal herbs, fungi, edible fruits and nuts. Marla R. Emery, Rebecca Jean McLain (Eds)

Wier, W. and Wuttunee, W. (2004) "Respectful Research in Aboriginal Communities and Institutions in Canada" in Fairbairn, B and Russell, N (eds) (2004) Co-Operative Membership and Globalization, Saskatoon: Centre for the Study of Co-operatives, p207-236.

Zuur, A.F., E.N. Leno, and G. M. Smith. 2007. Analysing ecological data. Series: Statistics for Biology and Health, Springer Science, New York, USA.

Appendices

Appendix 1 - Interview Questions

1) What plants do you harvest from the land base?

Berries
___Huckleberry
___Soapberry
___Silverberry
___Thimbleberry
___Raspberry
___Blueberry
___Saskatoon
___Chokecherry
___Pin/bitter-cherry
___Hawthorne
___Bunch berry
___Current
___Gooseberry
___Red Elderberry
___Oregon grape
___High-bush Cranberry
___Bog Cranberry
___Snowberry
___Mtn. Ash
___Wild Strawberry
___Juniper berry

Plants
___Devils Club
___Horsetail
___Box Wood
___Moss
___Mushrooms
___Dogwood (red willow)
___Birch
___Yarrow
___Arnica
___Nettles
___Ferns (Fiddleheads)
___Wild Rose (Rose hips)

Other_____

1a) Thinking about the list we just talked about, which plants you would like to see researched for the inventory. Can you please describe why?

Which plants you would **not** like to see researched for the inventory. Can you please describe why?

2) Do you pick plants or berries for sale?
__Yes, for making Jam
___No, never
___Yes, I have in the past, but not now

2a) How much of your yearly income do you normally derive from commercial picking?
___Less than 10 percent
___10-25 percent
___26-50 percent
___51-75 percent
___More than 75 percent

3) Have you ever had problems with competition with other people at the harvesting site? (If Yes) Have you experienced any conflict?

4) What are some factors that you think about when going out to harvest plants, eg steepness, number of plants to access, wildlife, etc.

5) Does it matter where you pick as long as there is good access?

6) From what you've seen in the past, do you see many changes in the plants now (i.e. Size, quantity of berries, quality of the plants).

6a) If so, Why do you think the plants have changed?
6b) Do you notice changes in when you can harvest?
6c) Do you notice changes in the length of time you can harvest for?

7) From what you've seen in the past, how do you think these plants will respond to MPB?
.
8) In areas of salvage logging, how will the plants respond?

8a) What about areas where there isn't salvage logging?

8b) Do you have any suggestions for how the salvage logging is done?

8) Have you noticed weather patterns changing?
Snow levels?
Rain levels and frequency?
Length of snowy season?
Length of growing season?
Water in the rivers?

9) Are you aware of any traditional or contemporary techniques to manage the harvesting sites?

9a) Do you use any management practices at the harvesting sites that you described above?

10) In your opinion, how should the plants be managed?

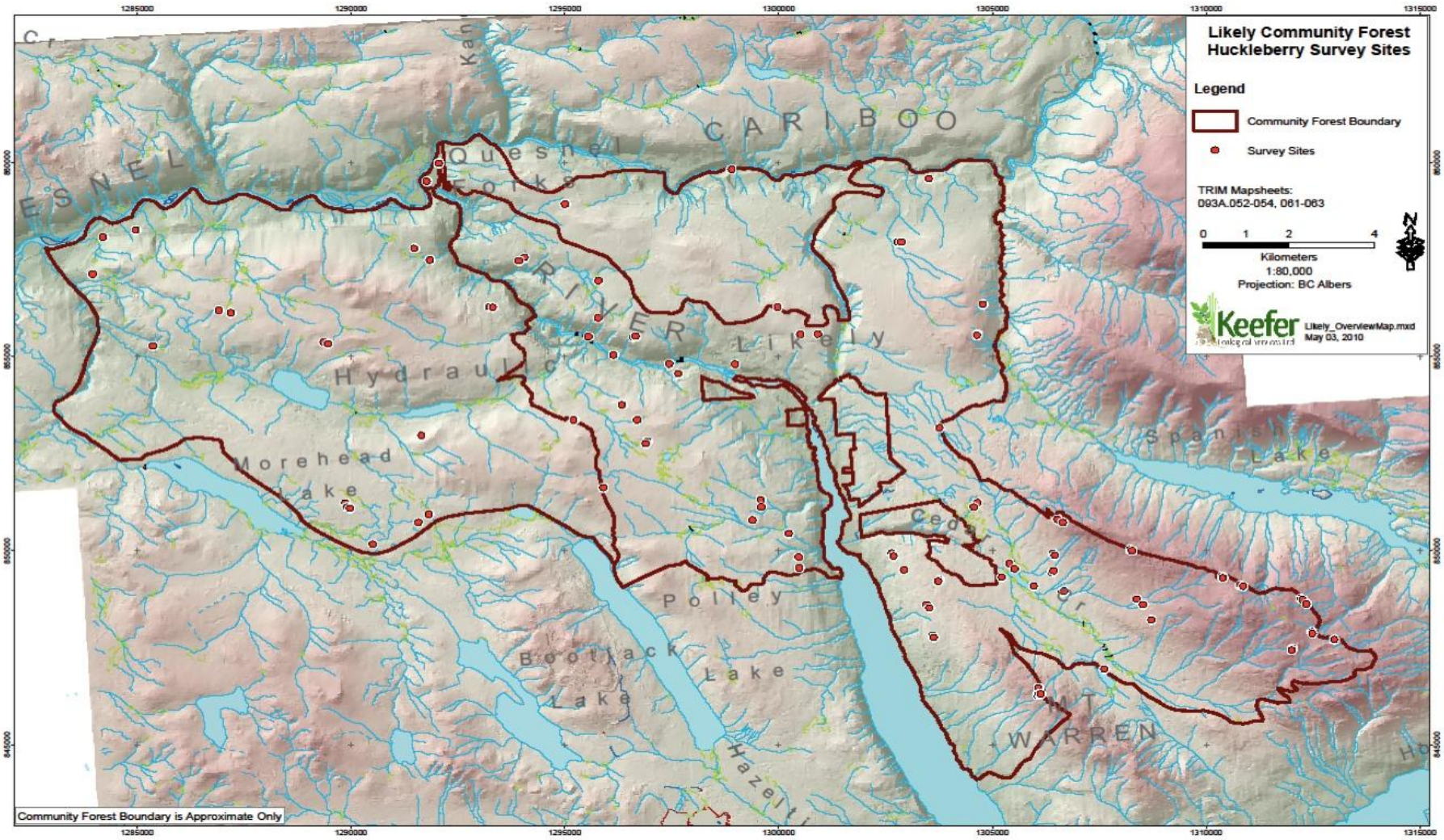
10a) What about in terms of the present situation with MPB or climate change?

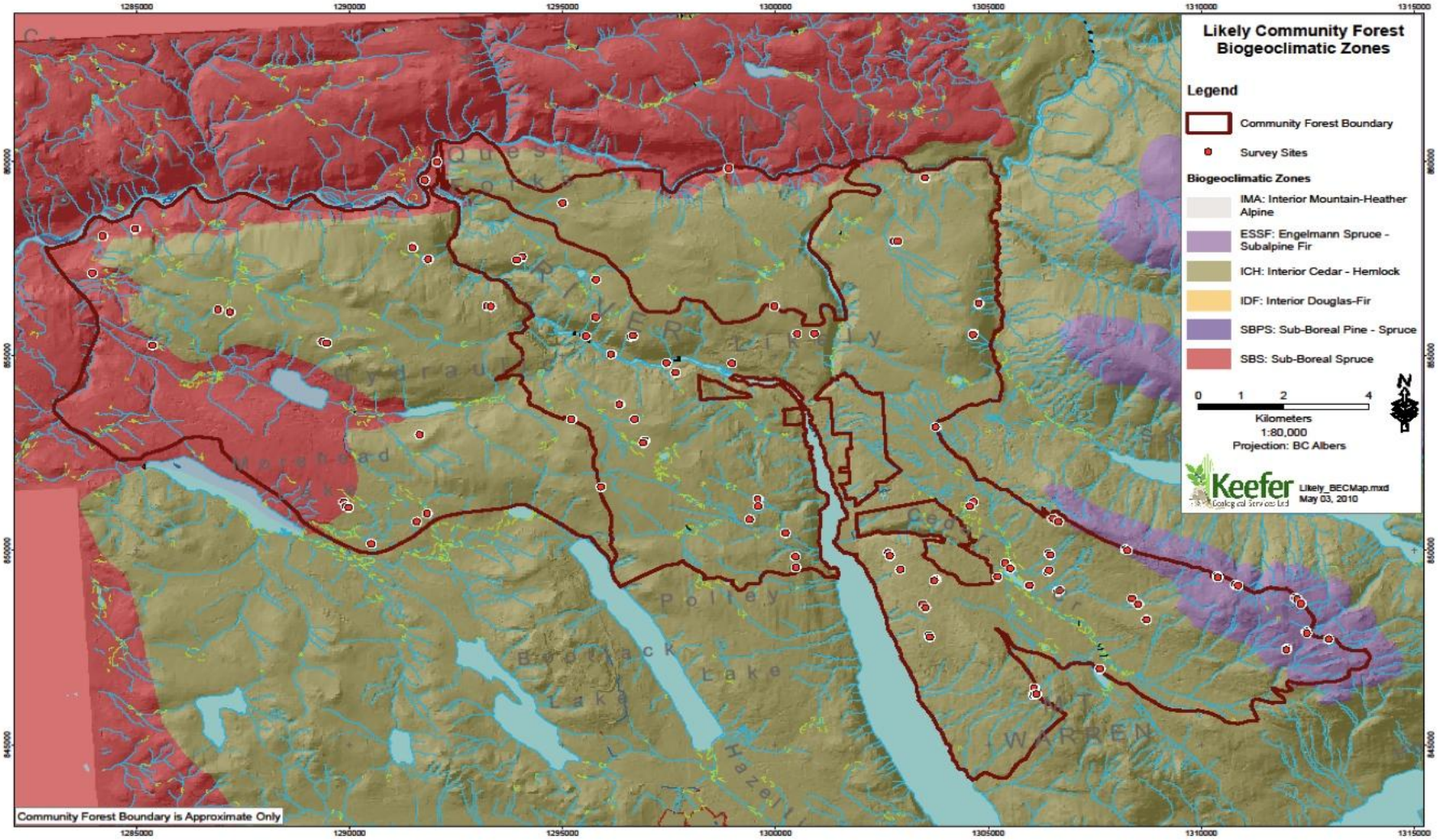
10b) Given that we have MPB, what can we do to protect the plants?

