FOOTSTEPS AMONGST THE BERRIES:

THE ECOLOGY AND FIRE HISTORY OF TRADITIONAL GITSXAN AND WET'SUWET'EN HUCKLEBERRY SITES

by

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ABSTRACT

This is a multidisciplinary study of first Nations environmental management using landscape burning. Five Gitxsan and Wet'suwet'en traditional black huckleberry (*Vaccinium membranaceum*) gathering areas were sampled for ecological, cultural and fire history attributes. The sites were divided into three elevation categories (400-700m, 701-1000m, 1001+m) for the purposes of analysis. Low elevation sites were located on cool (NE) aspects, while middle and high elevation sites were on warm (SW) aspects. Low and middle elevation sites had relatively even terrain and moderate to steep slopes, while high elevation sites were characterized by rolling, upland plateaus. All sites were predominantly mesic to submesic with medium to poor nutrient status. Higher elevation sites were most variable with a broader ecological niche occupied by black huckleberry. Fire history sampling indicated that fires had been much more frequent on these sites than the benchmark values of the "natural" fire regimes. Most sites exhibited little evidence of previous forest conditions, and in all cases huckleberry production was non-existent at present due to competition from fire sensitive species. Successional patterns were variable at middle and low elevations with both trembling aspen (*Populus tremuloides*) and western hemlock (*Tsuga heterophylla*) dominated stands occupying similar site types. It is postulated that the characteristics of recent fire events and the availability of abundant hemlock seed are important determinants of post-fire succession on these sites. The Gitxsan and Wet'suwet'en managed several specific site types for black huckleberry, a strategy that would both extend the effective harvest period and mitigate against crop failure in any particular locale. Landscape burning of black huckleberry patches was an environmental management tool, which promoted predictability and reliability in this patchy resource that was critically important to the subsistence, commercial and cultural lives of both the Wet'suwet'en and the Gitxsan.

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CHAPTER 1: A RETROSPECTIVE STUDY OF ENVIRONMENTAL STEWARDSHIP: RESEARCH OVERVIEW AND BACKGROUND

> *He (the Chief) knows the territory. When it is the right time he burns the berry patches so the berries are fat and plump. If he didn't do that the berries would become old and overgrown and there would be berries but they would just be small. But he knows when to burn so that it cleans up just the berry patch and doesn't spread to the trees.*
>
> (Pat Namox[1] recorded by Antonia Mills 1994)

> *"In the Pacific Northwest we must make use of those fragments of information about former and different land management systems that remain available to us in elders. These fragments are what remains of indigenous systems of knowledge that, though different, were extensive and effective. In our search for more and better ways to manage the rich but threatened ecosystems of the Pacific Northwest, it is folly to ignore them".*
>
> (Robert Boyd, 1999a)

This research thesis is an effort to document one of the fragments that Boyd speaks of, following not only the leads that he has identified, but also the evidence that remains on the land, as well as the fading signs of traditional use and management of black huckleberry patches, which are part of the environmental and cultural legacy of the Gitxsan and Wet'suwet'en.

1.1 Overview

Northwestern British Columbia (BC) is a region characterized by variety; in climate, topography and ecological assemblages. In this region the coast range in the west is cut by deep, flat-bottomed valleys, which dissolve into the gentler topography of the Nechako Plateau to the east. Maritime air masses move far up the broad valley of the Skeena River moderating climates and supporting interior rainforests far inland. This variability in topography and climate supports a great diversity of plant and animal species adapted to the physical and environmental attributes of the many unique habitats in the region. This richness and diversity

have allowed several First Nations cultures to flourish in this region over many millennia. Two of these First Nations groups, the Gitxsan and Wet'suwet'en, have traditionally interacted with the physical environment in a manner that promoted growth and renewal of the plant and animal resources that have supported them. As other writers have described (Gottesfeld, 1994a; Gottesfeld, 1994b), these groups are both governed by a cultural framework, which embodies a strong conservation ethic. They have traditionally utilized a number of resource stewardship strategies and techniques designed to promote abundance and reliability in plant and animal resources that they depended upon.

1.2 Introduction

The primary objective of this thesis is to develop a more comprehensive understanding of the ecological and cultural characteristics of traditional land stewardship approaches and techniques employed by the Gitxsan and Wet'suwet'en. This research objective is addressed by investigating and documenting one of the primary environmental management tools used by many Aboriginal cultures; landscape burning. It has long been recognized that this tool was widely used by traditional cultures worldwide (Lewis, 1988; Stewart, 1954). However, in many cases, relatively little is known about the actual application of fire as a tool (Lepofsky et al., in press). Investigating the ecology and the fire history of traditional gathering areas, managed through the application of prescribed fire, can tell us a great deal about how and why this tool was used.

