

STUDY OF PINE MUSHROOM ECOLOGY AND MANAGEMENT STRATEGIES IN THE ANAHIM LAKE AREA

Main Proponent: Laurie Vaughan/ Bill Chapman

Organization: Yun Ka Whu'ten (YKW) Holdings Ltd.

Team Members: Laurie Vaughan - Main Proponent
Bill Chapman Ph.D. - Lead Researcher, MOF
Rebecca Bravi B.Sc. - Project Coordinator and Researcher, YKW
Rebecca Holte - Field Technician, YKW
Lorne Cahoose - Field Technician, YKW
Bob Sagar Ph.D. - Weather Data Specialist, YKW

Project Start Date: September 1998

Project End Date: March 2003

1. ABSTRACT

During the five years the Study of Pine Mushroom Ecology and Management Strategies in the Anahim Lake Area has been ongoing, data has been gathered which can provide information on stand level and site level attributes associated with pine mushrooms. This may lead to a management tool for Developers to use in the planning process. Testing of the efficacy of these results is required prior to implementation. The data set formed from this research is comprehensive and will require time to fully analyse but once completed will provide further information that will assist in understanding the unique habitat requirements of pine mushroom on the landscape. Forestry sites were chosen and laid out. However, due to the Mountain Pine Beetle epidemic in the area, logging of these trails was delayed. The result of this delay was that Forest Managers and Mushroom Researchers developed a close working relationship in trying to come up with innovative ideas on how to work within the constraints of the Beetle epidemic. This is of utmost importance as the Mountain Pine Beetle preferentially attacks mature and old pine trees. These are the same trees that the pine mushroom is associated with in the area. Implementing the trials at the time may have been a poor investment as the beetles could conceivably have destroyed the treatments. Therefore, finding a possible solution to this was important prior to implementation. Furthermore, the mushroom is now at risk because its local host is threatened. Finding a management solution that will address this new concern has taken top priority in the region. A new research proposal has been submitted to FII to look at the potential to use selective harvest techniques as a method of beetle proofing stands as well as maintaining pine mushroom presence on the landscape.

Location

The work was conducted around Anahim Lake, extending from within Tweedsmuir Park to near Tatla Lake. Plots were established in the ESSFxv, MSxv, SBPSmc, SBPSxc, and IDFdw Biogeoclimatic Subzones. These are all the Biogeoclimatic subzones where mushrooms are found in the area.

Keywords

pine mushroom, *Tricholoma magnivelare*, matsutake, mushroom harvest, pine mushroom management, non-timber-forest products, First Nations, pine mushroom ecology, silvicultural systems.

2. PROGRESS RELATIVE TO APPROVED WORKING PLAN

Objectives for 2002/03 were met or were largely met. Presented below is the 2002/03 Work Plan followed by a detailed summary of activities, results and outputs.

2002-03 Working Plan

Quarter	Project Activities
Q1 April 1, 2002 to June 30, 2002	<ul style="list-style-type: none"> • Develop and submit comprehensive work plan to FIA for funding purposes. • Obtain MOF approval for forestry two forestry trials already designed and begin installation. • Layout of the forestry trial at Kappan. • Design a forestry trial for Telegraph and begin approval process. • Oversee logging operations at the Kappan forestry trial. • Pre-field season organizational meetings with key players (LV, BB and BC). • Preparation of materials and supplies for the field season. • Bring weather stations back online. • Pre-work orientation and training for field staff. • Begin soil and vegetation descriptions.
Q2 to Sept 30, 2002	<ul style="list-style-type: none"> • Finish detailed description of remaining transect plots (soil, vegetation, canopy etc.). • Continue description of characteristics at the scale of individual mushrooms. • Layout forestry trial on Beef Trail. • Supervise logging of forestry trial at Beef trail. • Layout forestry trial at Telegraph (pending approval). • Initiate seasonal collection of mushroom productivity data. • Complete plot and mushroom scale sky-view photos – 180° Fish-eye photos.
Q3 to Dec 31, 2002	<ul style="list-style-type: none"> • Finish collecting mushroom productivity data. • Finish collecting plot and mushroom scale data. • Fall data dump at weather stations. • Put weather stations to bed for winter. • Collect historical productivity data. • Complete site series determinations for current years data. • Complete soil chemical analyses. • Complete sky view photography and complete analysis of photos. • Community update.
Q4 to Mar 31, 2002	<ul style="list-style-type: none"> • Complete data compilation and entry. • Begin analysis of data, correlation of site characteristics with mushroom productivity. • Continue data analysis and correlate stand characteristics with mushroom productivity. • Continue data analysis, correlate weather (and micro-site) data