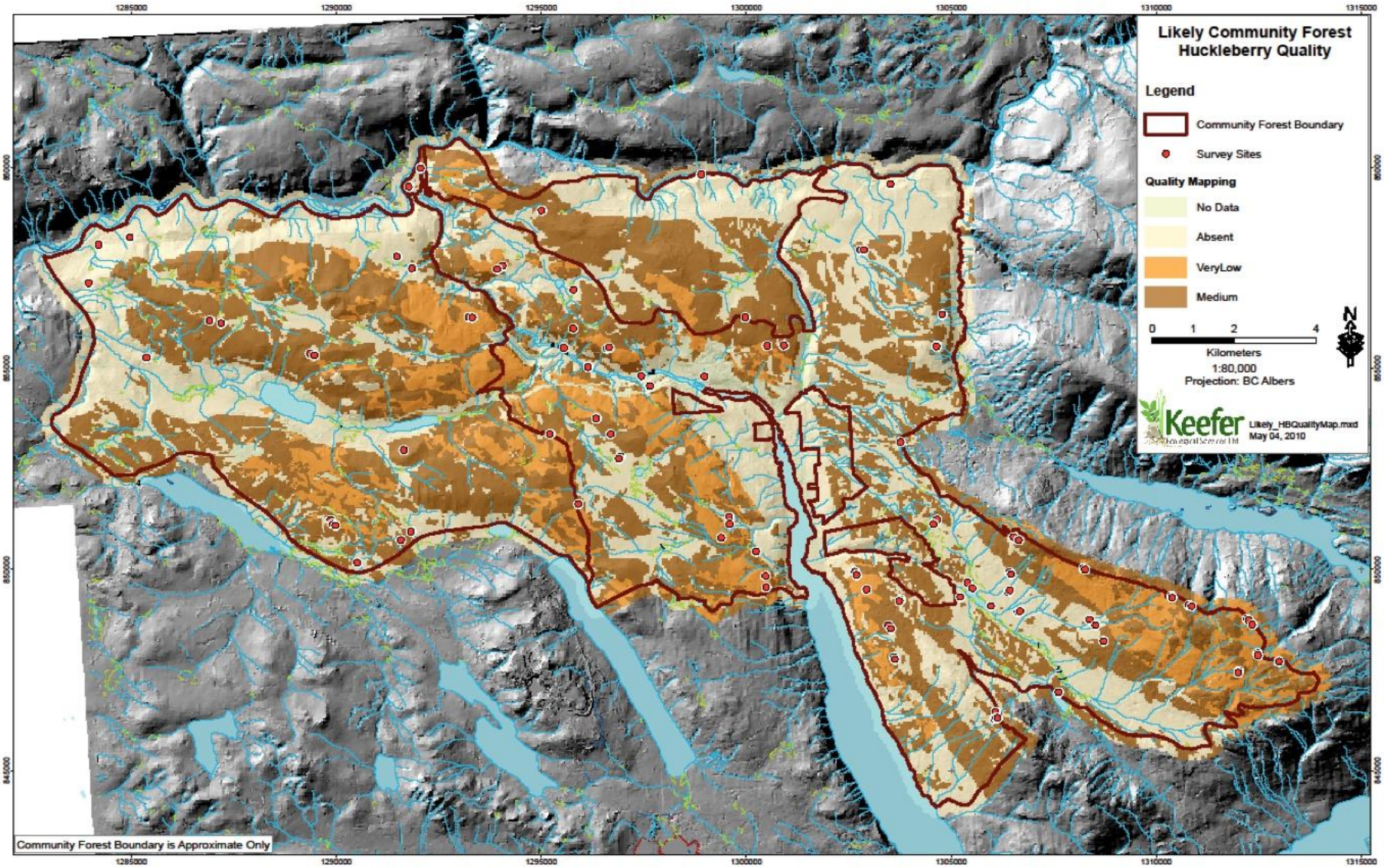
11) What questions would you like to see answered about how your plants are affected by MPB or climate change?

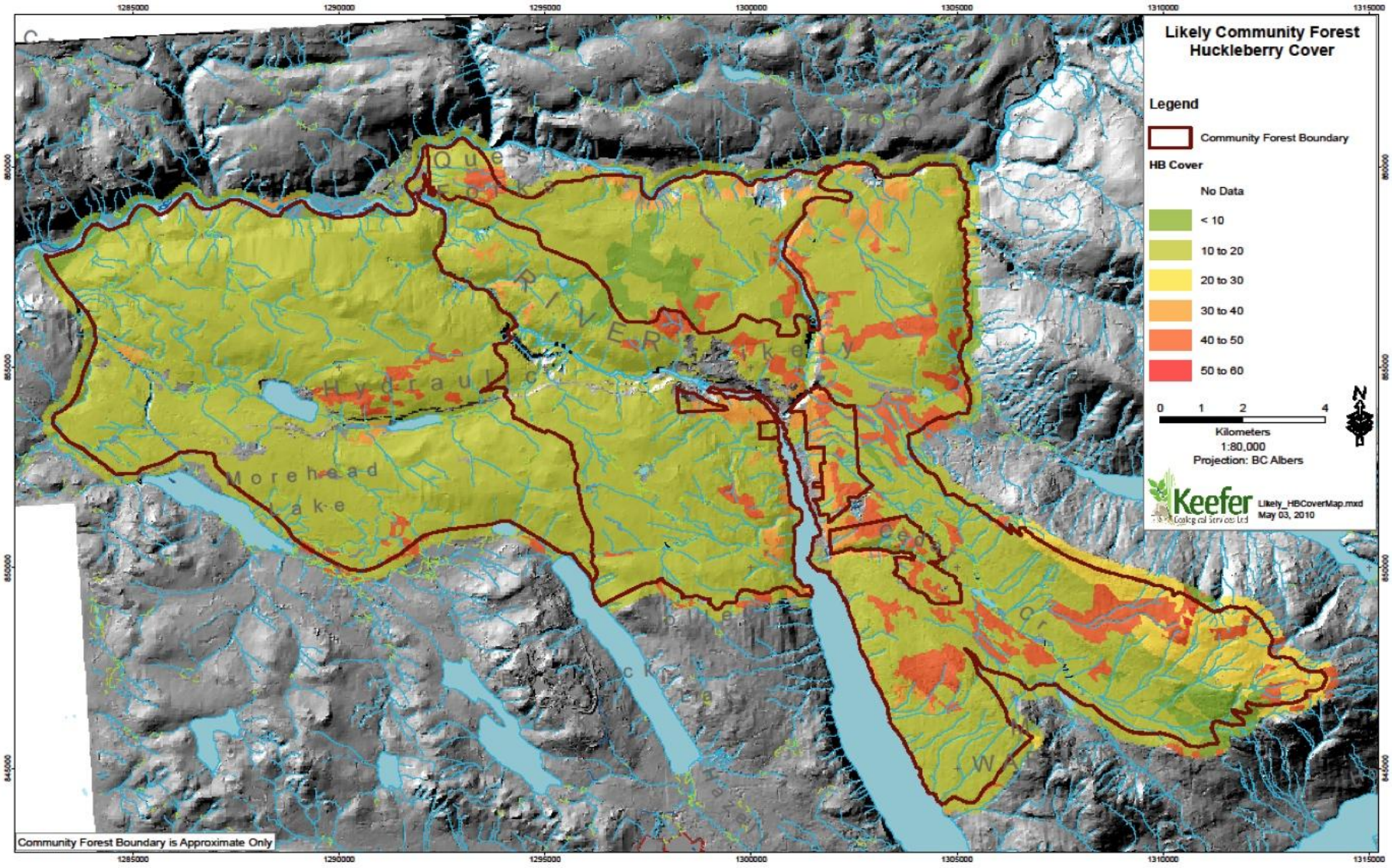
12) Do you have any additional questions or comments?

Appendix 2 – Maps




Likely Community Forest Biogeoclimatic Zones
Legend
Community Forest Boundary
Survey Sites
Biogeoclimatic Zones
IMA: Interior Mountain-Heather Alpine
ESSF: Engelmann Spruce - Subalpine Fir
ICH: Interior Cedar - Hemlock
IDF: Interior Douglas-Fir
SBPS: Sub-Boreal Pine - Spruce
SBS: Sub-Boreal Spruce
0 1 2 4
Kilometers
1:80,000
Projection: BC Albers
Keefer
Likely_BECMap.mxd
May 03, 2010
Community Forest Boundary is Approximate Only
1285000
1290000
1295000
1300000
1305000
1310000
1315000
860000
855000
850000
845000


Likely Community Forest
Huckleberry Quality
Legend
Community Forest Boundary
Survey Sites
Quality Mapping
No Data
Absent
VeryLow
Medium
0 1 2 4
Kilometers
1:80,000
Projection: BC Albers
Keefer
Likely_HBQualityMap.mxd
May 04, 2010
Community Forest Boundary is Approximate Only


Likely Community Forest Huckleberry Cover
Legend
Community Forest Boundary
HB Cover
No Data
< 10
10 to 20
20 to 30
30 to 40
40 to 50
50 to 60
0 1 2 4
Kilometers
1:80,000
Projection: BC Albers
Keefer Ecological Services Ltd
Likely_HBCoverMap.mxd
May 03, 2010
Community Forest Boundary is Approximate Only
1285000
1290000
1295000
1300000
1305000
1310000
1315000
850000
845000

Appendix 3 – Site Visit Form

BRITISH COLUMBIA The Best Place on Earth | Ministry of Forests and Range

SITE VISIT FORM

PROJECT ID	

Plot No.	Plot Type	Grnd ☐	Visual ☐	Note ☐	Other ☐	Date YY - MM - DD
Surveyors	Polygon No.	Plot Photo				

Plot Location

FS Region. District	UTM Zone	East	North
NTS Map.	Lat.	Long.	Accur.(+/- m)
Air Photo No.	X Co-ord.	Y Co-ord.	