The upland huckleberry sites that are the focus of this research have gone largely unrecognized as hubs of cultural activity by the archaeological community (Mack and McClure, in review; Rabnett, 2000). Descriptions of these huckleberry gathering and processing areas, which emphasize their importance in the seasonal round of First Nations groups and the cultural

[1] The late Chief Wah Tah Kwets of the Wet'suwet'en Laksilyu (small frog) clan

associations that these landscape embody will assist in the interpretation, documentation and protection of cultural heritage resources. It is important in this day of disappearing traditional languages and loss of culture that examples of First Nations cultural practices are well documented, particularly interactions with the environment. This will ensure, that in a future where First Nations people are entrusted with additional opportunities and responsibilities for land stewardship, they will have a solid basis from which to make culturally relevant environmental management decisions.

In the Gitxsan and Wet'suwet'en context, the topic of environmental management is explored by looking closely at the management of a single, very important resource, black huckleberry (*Vaccinium membranaceum* Dougl. ex Hook.). Gitxsan and Wet'suwet'en elders report that they and their ancestors traditionally promoted abundant harvests of this species through the careful application of landscape burning (Gottesfeld, 1994a; Mills, 1994). This study focuses on research and documentation of the ecological and cultural aspects of these land stewardship practices.

1.2.1 Research Context

First Nations people in northwestern BC have traditionally used fire as a tool to shape their environments and improve opportunities to harvest abundant, sustainable plant and animal resources (Gottesfeld, 1994a). By manipulating plant communities and landscape patterns, First Nations became active facilitators of ecological disturbance and change within their traditional territories. Evidence presented in a number of ecological studies (Williams et al., 2000a; Haeussler et al., 1985), strongly suggests that the landscape burning activities of First Nations have contributed to the maintenance of the extensive seral landscapes which characterize the "Hazelton variant" of the Interior Cedar Hemlock (ICH) biogeoclimatic[2] zone. Anthropogenic fire

[2] biogeoclimatic classification represents classes of ecosystems under the influence of the same regional climate.

has also been identified as a factor contributing to the existence and persistence of the extensive seral aspen landscapes in the Bulkley Valley (Williams et al., 2000a). Other research suggests that burning by aboriginal people is responsible for the persistence of many xerophytic habitat types such as scrub-steppe grassland which, it is suggested would have disappeared from the region due to climate changes without active intervention by First Nations (Haeussler, 1994). Several plant species found in this region are far outside or at the northern limit of their general distribution (Haeussler, 1998a, 1998b). Such range extensions have been cited by some authors as indirect evidence of prescribed burning by First Nations (Lepofsky et al., in press). Further evidence presented in a paleoecological study conducted in this region (Gottesfeld et al., 1991) indicates the existence of an "enigmatic" increase of lodgepole pine (*Pinus contorta var. latifolia* Engelm.) pollen during the period from 2200 years BP to present, suggesting an increased fire frequency in a period of cooling climate that characterized the late Holocene Epoch. The authors of this study postulate that this unexpected increase in fire activity was likely due to anthropogenic burning activity in the region. These various lines of evidence from a variety of disciplines support the contention that Gitxsan and Wet'suwet'en have traditionally managed a variety of habitat types through the application of fire, and suggest that these management activities are of considerable time depth.

Traditional landscape burning practices were reportedly being carried out by First Nations in northwestern BC well into the 1930s, but a program of active fire suppression by the provincial forest service in the 1930's and 40's largely halted these activities (Gottesfeld, 1994a). Cessation of this anthropogenic burning, as well as general fire suppression activities which have severely limited the frequency and extent of natural fires, have also initiated a process of successional change that has profoundly influenced the ecological character of these once fire-maintained, anthropogenic landscapes. This contention is supported by the documentation of several fire maintained ecological types listed as locally rare or threatened due to cessation of natural and anthropogenic burning (Haeussler, 1998a, 1998b). With respect

to traditional huckleberry patches, the lack of fire disturbance has, in every case I am aware of, resulted in an increase of (often culturally undesirable) fire sensitive shrub species and coniferous regeneration. Many of these traditional gathering areas, some reportedly used for many generations, have now succeeded to closed forest condition after several decades without disturbance by fire.