	<p>with yield including analysis of historical weather data.</p> <ul style="list-style-type: none"> • Year-end report for funding agency. • Pursue funding sources for extension of the trial, particularly for monitoring forestry sites.
--	--

Quarter 1 - Summary of Activities, Results and Outputs

- **Develop and submit comprehensive work plan to FIA for funding purposes.**
- **Pre-field season organizational meetings with key players.**

A comprehensive working plan was developed and submitted to FII for funding purposes. Pre-work meetings were held at the end of May 2002 between key project players to discuss budgets timelines, materials, supplies, research methods and community involvement in the project.

- **Pre-work orientation and training for field staff.**
- **Preparation of materials and supplies for the field season.**
- **Bring weather stations back online.**
- **Begin soil and vegetation descriptions.**

Training sessions were conducted over a three week period in June 2002 with the field crew on; vegetation descriptions as per the Describing Ecosystems in the Field, DEIF, Manual, soil pit descriptions, plot location and establishment, sample collection, sample labelling and storing, field notes, GPS use and mapping, Fish eyed camera use, weather station assessment and maintenance and stand vigour assessment. During this time weather stations were brought back online, materials and supplies were gathered and soil and vegetation descriptions were started.

- **Obtain MOF approval for forestry two forestry trials already designed and begin installation.**
- **Layout of the forestry trial at Kappan.**
- **Oversee logging operations at the Kappan forestry trial.**

Approval was granted for two forestry trials CP 87 Block 2 and CP 38 Block 15 under Yun Ka Whu'ten Holdings Limited Licence at the District level. This involved discussions with West Chilcotin Forest Products and District Ministry of Forests staff. Layout was completed on CP 38 Block 15 but logging was postponed due to logging efforts being dedicated to Mountain Beetle suppression.

- **Design a forestry trial for Telegraph and begin approval process.**

The Ministry of Forests Small Business was approached regarding the design and implementation of a Forestry Trial in the Telegraph area. Support was granted for the idea and a general working plan for all trials was developed and submitted for approval to Victoria.

Quarter 2 - Summary of Activities, Results and Outputs

- **Finish detailed description of remaining transect plots (soil, vegetation, canopy etc.).**
- **Complete plot and mushroom scale sky-view photos – 180° Fish-eye photos.**
- **Initiate seasonal collection of mushroom productivity data.**
- **Continue description of characteristics at the scale of individual mushrooms.**

Detailed plot descriptions were completed on all transects by September 30, 2002. Plot center sky view photos taken to assess stand level structure were completed on October 4, 2002 while sky view photos taken to assess structure over specific mushrooms continued to the end of seasonal pine mushroom production. The collection of the 2002 mushroom productivity data began with the first appearance of fruit bodies at Ecology Site B8 producing on August 23, 2002. Mushroom specific site characterization commenced on August 28, 2002 at Ecology Site B8 producing as well. This included collecting 4 soil samples each at 1cm and 15cm distances and describing the vegetation within a 1m radius around the mushroom.