Plot Representing

BGC	Site Series	SMR	SNR	Map Label

Site Features	Elev.	Slope	Aspect

Crest ☐	Upper ☐	Mid ☐	Lower ☐	Toe ☐	Dep. ☐	Level ☐	Alluvium? ☐

Expose. Type ☐ insolation ☐ wind ☐ snow ☐ water spray ☐ misc.
☐ n/a ☐ frost ☐ cold air ☐ salt spray ☐ air toxicity _____

Site Disturb. ☐ fire ☐ site prep. ☐ terrain ☐ soil dist. _____
☐ n/a ☐ harvest ☐ planted ☐ biotic ☐ other _____

Stand Attributes	Stand Age	Stand Ht. (m)	Canopy Composition

Struct. Stage	1a(sp) ☐	1b(br) ☐	2a(fo) ☐	2b(gr) ☐	2c(aq) ☐	2d(ds) ☐	3a(ls) ☐	3b(ts) ☐	4(ps) ☐	5(yf) ☐	6(mf) ☐	7(of) ☐

Success Status	NV ☐	PS ☐	YS ☐	MS ☐	OS ☐	YC ☐	MC ☐	OG ☐	DC ☐

Terrain	Texture	Surficial Material	S. Expression	Geomorph Process
1				
2				

Rooting Zone Drainage ☐ X ☐ R ☐ W ☐ M ☐ I ☐ P ☐ V

Humus/Organic Form ☐ Mor ☐ Moder ☐ Mull ☐ Fibric ☐ Mesic ☐ Humic

Humus Thickness _____ cm	Ah? ☐ Ae? ☐ _____ cm	Soil Depth(cm)

Soil Texture	☐ Sandy (LS,S) ☐ Loamy (SL,L,SCL,FSL) ☐ Silty (SiL,Si) ☐ Clayey (SiCL,CL,SC,SiC,C)	Coarse Frag. % _____

Gleying or Mottling	Water Table	Restrict.Layer	Type
☐ No _____ cm	☐ No _____ cm	☐ No _____ cm	_____

FS 1333 HRE 2008/03

Appendix 4 - Interview responses

1) Do you pick plants or berries for sale?
_1__Yes, for making Jam
11__No, never
___Yes, I have in the past, but not now

(If Yes) To whom did you sell to?
1-People at the Farmers Market and at the Likely Museum. Through word of mouth.

2) How much of your yearly income do you normally derive from commercial picking?
_1__Less than 10 percent
___10-25 percent
___26-50 percent
___51-75 percent
___More than 75 percent

3) Have you ever had problems with competition with other people at the harvesting site?

7 people- "No"

"If there are people in a spot we don't pick at that exact spot or we move down the road a bit".

"People can be secretive about where they harvest, yes they want to know where you harvest at".

"No there are berries enough for everyone, but some people are very secretive about their sites".

"Not with people. Bears are more of an issue".

(If Yes) Have you experienced any conflict?

12 people –"No"

4) What are some factors that you think about when going out to harvest plants, eg steepness, number of plants to access, wildlife, etc.

1- Proximity to home. Fuel costs cut into profit.

2- I go to the place where the berries are the best and I can walk the least. They need to be accessible by logging road, but now that the roads have been deactivated, (bar ditches make it hard for my car) I can walk on the road or some people ATV, but without my ATV I have to walk.
I really resented when they made it so that only ATV people can go and rip and destroy everything. I hate it. They are not out there to pick berries, they are there to mud bog.

3- Proximity to residence and size of patch.

4- Access- all of the old growth roads are deactivated now or overgrown- the berries are not there anymore.

5- Distance from home. Moose and Bear. Also the size of the patch and the quality of the product.

6- Accessibility, close to roads and the quality of the plants.

7- Proximity to home, the number of plants and the access.

8- I like to find something accessible, but I will walk quite far on a deactivated road or in the bush to find plants [berries]. If I am concerned about animals, I take my husband or a dog with me.

9- The size of the berries, the access. Most of my patches are around home. I don't really think about the gas money, I just pick for fun and to give berries to people who can't pick for themselves.

10- I don't go alone, it isn't a good idea. If there is a patch right by the road, I might go there by myself, but I usually go with others.

11- Abundance, ripeness, time of the year, elevation, travel time to site (prefer local sites).

12- I look for lots of berries, steepness isn't an issue.

5) Does it matter where you pick as long as there is good access?

1- No, as long as it is close to home.

2- Not as long as I am not on private land. Bears and wildlife are never a factor for me, I don't know a bear who would attack a bunch a women. We are all so loud (some of the women I pick with) are busy talking and picking, the bears wouldn't bother us.

3- No.

4- That is the main thing.

5- No

6- Not really.

7- Not asked.

8- See above.

9- No

10- No

11- I prefer local sites; gas is a factor.

12- Proximity isn't too much of a consideration. I am willing to go far for berries.

6) From what you've seen in the past, do you see many changes in the plants now (i.e. Size, quantity of berries, quality of the plants).

1- The season before last, there were fewer berries, maybe because of a frost late in the spring.

2- The last few years I haven't found as big of berries, but that is because it has been dryer. The places I used to go are all brushed up now.

3- Things change based on the seasons; on specific factors related to specific seasons.

4- No

5- Now that there is extra logging, we will get more huckleberries but eventually they will fade because the brush will come up.

6- I notice that some plants flourish after clear cutting has taken place.

7- Not in general, it is cyclical.

8- No

9- Really late this year and last year too.

10- If we get the right sun and rain or if the frost gets the blooms, that effects them. Some areas will freeze and other areas next to them won't.

11- No, because I don't go to the same site year after year- the sites brush up.

12- Yes, in some areas where the canopy is opened up the shrubs have exploded. I was in my woodlot and on the open west slopes there are lots of blue and huckleberries.

- If so, Why do you think the plants have changed?

1- Because of the frost.

2- Dryer, brushed up-- the roots are all choked out by the brush.

3- Seasonal changes. Also, logging enhances some things and diminishes others.

6- More sunlight, less competition.

8- It depends on the weather that season.

12- Light, harvesting and new roads are leading to new patches.

- Do you notice changes in when you can harvest?

1- Every year is pretty consistent within a week or two.

2- No, because moisture governs that (when you can pick).

3- It is cyclical like the weather. I don't memorize the dates of when things are ready- they are just ready when they are ready.

4- Weather, frost will toast them for the year. Cool weather will effect the ripening.

5- It depends on the year. Also, it depends on how much vegetation is growing up around the plants you are looking for.

6- No, it is cyclical.

7- It's year to year. There are changes but it is part of a natural cycle.

8- When they are going to be ready depends on the weather- for example, this year we had a late spring so the berries might be late.

9- Last year was late for harvesting. We went out in September long and picked huckles and we could have picked for another 2 weeks.

10- No

11- No

12- Last year was wet and long. I remember a few years ago it rained every day. It depends on the year.

- Do you notice changes in the length of time you can harvest for?

1- If it is hot in the summer, the raspberries are shorter because they dry up.

2- Any early frost would wipe the berries out early. Huckleberries can take a lot of frost, blueberries can't handle it. If you get hot weather in July you will be picking early- it is based on year to year specifics.

3- No, it depends on how hot it is.

4- The southwest slopes come into berries earlier. On Brown Top- in Sept.- on the Northeast slope, berries were there.

5- Again, it depends on the year. There are no trends, it is a cycle.

6- No, again, it is cyclical.

7- No

8- No it is year to year.

9- Not all the time, but some years. The berry plants move around and disappear after a while too. Like at Potter's sawmill we picked for 10 years, and then the plants brushed up. The plants need just enough light, if they get too much they dry out.

10- No

11- No

12- Depends on the year.

7) From what you've seen in the past, how do you think these plants will respond to MPB?

1- Some of the plants will do better because they will get more light. More light = more berries. Also, from the site disturbance from logging, the raspberries will like this.

2- Area will be opened up, with the dead trees. If a fire comes up that would be good for the berries, but the more sun you get, the more brush you get.

3- Open up the canopy- it will affect all plants differently depending on what they like.

4- To start with they will do way better. Once the second growth starts to have too much shade- if we go brush out these blocks we have to be careful not to cut the evergreens.

5- When the trees die, the needles fall off and the plants will respond differently depending on the site and the plants themselves.

6- I expect that many sites may become more productive as competition or light and nutrients decreases.

7- They will open it up, and make space for other plants.

8- The dead trees have affected the land, where the land has been logged, the berries are in abundance. But they are good for a few years, and then it brushes up again. [I ask- "Because the land brushes up do you think it would be a good idea to brush-out some of the good patches that are close to town"] RESPONSE_ "It is hard to imagine brushing out areas, being here my whole life, we just harvest where we can and when we can, but an experimental project might be interesting or useful".

9- They didn't really seem to be affected. We have lots of spots we can pick. The year before last we picked in one spot, and last year when we went back the berries weren't there as much, they were up the road a bit.

10- Huckleberries like light, but too much heat fries them.

11- Some berries like the cut blocks, but it depends on the plant and the site.

12- I think a big part of the richness of this ecosystem is the diversity. There is enough bio-diversity to keep the land producing different plants. Some of the shade liking plants will be displaced for 10-15 years.

8) In areas of salvage logging, how will the plants respond?

1 - They will like the site disturbance. In the LXCF, one contractor has made some piles so that berries can get started on the sites. It might take a couple of years to get the canes started, but once they get going they could produce for 10-15 years.

2- I believe it should be clear-cut, burned and reforested to avoid blow down and debris. Blow down should be able to be collected by little contractors, but it has to be made financially viable for a small person to come in and make use of the trees that have blown down.

3- Huckleberries did well in a logging slash, but I don't know if the plants were there before the logging or not.

4- They will respond well, I used to salvage log with small machines- we would use old skid trails, put all the old stumps and debris and pile it on the trail for plants. Also, we would drag an excavator across the trails to make site disturbance.

5- Increase in logging opens up the canopy, so some plants like it. But, it is site dependent, all sites are different.

6- Mostly Good, but results are very site specific. Huckleberries- after a few years, the lack of sunlight will choke them out again.

7- It depends on the plants. The canopy will open. It depends on the type of logging. I work in some 30 year old plantations, and there are other parasites (gull-rust, weevil, mistletoe). I was recently on a 1 year old clear- cut, and I saw a blueberry plant that was very fried by the sun. There were also a lot of fiddleheads on this site.

8- Good, because we are clearing more land.

9- The plants do better. Up the 8900 road, the logging slash that was cut down the year before last, is producing so many raspberries and strawberries. Berries are a ground cover out there, it was incredible, all the new growth. We pulled out a bunch of Rhododendron, currents and lupines for our yard.

10- *Doesn't know enough about the topic.*

11- Some plants will like more light.

12- The plants will be less productive for the first 1 or 2 years after harvest.
After a couple of years the plants will do better, they will find new areas to move into.

- What about areas where there isn't salvage logging?

1- LXCF has logged all of the beetle, but if there wasn't logging done in some places then the plants that like shade better, like bunch berry, would do better.