Berries formed major components of the traditional diets of First Nations people throughout BC (Kuhnlein and Turner, 1991). The Gitxsan and Wet'suwet'en harvested large quantities of berries, which were processed, preserved and stored for use during the winter months (Gottesfeld, 1993; Johnson-Gottesfeld, 1995; Daly, 1988). Berries were also an important item of trade for the Gitxsan and Wet'suwet'en, often being exchanged with coastal groups for highly valued products such as oolichan grease, seaweed and herring roe (Mills and Overstall, 1996). Many of these berry producing species are most productive in early seral environments (Burton, 1998), and are well adapted to recovery following fire (Haeussler, 1987). Gitxsan and Wet'suwet'en needed abundant, reliable harvests of key berry species in predictable locations, to meet their subsistence needs. In order to meet this requirement, several key berry species such as black huckleberry and dwarf blueberry (*Vaccinium caespitosum* Michx.), were managed using landscape burning techniques (Gottesfeld, 1994a).

1.3 Study Area

The study area is located in northwestern British Columbia, more specifically, in the Bulkley and Kispiox ranges of the Hazelton Mountains in the northwestern portion of the Skeena River drainage. This region encompasses an area of transition between the rugged coast ranges to the west, characterized by steep mountainous terrain and the Nechako plateau to the east, an extensive upland region of gently rolling hills. Regional climate is also transitional, with significant maritime influence moderating temperatures in the western portion of the study area

and more continental boreal climates, with seasonal extremes of temperature and heavy snowloads in eastern portions. The study area encompasses portions of the traditional territories of two First Nations groups: the Gitxsan and the Wet'suwet'en.