- **Layout forestry trial on Beef Trail.**
- **Supervise logging of forestry trial at Beef trail.**
- **Layout forestry trial at Telegraph (pending approval).**

Layout of the forestry trial on the Beef Trail (CP 87 Block 2) was conducted as a paper exercise. Ground assessment of the block indicated Mountain Pine Beetle presence. In light of the Beetle epidemic facing the area and the fact that the Beetles preferentially utilize the same host tree as the pine mushroom a new focus was to assess the potential to mitigate the impacts of the Beetle which may also lead to the preservation of mushroom habitat. A full Beetle probe of the block was planned and executed under Yun Ka Whu'ten Holdings Limited FIA LBIP to determine the potential to go ahead with a trial. The final probe information is under review and we are currently developing an amended partial cut prescription to meet the new objectives of limiting Mountain Pine Beetle spread in the area as well as maintain mushroom presence.

Due to Beetle Management efforts in the Anahim Supply Block logging of the Telegraph area has been postponed indefinitely by Ministry of Forests Small Business. Layout of a trial in the area was delayed. However, a research trial plan was established for all sites (CP 87, CP38 and Telegraph) for submission at the Provincial level. The plan has been peer reviewed and is currently in the final submission stage.

Quarter 3 - Summary of Activities, Results and Outputs

- **Finish collecting mushroom productivity data.**
- **Finish collecting plot and mushroom scale data.**

Mushroom productivity and mushroom specific plot data was collected until October 17, 2002. An attempt was made to collect mushroom specific plot data at 9 sites within each

Bio-geo-climatic subzone. Because no mushroom production occurred in the ESSF xv and the SBPS mc zones in 2002 no data was collected for these zones. Sufficient sampling was done in the MS xv, SBPS xc and the IDF.

- **Fall data dump at weather stations.**
- **Put weather stations to bed for winter.**

All weather stations were visited between October 15 and 17, 2002 and data was downloaded from the data loggers. Data loggers were reset, regular maintenance was conducted at all sites and repairs were made to 2 stations that had been damaged by animals digging up wires. Rain gauges were dismantled for the winter.

- **Collect historical productivity data.**

Waybills from the airline that shipped mushrooms out of the area are no longer on file. Attempts to get information from buyers to collaborate with information collected from pickers on historical production rates were unsuccessful. There seems to be a high level of protection around the information.

- **Complete site series determinations for current years data.**
- **Complete soil chemical analyses.**
- **Complete sky view photography and complete analysis of photos.**

Site series determinations were completed by January 31, 2003. Site series determinations were reviewed by the Regional Vegetation expert to ensure the accuracy of the assessments. Soil chemical analyses of both plot and mushroom specific soil samples were completed by March 1, 2003. Chemical analyses included testing pH and calcium. Soil textural analyses were also completed. Sky view photographs were analysed with the computer program GAP Light Analyser to assess canopy structure and site openness. Analysis was completed by February 15, 2003.

- **Community update.**

A community update was published for dissemination at the Community Annual General Meeting in November 2002.

Quarter 4 - Summary of Activities, Results and Outputs

- **Complete data compilation and entry.**

Complete

- **Begin analysis of data, correlation of site characteristics with mushroom productivity.**

Analysis has begun. There seem to be few differences between producing and non-producing areas in terms of site characteristics. The data analysis is still in the early stages.

- **Continue data analysis and correlate stand characteristics with mushroom productivity.**

Analysis has begun. Specific stand level attributes have been queried using a stepwise regression analysis. Preliminary regression analysis seems to indicate that proportion of ground cover correlates most strongly (inversely) with mushroom production. Percent cover of all lichen species also seems to correlate negatively with mushroom production. Data analysis is still in its early stages.

- **Continue data analysis, correlate weather (and micro-site) data with yield including analysis of historical weather data.**

Preliminary analysis has been conducted to look for correlations between weather data and mushroom yield data. Early analysis seems to indicate precipitation events approximately one week before mushrooms are produced. Historical productivity data collected from pickers has been summarized in a response matrix and the information has been graphed (Appendix 1)

- **Year-end report for funding agency.**

Complete

- **Pursue funding sources for extension of the trial, particularly for monitoring forestry sites.**

A new proposal has being submitted to FII to further analyse the data set and to test stand structure findings for their utility as management tools. Commitments for funding and support have been obtained for implementation and monitoring of the forestry sites.