2- The blow down will be such that we wouldn't be able to access the berries anyway. It would be impossible to get through the bush.

3- The difference is it will still be opened up (the canopy because of the dead trees) but it is specific to the plants.

4- No answer.

5- In Likely we selective log, I think that is good. We get blow down, but then we go back in and gather the blow down the next year.

6- Not asked

7- Fire is a concern; it would change things.

8- When the re-growth comes you loose the berries because they don't get enough light.

9- If you leave it, you can't even walk through it.

10- *Doesn't know enough about the topic.*

11- I don't know.

12- It depends. The areas will be more susceptible to fire (stand removing fires). Leaving the trees will make it hard for NTFP harvesters to have access. If there is an existing road, and they don't log the MPB trees, blow down will be an issue.

- Do you have any suggestions for how the salvage logging is done?

1- More ground disturbance would be good. Do a partial cut. In the LXCF we have done a lot of selective logging.

2- It may have to go back to the small contractors with small equipment, or even better, someone with horse logging. Back, a number of years ago, they used to have small contractors, before the big licensee came in. Maurice Genier used to do this.

3- No continuity in forest management of industrial forestry. Generally, equipment doesn't disturb the land as much as it used to- but certain plants like site disturbance.

4- Logging benefits the berries, all the disturbed parts from the skidder ripped it up, that's where they grow.

5- My gut feeling is, depending on the thickness of the forest and the amount of beetle kill it depends on these factors as to how to log it. It could be a fire hazard if we leave it, but a flash-fire could benefit the plants.

6- I think we should have small openings.

7- Don't take out all the little trees, use the arm of the buncher from the small trails. Don't cut the 20-30 year old spruce.

8- My husband has been involved in it, people should just do it carefully and do a good job.

9- The logging benefits the plants. My husband is a logger and he leaves all of the old 10-15 year old spruce and fir. You have to leave the little trees- and some wildlife trees. Wayne gets the dead and down and the other smaller trees grow up nicely.

10- *Doesn't know enough about the topic.*

11- They should leave some of the trees and try to maintain the 20-30 year old trees for the next harvest.

12- One thing to be considered is to not damage the soil. Keep the other values in mind rather than the money. Don't ruin the soil and it will keep producing other organisms which will help the trees. There isn't much point in salvaging unusable timber and destroying other plants.

9) Have you noticed weather patterns changing?

1- Quesnel Lake doesn't freeze as consistently as it used to. Last year everything was shifted ahead a month- we didn't get snow until Xmas, and then it didn't leave until May Day.

2- No, I have not. It always changes from year to year. The only thing I can say, is the weather isn't as severe with cold. We aren't getting enough cold weather in the winter to wipe out the beetles.

3- They are always fluctuating and changing.

4- Yes, but how to explain it would be hard. Up to 15 -18 years ago lots of snow. Then not as much and last year there was tonnes of snow.

5- No there is no trend. There are cycles that the earth goes through. The water in the river was high this year and last year (higher than it had been for a few years, but not as high as it was 10-15 years ago).

6- Not really. Everything is cyclical.

7- There is way more wind now, I think because of the logging.

8- It varies from year to year. Over time, we don't get the cold spells we used to, the time between warm and cold days is greater. We used to get -20 for a week at a time, but now it is like a couple days of -20, then up again, and then down to -20 it moves up and down quicker.

9- Last year we had a long growing season. We also had a lot more cumulative snow. Usually snow melts, but last year it just kept piling up.

10- We had major snow last year. 40 years ago when we moved here there was lots of snow, and then we had a few winters where there wasn't as much.

11- It is more variable now. The changes in the weather are more "all over the place". We have had a lot of frosty nights this summer already.

12- We are experiencing more extremes in temperature and faster fluctuations.

10) Are you aware of any traditional or contemporary techniques to manage the harvesting sites?

1- After logging, leaving debris on the roadside so that berries can get started.

2- Brushing and fire. But brushing is the main thing.

3- Leave some of the most rigorous plants behind for seeds- we don't always consider this because we are using for personal use, however if we start harvesting more, we will need to consider this.

4- Burning, the harvesting sites change from year to year.

5- Not harvesting every plant in an area. For example, false box wood, if you are harvesting this for floral arrangements, you wouldn't want to pick every plant.

6- No

7- When I pick fiddleheads I only pick 2 or 3 per clump. When I pick nettles, I only take the tops, this is mostly because the tops are the tender part, but it also keeps the plant producing.

8- No

9- No

10- No

11- Take the minimum amount that you need and leave the rest intact. Leave some of the plants for regeneration. If it is a perennial, make sure the leaves stay intact.

12- Natives can harvest devils club without getting thorns. For mushrooms, you can tap out the spores. Not over-harvesting.

- **Do you use any management practices at the harvesting sites that you described above?**

1- Yes in the LXCF.

2- No

3- No

4- No

5- Yes, I am careful to not harvest all the plants in one area.

6- n/a

7- n/a (see above).

8- n/a

9- n/a

10- n/a.

11- Yes

12- Yes, the not over harvesting one.

11) In your opinion, how should the plants be managed?

1- No, we have such an abundance of berries, if we start managing we might need permits- we don't have a problem yet.

2- Brush or burn after the logging has been done.

3- I believe that we should possibly regulate if things are being over harvested- only regulate where necessary.

4- Possibly raising some of the plants in a nursery for selling or mining reclamation. I don't want them to regulate it though. I think even doing research out here is a bad idea. I heard they [the First Nations] are making a land claim over this area, and I think eventually we will need a permit from them or the government to even go and harvest anything. I think doing research is a bad idea, because it will restrict us.

5- They don't need to be managed.

6- We have to ask ourselves, what objective we have. If we want to start making money off of the berries, we should start managing for them. Huckle, raspberries and thimbleberry would thrive if managed. We could start identifying sites where berries grow within the blocks before logging is carried out. We could start writing it in to the SP [silviculture prescription or site plan]. The forestry obligations would still have to be fulfilled, so this would have to be done during the cruising or beetle (survey). We could write it into the SP to harvest the area around these plants, and then not replant them.

Why not try to maintain some sites as community picking sites. Right now people don't pay attention to these things, so contractors could have to look for other factors- such as berries. It would be way more labour intensive because they would have to look for different plants. Also, it would be a bit of a gamble, because we could put money out and not see any return (not like with timber). We don't have a guaranteed revenue. It would be about finding a balance between timber and NTFP values. Not replanting the area around the plants would cut into timber revenue down the road.

7- The permitting that might happen is a concern. If too many people are harvesting, there might be too much competition. Also, I have heard one person say (not from here) that we shouldn't harvest anything from the forest, so the animals will have enough to eat. I don't think that applies out here, but it is something to consider.

8- I don't know. The experimental brushing might be an idea- but the plants just move around and we follow them.

9- I don't know if we can manage them. If we managed a certain area close to town, a couple of people will come and pick all of the berries. There will be too much competition if we manage them.

10- They just do well if they are left on their own.

11- If forestry is going to manage, it would be more like "mis-manage" the plants. We don't want to have people pillaging out there. They could possibly monitor the sites- if there is high abundance and a lot of people pick there, and then we notice that the plants aren't doing as well, we could ask people to let that area rehabilitate. Like "lie fallow" in farming.

12- With minimal impact. We can manage by leaving resources during logging. Harvest sensitive sites during the winter. Combine NTFP management sites with wildlife tree patches. Just make it part of the overall part of the maintenance. If we consider wildlife tree patches, they are now seen as a loss of revenue, but they could be potentially, a source of revenue for someone else in the community.

- What about in terms of the present situation with MPB or climate change?

1- See above answer

2- Because of the mountain pine beetle, we have to find other ways of making a living out here. Logging is down, so we as a community could have work by brushing and planting berries. High school students or university, or First Nations, could get work from this now that industry is down. Plus, if FN or others, start nurseries to grow berries, we would buy off them the berries and also have the plants to plant on the land in the summer. And as a separate industry, the FN could also plant the berry-plants that they grew in their nursery onto their reserve land and have them to use as a traditional food, as well as sell the surplus to us (surplus plants and berries).

3- Same answer as above.

4- We have to go in and salvage all the wood we can- it could burn if they fall down.

5- We don't have to manage them, the MPB will just influence and change the products that are available. For example, berries will come in after logging, and then the succession will lead to Devils Club and then other plants. It is all part of the natural forest succession. Erosion could be a factor, but we haven't seen that here. There could be increased water running down the land rather than going into the ground, I have heard of that happening, but not here in Likely.

6- Log it out- utilise the wood before it goes to waste- the plants will benefit.

7- Not asked.

8- Same as above.

9- I don't understand why we don't take out more of the dead trees. They should use all of the dead trees for chips, or something.

10- Don't know.

11- If there is an abundance of forest product, and the timber revenue will be too low, just leave the logging and manage for the NT values.

12- Consider the other values.

- Given that we have MPB, what can we do to protect the plants?

1- We can't manage the plants because it would be too expensive, plus we don't need to because there is such an abundance. The only thing we could do is write the plants into brushing prescriptions so they would be brushed indecently. If we started going out and brushing for berries people would think we had lost our minds.

2- Not a dam thing. The only thing that will protect the plants are the rules and regulations that the forest service can do to protect the plants. We could keep the brush down. In an area where the berries are good, we can manage them. Burn or brush, those are your answers. The logging does the berries pickers favours, by logging and burning we always have access to berries. The MPB will add to this, but they will also disturb areas that are

good now, because I can't see the forest being as healthy after the beetle kills the tree. No one really knows what is going to happen.

3- It might be detrimental for certain plants to cut the pine down. To leave the pine standing may be beneficial for some plants. What else can you do with dead pine trees, they are useless once they are dead, so if the plants under them will be healthier if we leave them we should leave them.

4- Nothing.

5- We could choose not to log, but that would be a waste. Also, logging will benefit some plants, because of the disturbances to the ground and the increase light through the canopy.

6- See above answer.

7- More retention blocks, don't take out the Fir. Winter log, that has the least amount of ground damage.

8- It is so out of control, it is so advanced there is nothing we can do.

9- I would think it has made it better, more sun and light into the sites, so we don't have to protect the plants. The next spring after logging the berries grow.

10- Nothing. They are fine on their own.

11- Watch the logging practices, and make sure we leave some areas for natural regeneration.

12- Careful harvesting reduces risk of fire, which will in turn effect the plants.

12) What questions would you like to see answered about how your plants are affected by MPB or climate change?