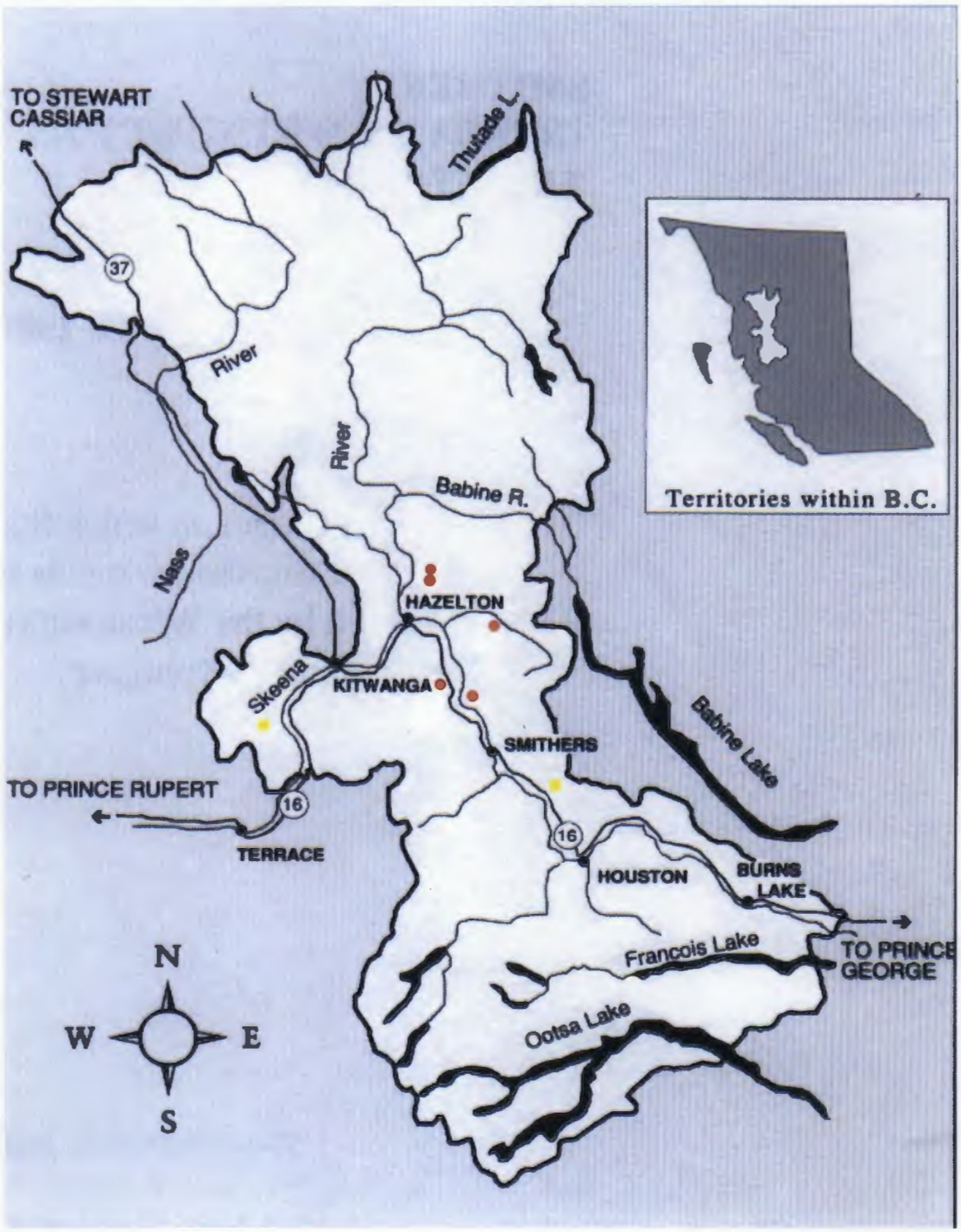

Figure 1. 1. Study Area and Traditional Territories of the Gitxsan and Wet'suwet'en with Study Sites Marked - Case Study Sites in Red. Adapted from Gisday Wa and Delgamuukw, 1992.

1.4 Problem Statement

Traditional huckleberry management is one component of a complex system of resource stewardship practiced by the Gitxsan and Wet'suwet'en. Cultural mores provided a series of checks and balances to ensure that the land, plants, animals and fish were accorded respect and cared for (Gottesfeld, 1994b). It was this stewardship approach which permeated these traditional cultures and directed their interactions with the physical environment. This investigation of one aspect of territorial stewardship is intended to further illuminate the complex interactions between First Nations and the environment so that their descendants and others might better understand and learn from the wisdom that was acquired through so much experience. The following sections describe the primary problem areas that are addressed in this thesis.

1.4.1 Research and Documentation of Traditional Knowledge and Cultural Heritage Evidence

As widespread landscape burning practices have been discontinued for many years, much of the knowledge about where, when and how to burn huckleberry patches has been lost. Fortunately, knowledgeable elders have passed a great deal of traditional ecological knowledge to succeeding generations of Gitxsan and Wet'suwet'en. Much valuable information has also been recorded in historical journals, ethnographic studies and in a variety of cultural heritage documents. As well, there are still Gitxsan and Wet'suwet'en people with knowledge of traditional landscape burning practices used to manage black huckleberry patches early in their lifetimes. Therefore, the present challenge is to document unrecorded traditional knowledge of landscape burning and to analyse it in the context of existing information on this topic, as well as to review relevant historical and ethnographic sources to develop a clearer understanding of the strategies and techniques employed. The development of a more comprehensive picture of traditional huckleberry management will facilitate transmission of this knowledge to younger generations of Gitxsan and Wet'suwet'en people. In addition, it will help to develop the

necessary knowledge base to actively use this experience in developing projects such as the reinstatement of landscape burning practices as a territorial stewardship tool.

1.4.2 Field Survey and Analysis of Ecological and Fire History Information

Traditional berry patches hold many of the clues that may help to improve our understanding of traditional management of berry resources by First Nations. To date there has been very little focus on ecological sampling, or research on the ground in these berry patch sites. As time passes, processes of decay and new growth further obscure signs of the burning regime that played a key role in shaping the plant communities that presently exist in these areas. It is important that the ecology and fire history of these sites be recorded soon while the effects of traditional environmental management activities are still in evidence.

1.4.3 Contemporary Berry Management Approaches

As contemporary resource managers move towards more effective use of integrated resource management models, they will increasingly find themselves managing for a number of economically important non-timber forest products as well as for timber production. Due to the long-standing focus on timber as the forest product of primary importance, there are few well-tested management strategies or techniques available to promote sustainable, abundant populations of non-timber species such as berries (deGues, 1995). First Nations groups such as the Gitxsan and Wet'suwet'en have experience managing some of these economically important, non-timber species over long time periods, and have developed well-tested resource management approaches which achieved many of the objectives currently being pursued by contemporary resource managers. Traditional stewardship strategies and techniques, such as landscape burning of huckleberry patches, should be closely examined and analysed when attempting to develop resource management models to integrate non-timber species into contemporary resource management planning. This research is intended to help bridge the gap

between First Nations approaches to resource stewardship and contemporary integrated resource management by presenting information about traditional huckleberry management, which includes an ecological perspective and empirical field data.