3. EVALUATION OF PROJECT OUTCOMES

Key Results

Soil, vegetation, mensuration and canopy structure data collection was completed for all research transects. All data entry is complete. Lab analysis of all soil samples has been conducted. Canopy data analysis is complete. Vegetation data has been assessed to determine Sites Series for each research transect. An initial data set has been compiled for statistical analysis using stepwise regression. This analysis is intended to enable a broad review of the data to look for correlations or areas where further analysis will be beneficial. Stand level attributes where mushrooms occur are in the data set and further assessment will resolve whether these attributes will be useful in management planning of the resource. however attribute information must be assessed to identify it's utility in predicting pine mushroom presence. Weather and productivity data has been examined for correlations.

Measurable indicators of success

This work was undertaken with the intent of describing the ecology of the pine mushroom in the West Chilcotin and then to use that information to develop management strategies for the pine mushroom in the study area. Data collection has been successfully completed and data analysis is underway. Based on preliminary findings, a strategy has been developed for managing pine mushrooms and an application has been made for funding to test that strategy. There has been tremendous support from the entire West Chilcotin community to participate in testing of the strategy. The current interest/participant group has expanded well beyond the initial group that was involved in the study. Initially the study was a co-operative effort between Yun Ka Wh'ten and the BC Ministry of Forests. Now, most of the licensees operating in the area are participating in the new project, including West Chilcotin Forest Products, Tsi Del Del, Riverside and Lignum, as well as a continued leading role from Yun Ka Wh'ten. Also the Alexis Creek Band is now supporting the project, in addition to the Ulkatcho First Nation, and there is support from several other groups in the area. This overwhelming support from the community is probably the strongest indicator possible of the success of the work done so far.

DATA ANALYSIS DISCUSSION

Forestry sites have been identified and although original goals associated with these sites have had to be modified as a result of the Mountain Pine Beetle epidemic the new objectives will provide extremely beneficial information to land-use planners, researchers and community members. The need to develop innovative strategies for dealing with Mountain Pine Beetle effects on forest resources has resulted in closer interactions between mushroom interests and timber harvest interests. There appears now to be a genuine belief that cooperative management of these two resources is possible and desirable. This is evident in the fact that pine mushroom research is being sought by other communities and timber interest groups as well as by the fact that pine mushrooms have been included in the regional resource values list.

Weather data that is site specific to mushroom producing areas will continue to be collected. Money is being sought to continue collecting productivity data at the research sites. This will provide longer-term information on how weather patterns influence fruiting.

4. Assessment of Results

During the five years the Study of Pine Mushroom Ecology and Management Strategies in the Anahim Lake Area has been ongoing, data has been gathered which can provide information on stand level and site level attributes associated with pine mushrooms. This may lead to a management tool for use in the planning process. Testing of the efficacy of these results is required prior to implementation. The data set formed from this research is comprehensive and will require time to fully analyse but once completed, will provide

further information that will assist in understanding the unique habitat requirements of pine mushroom on the landscape.

Forestry sites were chosen and laid out. However due to the Mountain Pine Beetle epidemic in the area, logging of these trails was delayed. The result of this delay was that Forest Managers and Mushroom Researchers developed a close working relationship in trying to come up with innovative ideas on how to work within the constraints of the Beetle epidemic. This is of utmost importance as the Mountain Pine Beetle preferentially attacks mature and old pine trees. These are the same trees that the pine mushroom is associated with in the area. Implementing the trials may have been a poor investment as the beetles could perceivably attack all trees. Therefore, finding a possible solution to this was important prior to implementation. Furthermore, the mushroom is now at risk because its local host is threatened. Finding a management solution that will address this new concern has taken top priority in the region. A new research proposal has been submitted to FII to look at the potential to use selective harvest techniques as a method of Beetle proofing stands as well as maintaining pine mushroom presence on the landscape.

5. Contribution to Knowledge Gap

Preliminary calculations indicate that the value of pine mushrooms in producing areas (patches) may exceed the value of the timber over a rotation. Given the current economic situation regarding tree harvesting, diversification of the harvest from forests should be paramount. The ultimate goal of this project is to develop a strategy to maintain timber and mushroom harvesting. That process has begun through the co-operative design and implementation of experimental silvicultural systems to maintain mushroom production.