10 participants have answered "None"

7- I want to know where the NIVMA went to. Why weren't these kept? It sounds like this project you are working on is repeating the same data collection.

11- Which sites will be good in the next decade.

13) Do you have any additional questions or comments?

1- We are not affected as much here by climate change because it is a wet area, maybe in the areas that are hotter and dryer they feel climate change more. Also, we have a very diverse ecology here, i.e. ICH, SBS, and ESSF. However, the MOF has changed the elevation specifics as to where we can plant certain seed lots. In the past we couldn't take a specific seed lot up past 1000ft, and now we can take them from 1200 (the numbers in this example are for illustrative purposes).

5- Berry infused vinegars would be a good thing to sell. Also, ferns, and goats beard make nice floral arrangements.

7- I make dream-catchers with willow.

8- It is a concern that the government could eventually require permits.

11- They should manage the logging around what is already there, the other values. They should identify all the products that will grow after the site is harvested and manage for the whole ecosystem.

There is a potential for revenue generating from this. We have to get away from the need for guaranteed revenue, we need to look at diversifying and what is considered valuable now may not be a decade from now.

12- I hope that we can protect the plants and provide an opportunity for a new economy while maintaining timber and recreational values.

14) Are you willing to go out with us on the land? How many locations do you have?
1- Yes

2- Yes and I used to have half a dozen spots. Now they are all brushed up though.

3- Will be away.

4- Will be away.

5- No, she says Wayne Henke is the one to talk to about that

6- Yes.

7- Yes, but the spots are out of the community forest.

8- I have 4 or 5 spots, but my best spot last year, the road washed out. I would love to know where some new spots are.

9- I will be working, but I have 5 spots I go. The 8900 road, Quesnel Forks, Spanish, Yanks Peak, Abbot Creek and BB Road.

10- I harvest on Quesnel Forks, Spanish Mt and the “Look-out”.

11- No because I don’t really go out to the same place year after year.

12- I would be willing, but I don’t have any specific sites I go to year after year.

Appendix 5 - Workshop handout

Project Title- **An assessment of the effects of the mountain pine beetle on the non-timber forest resources (NTFR) in the Likely/Xat'sull community forest**

1) ***"An assessment of the effects of the mountain pine beetle...."*** The mountain pine beetle has caused dramatic changes in the forest ecology, opening up the canopy and allowing more light to reach the forest floor. Plants that like light (huckle and blueberry) have flourished.

2) ***"...on the non-timber forest resources...."*** Due to the decrease in timber supply, this was an ideal time for us to create NTFR inventory. Economic diversification is becoming increasingly important. How can we achieve community sustainability?

3) **"...in the *Likely/Xat'sull community forest."*** Harvesters and long time residents were interviewed to find out what changes they have witnessed on the land, and to identify twelve plants that have the potential for commercialisation. As community forest tenure holders we have a unique opportunity to manage for the entire ecosystem.

The plants that were choose as having potential commercial value were-	When asked during the interview what projects could be done with NTFP people suggested-
• raspberry, • wild strawberry, • blueberry, • huckleberry, • saskatoon, • high-bush and bog cranberry, • pin/bitter-cherry, • arnica, • Oregon grape, • wild rose, • ferns, (fiddleheads) • birch, • nettles, • willow • *Labrador tea* • *Hazelnuts*	• raw or frozen berries, • gourmet vinegars, • jams and jellies, • willow products (furniture), • wreaths • paper out of different plants, • beauty products, • floral arrangements, • health remedies

LIKELY-XATS'ULL COMMUNITY FOREST LTD. Keefer Ecological Services Ltd Queensel River Research Centre QRRC ROYAL ROADS UNIVERSITY Centre for Non-Timber Resources

Appendix 6 - Community briefing note

The University Of Northern British Columbia
Quesnel River Research Centre
Likely, British Columbia

Keefer Ecological Services Ltd
Cranbrook, BC

The Royal Roads University
Centre for Non Timber Resources
Victoria, British Columbia
And
The Likely Xat'sull Community Forest
Likely, British Columbia

An Assessment of the Effects of the Mountain Pine Beetle on Non Timber Forest Resources in the Likely Xat'sull Community Forest

Community Summary Report- 2009

Project No.: 000007009

March 2010

This is a briefing note to go with the final report

"They should manage the logging around what is already there, the other values. They should identify all the products that will grow after the site is harvested and manage for the whole ecosystem". Quote Interview participant

Non-timber values:

1. berries,
2. mushrooms,
3. fiddleheads,
4. edible greens,
5. honey,
6. essential oils,
7. floral greenery,
8. specialty wood products.

Project partners:

1. UNBC's Quesnel River Research Centre,
2. Keefer Ecological Ltd.,
3. Likely/Xat'sull community forest (LXCF),
4. Xat'sull Nation,
5. RRU Centre for Non-timber Resources

Project objectives:

The objective of this research project was to work with community members to decide what plants in the LXCF have the potential for ethical and sustainable commercialization.

Specifically, the project objectives included the following:

- Develop a predictive model for NTFP habitat for the LXCF through:
  - Identification of focal species important to the community;
  - Assessment of the distribution of the focal species and landscape trends;
  - Application and testing of the coding criteria for assessing quality for the identified species. These codes were previously developed based on local knowledge. And;
  - Development of baseline inventories to direct predictive modelling for the LXCF and similar ecosystems.

- Assess potential impacts of development, mass disturbance events, and climate change on NTFP species through local observational knowledge.

- Develop a participatory research approach which respectfully includes local knowledge, and builds on community interests and aspirations while addressing potential concerns.

(*For more information please refer to page 2 of the final report).*

The plants that were chosen as having potential commercial value were:	When asked during the interviews what products could be produced using NTFP's, people suggested:
• raspberry • wild strawberry • blueberry • huckleberry • Saskatoon • high-bush and bog cranberry • pin/bitter-cherry • arnica • Oregon grape • wild rose • ferns (fiddleheads) • birch • nettles • willow • Labrador tea • Hazelnuts	• raw or frozen berries • gourmet vinegars • jams and jellies • willow products (furniture) • wreaths • paper out of different plants • beauty products • floral arrangements • health remedies

Developing the inventory:

Twelve community members from Likely were interviewed to determine what species have potential for commercialization. From July 20-31, the field research team conducted 10 days of field sampling. To build the inventory, the team sampled 100 plots, gathering information such as target species, indicator species, soil conditions, aspect, and crown cover. As 2009 was the first year of this inventory project, the information collected in the summer of 2009 was base-line data. The inventory can be included in community forest planning, land and resource management plans, and community economic diversification planning. (*For more information please refer to pages 4-5 of the final report).*

Results

1) Base-line plant inventory data

We completed a full analysis and predictive model for black huckleberry, and a partial analysis for a further seven of the focal species. (*For more information please refer to page 13 of the final report*). We developed predictive maps for huckleberry within the community forest (*see Appendix 2 of the final report*). We also developed predictive attribute tables for seven more species (Saskatoon, falsebox, red raspberry, beaked hazelnut, soapberry, oval-leaved blueberry and Sitka valerian) which may help guide future management of these resources (e.g. zoning, compatible management to enhance their habitat). (*For more information please refer to page 17 of the final report*)

2) Plants that are present but not abundant

Two NTFPs that were talked about by some interviewees, as well as at the workshop was Labrador tea and hazelnut. During field work Labrador tea was only present in one plot therefore this NTFP should be included in management plans. Another example of a

resource being mentioned as having the potential for commercialization but being scarce was Hazelnut.

Recommendations: Resource managers should consider how prevalent a species is in regards to the entire ecosystem when trying to manage an area. In some cases the species may be "rare" and desirable for the immediate area thus requiring special considerations.

3) Noxious weed presence and management

During data collection the team found invasions of the noxious weeds marsh plume thistle, orange hawkweed, and yellow hawkweed. Knap-weed, a particularly harmful plant that is found in other areas of the Cariboo, was discovered by an invasive plant sprayer during a mission to eradicate the marsh plume thistle.

Recommendation: To mitigate the spread and introduction of noxious weeds within the LXCF, all logging and road building machinery should be hosed down using a pressure washer prior to work. This will be of particular importance if the heavy equipment has been outside of the community forest on land that is contaminated by noxious weeds, or on land within the LXCF that has a weed presence.

(*For more information please refer to pages 20-22 of the final report).*

Future data collection:

It is recommended that once funding is secured to continue building the inventory in the summer of 2010 a training component to mentor community members in collecting productivity data would be beneficial. (*For more information please refer to page 22 of the final report).*

Assessing impacts:

Results: Interviews

(P*lease refer to Appendix 4 of the final report for full interview responses).*

Management issues and recommendations discussed in interviews

1) Brushing

Based on what individuals have seen in the past, they were asked to identify changes in the plants they have witnessed (i.e. quantity of the plants and berries). The interviewees talked about berry patches being productive for a time and then becoming hindered by brush, which blocks out the light.

Recommendations: An important means of management would be upheld by including important NTFP into future silvicultural prescriptions. Specific methods that were discussed to ensure compatible management were pruning and spacing.

2) Conflict/Competition

None of the interviewees has experienced conflict at harvesting sites, but some people mentioned competition and some secrecy around productive harvesting sites. Two interviewees mentioned the potential for conflict if the LXCF started managing sites for community use.

Recommendations: Zoning areas for specific cultural use and commercial use.

3) Salvage Logging

Most people interviewed mentioned that they perceive logging as greatly benefiting the berries. In the LXCF, one logging contractor has made some piles of dirt and debris so that raspberries can get started on the sites. Three of the twelve people discussed how clear-cutting should not be carried out; they talked about the value of leaving small trees for regeneration.

> **Recommendations:** Using small contractors to salvage log and provide horse logging. Focus on retaining appropriate spruce and fir stocking densities for regeneration. Try to evaluate the other values (NTFP) in the ecosystem before logging.

Participatory research

Results: Community workshop

The final workshop in Likely provided an opportunity for community members to provide input, comments, and concerns about the project. Nine community members, three of whom are members of The Likely Community Forest Society, attended the meeting. The audience asked questions about starting community **greenhouses** both in Likely and nearby Soda Creek. Likely members talked about the importance of having food grown in **community greenhouses**, as well as nursery plants for stream, mining and other **ecological restoration** projects. The point was made that Soda Creek, having a longer growing season and milder winters, would be an ideal place to have LXCF greenhouses to grow food, tree seedling, and other native plants for restoration work. One audience member who works at Mount Polly Mine brought up the point of certain species of pine trees and alfalfa grasses being used along with fertilizer (which is a sewage waste product trucked as back-haul from Vancouver) as a major community concern. Another concern brought up about the mine was the effluent that is being released into Hazeltine Creek; planting sedges along the creek may be a way to remediate the effects of the effluent. Growing native NTFP in the context of **mining reclamation** is a subject that needs to be investigated further.