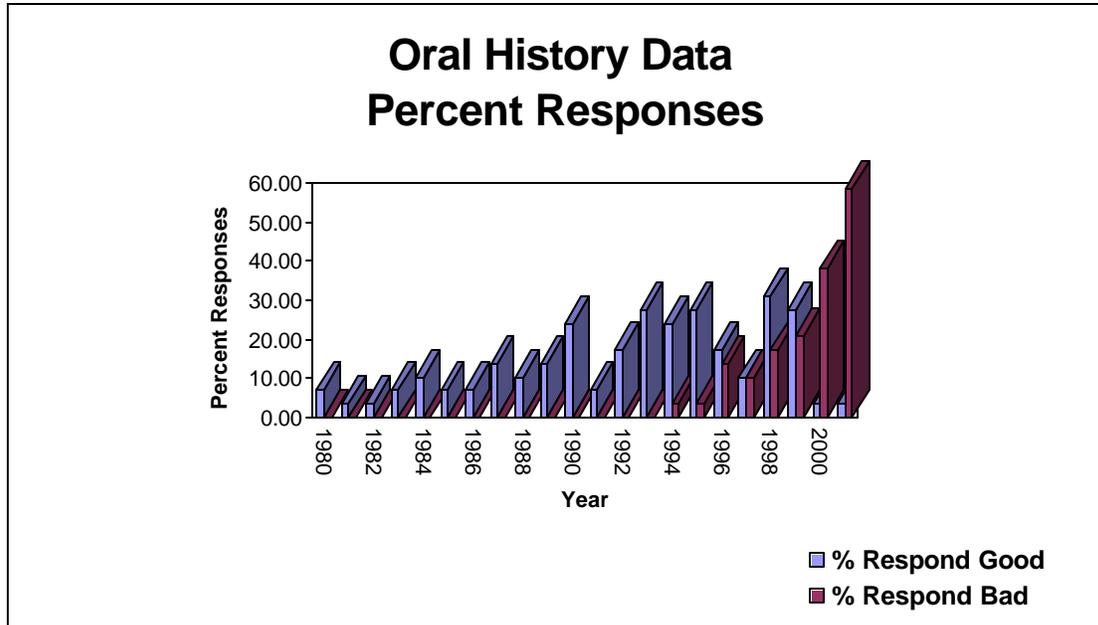
Within the Caribou Chilcotin Land-Use Plan, which is the higher level regional planning document it states that Forest License Holders are legally obligated to manage for Pine Mushrooms. Given that little information exists on the ecology of the pine mushroom, managing for it is a difficult if not impossible task. Furthermore, existing information on pine mushroom ecology is preliminary and scant. It has not been tested and views on the nature of its relationship to its host remain contentious. This research, to our knowledge, is the most comprehensive research that has been conducted to date on pine mushroom in British Columbia and perhaps North America. Although results may not yet provide definitive management planning tools they do provide critical information needed for continued progress to that end.

APPENDIX 1 – DATA ANALYSIS AND SUB SAMPLE DATA

Oral History Data Analysis

Oral history data was collected in the Anahim Lake area through a survey process. Mushroom Researchers went to buying stations and known local pickers and filled in a questionnaire about good and bad mushroom producing years. The information was then entered into a response matrix and graphed to see the results.

Respondents indicate that in the 1980's and early 1990's, when mushroom picking was first being started in the area, production was high. There are too few responses to get a good sense of this and the fact that fewer pickers were harvesting mushrooms may indicate that picking pressure may have an impact on resource availability rather than being an indication of actual production rates. In the late 1990's responses indicate poor production since 1999.



Transect Productivity Data – 1999 to 2002

Our data from picking transects indicates that production was higher in 1999 and 2001 than in 2000 and 2002. Oral history data for the same years indicates different views about production in 1999 with bad production being reported for 2000 and 2001.

Transect Productivity Data by Year