The attendees discussed creating a secondary industry by pruning trees for **wreath and garland-making** as well as **essential oils** as a diversification option. These industries would be a compatible management option that would allow for opening up more light to the forest floor, to benefit the huckleberry and blue berries, while at the same time producing better merchantable timber. The community forest could purchase an essential oil press and a wreath making machine for community enterprise promotion.

The use of fertilizers for trees was a question raised to Mike Keefer and he responded that there may be other ways to enhance tree growth such as thinning and pruning that will not compromise the other values in the ecosystem. The recommendation is to use pruning and spacing as well as compatible management techniques to achieve increased timber and non-timer resource production.

An audience member asked about needing permits to **sell raw berries and berry-preserves** commercially. To sell raw berries, a permit is not needed, however to sell jams and jellies in a store, a permit would be required. The community talked about the possibility of having a certified community kitchen to produce inspected products. Another person talked about making **specialty wood products** such as wood toboggans and sleighs. The importance of having a **story** with a product was discussed by the group. If the LXCF can market products with a story, it would add value to the merchandise.

Appendix 7 – Non-Timber Quality Code Criteria

Amalanchier alnifolia

Common name: Saskatoon berry

Description[2]: A tall shrub, 1 to 5 m high, with smooth, dark grey to reddish bark and alternate, deciduous leaves. Leaves are distinctively toothed above the middle of the leaf with a heart-shaped base. The flowers are large and showy, in short leafy clusters of 3-20, which grow upright to drooping on the branch. The edible fruits are dark purple berry-like pomes with a white bloom.
Distribution and habitat[1]**:** Saskatoon is quite common in dry and moist climates of the project area and grows from low to middle elevations in dry to moist coniferous and deciduous forests and in open, disturbed areas.
Preferred habitat notes[3]**:** Prefers well-drained, mesic soils and is intolerant of deep shade. Very common after disturbances such as fire, logging or mountain pine beetle outbreak.

Valuation criteria
Keep in mind that quality and cover are separate values; evaluate the quality based on an average of the individual plants within the plot, ***regardless of the overall cover of the species.***

FRUIT

Use: Food
Harvest time: July/August
Valuation time: June (green fruit) through August
Quality requirements: Healthy, plump, juicy fruit, with sufficient moisture and little infestation, bug chew or rot. Sufficient fruit structures to warrant personal harvest (for efficiency).

Code	Description	Detail
0	Nil	Not present OR plant is moribund or dead
1	Very low	No fruit structures present OR fruit are generally not fit for consumption.
2	Low	Few fruit present; a person would not bother stopping to pick. Fruit and plants are of low to medium vigour and appearance.
3	Moderate	Sufficient fruit per plant, on average, to warrant personal collection (e.g. for a pie) OR a few individuals with high fruit abundance and a few individuals with no fruit. Fruit and plants are of medium to high vigour and appearance. Possible to harvest 250 mL – 650 mL (1-2.5 cups) in 10 minutes.
4	Moderate high	Sufficient fruit per plant, on average, to warrant personal to significant collection. A person would find it worthwhile to come to the area to pick. Bushes generally healthy.
5	High	Sufficient berries per plant, on average, to warrant significant collection (e.g. for winter storage or commercial use). Fruit and plants are of medium to high vigour and appearance. Possible to harvest 750 mL – 1 L (3-4 cups) in 10 minutes in the area.
6	Excellent	Almost all of the plants have exceptional levels of fruit production. Uncommon.

[2] MacKinnon, A., J. Pojar, and R. Coupe. 1992. Plants of northern British Columbia. B.C. Ministry of Forests and Long Pine Publishing. Victoria, BC.
[3] Howard, Janet L. 1997. Amelanchier alnifolia. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [Accessed March 2008].

Arnica cordifolia

Common name: Arnica

Description4: Heartleaf arnica is a perennial, rhizomous herb. Lower leaves are heart-shaped and have long stalks, upper leaves become lance-shaped with no stalks. Leaves are opposite. Flowers are yellow composite heads, growing on stalks up to 60 cm tall, with hairy bracts.
Distribution and habitat: Heartleaf arnica occurs in cool temperate climates, commonly in open-canopy coniferous forests.
Preferred habitat notes: Grows well in open pine forests in water shedding sites; responds very well to increases in light.

Valuation criteria
Keep in mind that quality and cover are separate values; evaluate the quality based on an average of the individual plants within the plot, ***regardless of the overall cover of the species.***

FLOWERS

Use: Medicine.
Harvest time: In the summer (late June, July), when the flowers have begun to wilt.
Valuation time: June to early July
Quality requirements: Healthy flower heads.

Code	Description	Detail
0	Nil	Plants moribund or dead.
1	Very low	Few to no flower structures present OR flowers are generally not fit for use.
2	Low	n/a
3	Moderate	Sufficient flowers to warrant personal collection (a few individuals with flower abundance and many individuals with no flowers). Flowers are of medium to high vigour and appearance.
4	Moderate high	n/a
5	High	Sufficient flowers, on average, to warrant significant collection (e.g. for storage or commercial use). Plants and flowers are of medium to high vigour and appearance. Most plants are producing flowers.
6	Excellent	All plants have impressive levels of vigour, health, and flower production. Unusual.

[4] MacKinnon, A., J. Pojar, and R. Coupe. 1992. Plants of northern British Columbia. B.C. Ministry of Forests and Long Pine Publishing. Victoria, BC.

Betula papyrifera

Common name: Paper birch

Description[5]**:** Paper birch is a small to medium-sized tree. Its trunk reaches diameters of up to 75 cm, and the tree is often multi-stemmed. The characteristic bark peels in papery strips and is reddish to coppery-brown when young, maturing to white or cream with dark horizontal lines. The leaves of paper birch are pale green, oval with pointed tips and coarse, irregular, double-toothed edges. Male and female catkins are 2 to 4 cm long, borne on the same tree, appearing before the leaves. Fruits are small, winged nutlets. Birch is a relatively short-lived tree, with growth ceasing after 60-70 years.
Distribution and habitat [1,6]**:** Paper birch is widespread and common at low to mid elevations throughout the area, occurring in open to dense, usually moist woods, seepage sites and on floodplains. It grows best on well-drained moist sites in the moist and wet warmer climates of the project area. It is unable to withstand long periods of drought or saturated soils.
Preferred habitat notes [1, 7]**:** Wide variety of site conditions. In the Cariboo it grows best on moist loamy soils with good aeration. It is shade intolerant; responds well to canopy removal. Very productive in warmer 'transition areas' around Williams Lake. South slope is reportedly best for sap.

Valuation criteria
Keep in mind that quality and cover are separate values; evaluate the quality based on an average of the individual plants within the plot, ***regardless of the overall cover of the species.***

BARK

Use: Technology: e.g. baskets, canoes.
Harvest time: spring
Valuation time: all year
Quality requirements: Healthy, vigorous, medium to large size for the species. For bark, it should have few and short lenticels ('eyelets'), and be clear of scars or imperfections.

Code	Description	Detail
0	Nil	Trees moribund or dead.
1	Very low	Trees are too small (less than 10 cm DBH) OR unhealthy (chlorotic, fungal or insect infected) OR knotty, unattractive bark.
2	Low	n/a
3	Moderate	Trees are greater than 10 cm with moderate levels of health and vigour. Trees have fairly unmottled bark, or areas of unmarred bark are not large. May be slight lean on the tree.
4	Moderate high	n/a
5	High	Trees are 20-40 cm DBH, with high level of health and vigour of most to all of the trees. Trees have perfect, smooth, unmarred bark (few to no, or very short, lenticels / 'eyelets'). Tree is straight with no lean.
6	Excellent	All trees have impressive levels of vigour and health, are 20-40 cm DBH. Trunk is free of lower branches, bark is easy to collect and without any

[5] MacKinnon, A., J. Pojar, and R. Coupe. 1992. Plants of northern British Columbia. B.C. Ministry of Forests and Long Pine Publishing. Victoria, BC.
[6] Uchytil, Ronald J. 1991. *Betula papyrifera*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis [Accessed March 2008].
[7] Haeussler, S., D. Coates, & J. Mather 1990. Autecology of common plants in British Columbia: A literature review. British Columbia Ministry of Forests. Victoria, BC.

	scars or imperfection. Uncommon.

LEAVES

Use: Neutraceutical.
Harvest time: spring, summer
Valuation time: leaves present; spring, summer
Quality requirements: For leaves, they must be accessible (i.e. within reach) and have no fungal or insect infections.

Code	Description	Detail
0	Nil	Trees moribund or dead.
1	Very low	Leaves are unhealthy (chlorotic, fungal or insect infected) OR leaves out of reach.
2	Low	n/a
3	Moderate	Moderate levels of health and vigour OR leaves moderately accessible.
4	Moderate high	n/a
5	High	High level of health and vigour of most to all of the plants. Leaves within easy reach. Little to no insect or fungal infection.
6	Excellent	Impressive levels of access and health. Uncommon.

SAP [8] [9]

Use: syrup and beverages
Harvest time: March- early May
Valuation time: all year
Quality requirements: healthy, vigorous trees with good crown growth.

Code	Description	Detail
0	Nil	Trees moribund or dead.
1	Very low	Trees are less than 20 cm OR clearly unhealthy.
2	Low	n/a
3	Moderate	Trees are at least 20 cm DBH. Trees no older than 60 years. Trees of fair health and vigour.
4	Moderate high	n/a
5	High	Trees are at least 20 cm DBH. Stand contains some trees greater than 40 DBH. Trees no older than 60 years. High level of health and vigour of most to all of the plants with no indication of insect or fungal disease. Trees have large spreading branches, and no dead tops.
6	Excellent	Known very high sap production.

[8] Dixon-Warren, Heloise. 2007. The Birch Syrup Production Manual; Tapping into Syrup Boreal Forest Style. Quesnel community and Economic Development Corporation. Quesnel, BC.
[9] Kim McIvor and Pete Thumand, Birch Place Farm. Personal Communication July 2007.

Ledum groenlandicum

Common name: Labrador tea

Description[10]**:** Labrador tea is a scraggly evergreen shrub with many branches, growing up to .8 m tall. Its long and narrow leaves are alternate, have curled-under edges and often droop. The leaves are leathery with a furry underside that is white on new leaves, becoming a rusty brown colour with age. The small clusters of flowers are delicate and white with stamens that extend beyond the petals. The small brown seed capsules form on the end of short, drooping stem clusters.
Distribution and habitat[2]**:** Labrador Tea can be found, often in dense patches, from low to middle elevations and is common throughout the interior. It grows in nutrient-poor wetlands and, less frequently, in cool moist climates in frosty pine/spruce 'upland' forests.
Preferred habitat notes[11]**:** moist to wet, acidic cool sites on organic soils. Light to open canopy cover.

Valuation criteria:
Keep in mind that quality and cover are separate values; evaluate the quality based on an average of the individual plants within the plot, ***regardless of the overall cover of the species.***

LEAVES

Use: Neutraceutical
Harvest time: all year, best late summer and early fall.
Valuation time: all year. Most accurate in spring or summer.
Quality requirements: Healthy, non-brittle, green leaves with no yellowing.

Code	Description	Detail
0	Nil	Shrubs moribund or dead.
1	Very low	Leaves are chlorotic or unappealing, OR leaves are fungal or insect infected OR plants are uncommonly small.
2	Low	n/a
3	Moderate	Plant appearance fair, with reasonable but not excessive levels of health and vigour. Some plants may have yellow, chlorotic leaves.
4	Moderate high	n/a
5	High	Most plants are of high vigour and appearance, with ample stems and leaves. Leaves are moderate to large. Little to no insect or fungal infection.
6	Excellent	Plants are of exceptional high vigour and appearance. Leaves are large.

[10] MacKinnon, A., J. Pojar, and R. Coupe. 1992. Plants of northern British Columbia. B.C. Ministry of Forests and Long Pine Publishing. Victoria, BC.
[11] Gucker, Corey L. 2006. Ledum groenlandicum. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis [Accessed March 2008].

Rosa acicularus

Common name: Rose; prickly rose

Description[12]**:** The rose grows up to 1.5 m tall, with branches covered with dense straight prickles. Leaves are typical rose leafs, with 5-7 toothed leaflets. Flowers are large and pink with 5 petals. Hips are bright red and retain their sepals.
Distribution and habitat: Widespread and common at low to mid-elevations.
Preferred habitat notes: Grows best on well-drained soils in disturbed areas.

Valuation criteria:
Keep in mind that quality and cover are separate values; evaluate the quality based on an average of the individual plants within the plot, ***regardless of the overall cover of the species.***

FRUIT

Use: Food, medicine.
Harvest time: In the fall (September to October), often after the first frost.
Valuation time: June through September
Quality requirements: Healthy, plump hips, with sufficient moisture and little infestation, bug chew or rot. Sufficient fruit structures to warrant personal harvest (for efficiency).

Code	Description	Detail
0	Nil	Plant is moribund or dead
1	Very low	No fruit structures present OR fruit are generally not fit for consumption.
2	Low	Few fruit present; a person would not bother stopping to pick. Fruit and plants are of low to and appearance.
3	Moderate	Sufficient fruit per plant, on average, to warrant personal collection (e.g. for a batch of jelly).
4	Moderate high	Sufficient fruit per plant, on average, to warrant personal to significant collection. A person worthwhile to come to the area to pick. Bushes generally healthy.
5	High	Sufficient fruit per plant, on average, to warrant significant collection. Fruit and plant are of r vigour and appearance, ranging from 1- 2 m in height. Possible to harvest about 2 cups of hip bush.
6	Excellent	Almost all of the plants have exceptional levels of fruit production. Uncommon.

[12] MacKinnon, A., J. Pojar, and R. Coupe. 1992. Plants of northern British Columbia. B.C. Ministry of Forests and Long Pine Publishing. Victoria, BC.

Shepherdia canadensis

Common names: Soapberry, soapberry, buffalo berry

Description[13]**:** Soapberry is a spreading deciduous shrub, approximately 1 to 2 m tall. It has brownish branches that are covered with small scabs resembling bran. The younger branches are covered with many rusty spots. Its leaves are oval and arranged opposite each other; the upper surfaces are dark green and the lower surfaces are covered in a silvery-whitish felt of hairs and rusty brown spots. Soapberry has inconspicuous yellowish-brown flowers, in clusters of 1 to several that appear on the stems before the leaves open. Male and female flowers occur on separate plants. The oval-shaped berries are bright red, translucent and juicy, but bitter and soapy to touch.

Distribution and habitat[1]**:** Soapberry is widespread and very common at low to subalpine elevations throughout BC with the exception of the Queen Charlotte Islands, N Vancouver Island and adjacent N coast. It is common on dry to moist sites in dry to moist cool climates, and more restricted to drier warm aspects sites in the wet climates. It occurs in open forests and clearings.

Preferred habitat notes: various, but very abundant in riparian zones and valley bottoms. Responds well to disturbance as an early seral species. Does well in open, medium to dry forests and young clearcuts, in warmer climates OR in warm aspects.

Valuation criteria:

- Keep in mind that quality and cover are separate values; evaluate the quality based on an average of the individual plants within the plot, ***regardless of the overall cover of the species.***
- Soapberry is dioecious (separate male and female plants); if no berries are present on a plant, it is possible that it is male.

FRUIT

Use: Food, medicine.

Harvest time: In the Williams Lake area, fruit generally ripens in July, depending on elevation and latitude.

Valuation time: May to July

Quality requirements: Healthy, plump, juicy berries, with sufficient moisture and little infestation, bug chew or rot. The berries are not 'picked'; rather the bush is shaken to remove the berries.

Code	Description	Detail
0	Nil	Plant is moribund or dead
1	Very low	No fruit structures present on **any** of the bushes (dioecious plant) OR fruit are generally not fit for consumption.
2	Low	Few fruit present; a person would not bother stopping to pick. Fruit and plants are of low to medium vigour and appearance.
3	Moderate	Sufficient fruit per plant, on average, to warrant personal collection (e.g. for a batch of 'wild ice-cream'). Berries and plants are of medium vigour and appearance. Possible to harvest about 500mL (2 cups) fill from one plant.
4	Moderate high	Sufficient fruit per plant, on average, to warrant personal to significant collection. A person would find it worthwhile to come to the area to pick. Bushes generally healthy.
5	High	Sufficient fruit per plant, on average, to warrant significant collection. Fruit and plant are of medium to high vigour and appearance. Possible to harvest about 2-3 L (8-12 cups) from one plant.
6	Excellent	Almost all of the plants have exceptional levels of fruit production. Possible to harvest 3-4 L (16 cups; an ice-cream bucket) from a plant. Uncommon.

[13] MacKinnon, A., J. Pojar, and R. Coupe. 1992. Plants of northern British Columbia. B.C. Ministry of Forests and Long Pine Publishing. Victoria, BC.

LEAVES & TWIGS

Use: Neutraceutical
Harvest time: Whenever leaves are present, best after berry production.
Valuation time: When leaves present on shrub - spring, summer, early fall.
Quality requirements: Healthy, non-brittle, green leaves with no yellowing. Best off of a male (non-berry producing) bush.

Code	Description	Detail
0	Nil	Shrubs moribund or dead.
1	Very low	Leaves are chlorotic or unappealing, OR leaves are fungal or insect infected OR plants are uncommonly small.
2	Low	n/a
3	Moderate	Plant appearance fair, with reasonable but not excessive levels of health and vigour. Some plants may have yellow, chlorotic leaves.
4	Moderate high	n/a
5	High	Most plants are of high vigour and appearance, with ample stems and leaves. Leaves are moderate to large for the species. Little to no insect or fungal infection.
6	Excellent	Plants are of exceptional high vigour and appearance. Leaves are large. Uncommon.

Vaccinium caespitosum

Common name: Low-bush blueberry, dwarf blueberry

Description[14]**:** A short, deciduous, dwarf shrub up to 30 cm tall but often shorter, and has dense matted growth. Twigs are rounded and yellow-green to reddish, often hairy. Leaves are bright green, oblong shaped, widest above the middle, and distinctly toothed. Leaves may be pointed or blunt, but always have an obvious network of veins on the lower surface. The flowers are small whitish pink, urn shaped. The fruits are edible blue berries with a pale grey bloom.
Distribution and habitat[1]**:** Dwarf blueberry grows from low to high elevations, in a variety of habitats including dry to moist coniferous forests, in wet meadows, on mountain slopes and rocky ridges as well as alpine tundra.
Preferred habitat notes[15]**:** Well drained, acidic soils. Alpine or sub-alpine benches or basins which receive good snow pack, riparian or open mixed-wood forests, particularly common on slightly dry to moist sites in the moist climates of the project area.

Valuation criteria:
Keep in mind that quality and cover are separate values; evaluate the quality based on an average of the individual plants within the plot, ***regardless of the overall cover of the species.***

FRUIT

Use: Food.
Harvest time: late summer (August), depending on elevation and latitude.
Valuation time: early June to August
Quality requirements: Healthy, plump, juicy berries, with sufficient moisture and little infestation, bug chew or rot. Note that berry production of this species is generally lower than other *Vaccinium* species.

Code	Description	Detail
0	Nil	Plant is moribund or dead
1	Very low	No berry structures present OR berries are generally not fit for consumption.
2	Low	Few fruit present; a person would not bother stopping to pick. Fruit and plants are of low to medium vigour and appearance.
3	Moderate	Sufficient fruit per plant, on average, to warrant personal collection (e.g. for inclusion in pancakes). Berries and plants are of medium vigour and appearance. Possible to harvest 80 – 120 mL (1/3 to 1/2 cup) in 10 minutes.
4	Moderate high	Sufficient fruit per plant, on average, to warrant personal to significant collection. A person would find it worthwhile to come to the area to pick. Bushes generally healthy.
5	High	Sufficient fruit per plant, on average, to warrant significant collection. Fruit and plant are of medium to high vigour and appearance. Possible to harvest about 150 mL per m^2. 125 – 250 mL (½ - 1 cup) in 10 minutes, or about 150 mL/m^2.
6	Excellent	Almost all of the plants have exceptional levels of fruit production. Possible to harvest over 250 mL in 10 minutes. Uncommon.

[14] Parish, R. ,R. Coupe and D. Lloyd. 1996. Plants of Southern British Columbia. B.C. Ministry of Forests and Long Pine Publishing. Victoria, BC.
[15] Tirmenstein, D. 1990. *Vaccinium caespitosum*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [Accessed March 2008]

Vaccinium membranaceum

Common name: huckleberry, black huckleberry

Description[16]**:** An erect shrub growing up to 1.5m, densely branched and spreading. The young branches are yellowish green and somewhat angled; old branches become grey with shredding bark. The leaves are thin, lance-shaped to elliptic, finely toothed and are pointed at the tip. The leaves are deciduous. The flowers are pale pink, urn-shaped and appear with or after the leaves. The berries are dark purplish berries with no bloom.
Distribution and habitat: The black huckleberry is common in coniferous forests from valley bottoms to high elevations in moist and wet climates. It is more restricted in distribution and of poor vigour in dry climates of the project area.
Preferred habitat notes[17] [18]**:** Wide range of soils. Grows best under minimal but some canopy cover on cool mesic sites in warm wet climates; berries in clearcuts are not considered as good as those grown within forests. Northern aspects, moderate to steep slopes. Positive response to disturbance can be up to 2-3 decades. Assumed to have little frost resistance. Sensitive to drought

Valuation criteria:
Keep in mind that quality and cover are separate values; evaluate the quality based on an average of the individual plants within the plot, ***regardless of the overall cover of the species.***

FRUIT

Use: Food, medicine.
Harvest time: In the Williams Lake area, from mid to late August, depending on elevation and latitude.
Valuation time: June (green berries) through to August
Quality requirements: Healthy, plump, juicy berries, with little infestation, bug chew or rot.

Code	Description	Detail
0	Nil	Plant is moribund or dead
1	Very low	Few to no berry structures present OR berries are generally not fit for consumption.
2	Low	Few fruit present; a person would not bother stopping to pick. Fruit and plants are of low to medium vigour and appearance. Ability to harvest only 125mL (1/2 cup) in 10 minutes in the area.
3	Moderate	Sufficient fruit per plant, on average, to warrant personal collection (e.g. for a batch of 'wild ice-cream'). Berries and plants are of medium vigour and appearance. Ability to harvest approx. 250 mL (1 cup) in 10 minutes harvest in the area.
4	Moderate high	Sufficient fruit per plant, on average, to warrant personal to significant collection. A person would find it worthwhile to come to the area to pick. Bushes generally healthy.
5	High	Sufficient fruit per plant, on average, to warrant significant collection. Fruit and plant are of medium to high vigour and appearance. Possible to harvest 650-750 mL (2.5-3 cups) in 10 minutes.
6	Excellent	Almost all of the plants have exceptional levels of fruit production. Berries and plants are of exceptionally high vigour and appearance. Very little competition from other shrub species. Uncommon.

[16] MacKinnon, A., J. Pojar, and R. Coupe. 1992. Plants of northern British Columbia. B.C. Ministry of Forests and Long Pine Publishing. Victoria, BC.
[17] Barney, D.L. 1999. Growing Western Huckleberries. University of Idaho.
[18] Anderson, M.K. 2000. Vaccinium membranaceum. USDA, NRCAS, National Plant Data Centre c/o Plant Sciences Department, University of California, Davis, CA. Available at: http://plants.usda.gov.

Vaccinium myrtilloides

Common name: highbush blueberry, velvet-leaved blueberry

Description[19]**:** Velvet-leaved blueberry is a low shrub growing up to 0.4 m high, often in dense colonies. Branches and leaves are distinctively velvety hairy. The leaves are elliptic to oblong, sharply pointed with smooth margins. Flowers are greenish white or tinged pink, and cylindrically bell-shaped. They appear either singly or more commonly in few-flowered clusters. Berries are blue with a pale-blue bloom.
Distribution and habitat [2]**:** Velvet-leaved blueberry is scattered and locally common at low to mid elevations, occurring on rapidly drained gravelly or sandy soils, in open, often dry site forests and clearings and less commonly on bog hummocks.
Preferred habitat notes: Prefers open forests or young clearcuts with well drained, sandy soils.

Valuation criteria:
Keep in mind that quality and cover are separate values; evaluate the quality based on an average of the individual plants within the plot, ***regardless of the overall cover of the species.***

FRUIT

Use: Food, medicine.
Harvest time: August, depending on elevation and latitude.
Valuation time: early June through August
Quality requirements: Healthy, plump, juicy berries, with sufficient moisture and little infestation, bug chew or rot.

Code	Description	Detail
0	Nil	Plant is moribund or dead
1	Very low	Few to no berry structures present OR berries are generally not fit for consumption.
2	Low	Few fruit present; a person would not bother stopping to pick. Fruit and plants are of low to medium vigour and appearance.
3	Moderate	Sufficient fruit per plant, on average, to warrant personal collection (e.g. for a batch of 'wild ice-cream'). Berries and plants are of medium vigour and appearance. Possible to harvest approx. 250 mL (1 cup) in 10 minutes, or about 150 mL/m^2. Coverage may be patchy
4	Moderate high	Sufficient fruit per plant, on average, to warrant personal to significant collection. A person would find it worthwhile to come to the area to pick. Bushes generally healthy.
5	High	Sufficient fruit per plant, on average, to warrant significant collection. Fruit and plant are of medium to high vigour and appearance. Coverage is fairly continuous with little competition from other shrubs. Possible to pick about 600 – 650 mL (2.5 cups) in 10 minutes, or about 450 – 550 mL /m^2.
6	Excellent	Almost all of the plants have exceptional levels of fruit production. Berries and plants are of exceptionally high vigour and appearance. Very little competition from other shrub species. Uncommon.

[19] MacKinnon, A., J. Pojar, and R. Coupe. 1992. Plants of northern British Columbia. B.C. Ministry of Forests and Long Pine Publishing. Victoria, BC.

Vaccinium ovalifolium

Common name: Mountain blueberry, oval-leaved blueberry

Description[20]**:** Oval-leaved blueberry is shrub up to 1.5 m tall. Young twigs are brown-yellow, sometimes reddish; mature branches are grey. Branches are angled. Leaves are oval and blunt-rounded at both ends, with smooth margins. Oval-leaved blueberry has single pinkish, globular bell-shaped flowers, located in the axils of leaves. They generally appear before the leaves. The edible berries are blue-black, with a bluish bloom.
Distribution and habitat[3]**:** Oval-leaved blueberry is widespread and common at low to subalpine elevations and occurs in moist coniferous forests, openings, clearings and bogs.
Preferred habitat notes: In the Williams Lake project area it occurs in wet climate areas. Abundant in clearcuts, but is also shade tolerant, growing in open forests on cool aspects. In the Williams Lake area, *V. ovalifolium* tends to grow amongst other bushes such as *V. membranaceum.* Although berry quality may be high, exclusive harvesting is difficult due to its patchy coverage. Some harvesters say that berries in clearcuts are not considered as good as those grown within forests.

FRUIT

Use: Food, medicine. Fresh or dried, preserved as syrup canned or frozen.
Harvest time: August, depending on elevation
Valuation time: early June through August
Quality requirements: Healthy, plump, juicy berries, with sufficient moisture and little infestation, bug chew or rot. This species produces one of the most dependable production of berries.

Code	Description	Detail
0	Nil	Plant is moribund or dead
1	Very low	Few to no berry structures present OR berries are generally not fit for consumption.
2	Low	Few fruit present; a person would not bother stopping to pick. Fruit and plants are of low to medium vigour and appearance. Ability to harvest only 125mL (1/2 cup) in 10 minutes in the area.
3	Moderate	Sufficient fruit per plant, on average, to warrant personal collection (e.g. for inclusion in pancakes). Berries and plants are of medium vigour and appearance. Approximately 250 mL (1 cup) of berries could be picked in 10 minutes. Plants may have patchy cover.
4	Moderate high	Sufficient fruit per plant, on average, to warrant personal to significant collection. A person would find it worthwhile to come to the area to pick. Bushes generally healthy.
5	High	Sufficient fruit per plant, on average, to warrant significant collection (e.g. for winter storage or commercial use). Fruit and plant are of medium to high vigour and appearance. Possible to harvest 350 – 500 mL (1.5 - 2 cups) in 10 minutes.
6	Excellent	Almost all of the plants have exceptional levels of fruit production. Berries and plants are of exceptionally high vigour and appearance. Very little competition from other shrub species. Uncommon.

[20] MacKinnon, A., J. Pojar, and R. Coupe. 1992. Plants of northern British Columbia. B.C. Ministry of Forests and Long Pine Publishing. Victoria, BC.

Vibernum edule

Common name: High-bush cranberry

Description[21]**:** High-bush cranberry is a shrub up to 2.5 m tall, with smooth reddish bark. Its leaves are opposite, shallowly three-lobed, with sharply toothed edges, and hairy beneath. They turn crimson in the fall. A small cluster of white flowers is found on short stems between a pair of leaves. The fruits are one-seeded, red or orange, and berry-like with large, flattened stones. Fruit is edible, but tart and acidic.
Distribution and habitat[3]**:** High-bush cranberry is widespread and common at low to mid elevations, occurring in moist to wet forest ecosystems, seepage areas, swamps, clearings and along streambanks.
Preferred habitat notes[22]**:** Grows best on well-drained alluvial soils. Often does not respond well to disturbance or overstory removal. Shrubs seldom abundant on any site. Present but very low berry production of *V. edule* in the Williams Lake area.

FRUIT

Use: Food, medicine.
Harvest time: In the fall (September to October), often after the first frost.
Valuation time: June through September
Quality requirements: Healthy, plump, juicy berries, with sufficient moisture and little infestation, bug chew or rot.

Code	Description	Detail
0	Nil	Plant is moribund or dead
1	Very low	Few to no berry structures present OR berries are generally not fit for consumption.
2	Low	Few fruit present; a person would not bother stopping to pick. Fruit and plants are of low to medium vigour and appearance.
3	Moderate	Sufficient fruit per plant, on average, to warrant personal collection (e.g. for a batch of jam). Fruit and plants are of medium vigour and appearance.
4	Moderate high	Sufficient fruit per plant, on average, to warrant personal to significant collection. A person would find it worthwhile to come to the area to pick. Bushes generally healthy.
5	High	Sufficient fruit per plant, on average, to warrant significant collection (e.g. for winter storage or commercial use). Fruit and plant are of medium to high vigour and appearance. According to FEIS, in some areas a single bush may contain up to 100 berries[3] (likely not in the central or northern areas of British Columbia).
6	Excellent	Almost all of the plants have exceptional levels of fruit production. Fruit and plants are of exceptionally high vigour and appearance. Uncommon.

[21] MacKinnon, A., J. Pojar, and R. Coupe. 1992. Plants of northern British Columbia. B.C. Ministry of Forests and Long Pine Publishing. Victoria, BC.
[22] Matthews, Robin F. 1992. *Viburnum edule*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis [Accessed March 2008].