1.5 Research Objectives

The primary goal of this research is to investigate and document the ecological and fire history aspects of traditional huckleberry management by Gitxsan and Wet'suwet'en people. The following objectives are focused on achieving this primary goal:

1. Outline the cultural context of Gitxsan and Wet'suwet'en berry management, particularly as it applies to resource stewardship strategies and techniques.
2. Analyze aspects of the climate, ecology and natural fire regimes of the region that are relevant to this study, and describe the influence of these factors on vegetation growth patterns, species composition and stand dynamics.
3. Analyze ecological, cultural and fire history data from several berry patch sites to identify and describe ecological patterns, successional pathways, traditional use characteristics and fire regimes on these sites.

1.6 Research Questions

The following research questions are addressed by this research thesis:

1. Is there a set of ecological and or topographical characteristics that is commonly associated with traditional huckleberry sites?
2. Based on the ecological and fire history evidence collected, are there commonalties in fire regime characteristics among the huckleberry sites studied?
3. Have individual traditional huckleberry patches followed similar successional pathways after the cessation of anthropogenic burning?
4. Based on the analysis of field data from the case studies, what can be inferred about stewardship strategies and techniques used by the Gitxsan and Wet'suwet'en to manage the huckleberry resource?

1.7 Research Methodology

During the past fifty years, the study of landscape burning by First Nations has been undertaken using a wide variety of methods drawn from several disciplines. The method chosen in any particular research project appears to depend to some extent on the availability of knowledgeable First Nations advisors. In some cases, the lack of advisors requires the use of increasingly multidisciplinary approaches to marshal several lines of evidence with which to reconstruct the nature and extent of landscape burning activities.

Where knowledgeable elders are still living, oral history research is quite obviously the most productive and respectful option. However, even in cases where knowledgeable elders are able to provide detailed information, there are often outstanding questions. It is commonly the specific techniques of landscape burning that have been lost over decades of suppression of traditional management activities, as well as through continuing processes of cultural change. To address these knowledge gaps, secondary lines of evidence can be drawn from the ethnographic and historical literature. Many researchers have made effective use of these tools to elucidate a clearer picture of traditional management activities by First Nations peoples. Several authors have provided excellent summary papers of traditional burning activities by First Nations in BC (Turner, 1991; Gottesfeld, 1994a) utilizing such secondary sources to complement oral history accounts.

The use of ecological data as a contextual framework on which to "project" temporally and spatially scattered ethnographic and historic references was pioneered by Henry Lewis (1973) in his seminal paper, "Patterns of Indian Burning in California: Ecology and Ethnohistory". This "ethnoecological" approach uses ecology as the linkage to tie seemingly disparate sources of information together into a clear picture of environmental management of specific habitats. This approach has been modified and followed to some extent by other authors (Boyd, 1986; Norton, 1979).

Paleoecological analyses are also a useful tool for determining the characteristics of anthropogenic burning in precontact periods. A recent study combines this tool with oral history investigations and standard ecological and fire history methods, for the express purpose of describing environmental management (Lepofsky et al., in press). Judging from initial results, this multidisciplinary approach appears to be an effective way of both describing, and identifying the time depth of anthropogenic burning activities. Other studies such as the archaeobotanical and archaeological investigations of berry processing features in the Washington Cascades (Mack and McClure, in review) also combine oral history and historical records to discern the time depth and resource use patterns in these extensive subalpine berry grounds. Novel, multidisciplinary approaches such as these are needed to successfully reconstruct traditional subsistence economies and gain a more comprehensive understanding of the nature and extent of environmental management by First Nations.

This research is being conducted in collaboration with Gitxsan and Wet'suwet'en. Both groups are fortunate to have elders with first and second hand knowledge of landscape burning practices. A large amount of this information has been recorded during testimony in the *Delgamuukw/Gisday Wa* court case[3] and through research initiatives (Gottesfeld, 1994a). There are, however, several questions that remain outstanding regarding management of specific species using landscape burning. This study focuses solely on one species, black huckleberry, in order to narrow the focus and understand the myriad of interactions that are involved in a system of environmental management.

The methodological framework employed in this research initiative was developed after a review of several papers by researchers who have endeavoured to understand and document the use of fire as a tool by First Nations groups throughout the Pacific Northwest (Lewis, 1993;

Norton, 1979; Boyd, 1986; Turner, 1991; Gottesfeld, 1994a). Based on a review of these papers the following research framework was developed:

1. Detailed descriptions of the ecological characteristics of the landscape, often involving classification of component plant communities or successional stages.
2. Demonstrations of the ecological importance of an anthropogenic fire regime for persistence of an ecosystem or successional stage.
3. The use of ethno-historical sources to present the anecdotal evidence for aboriginal landscape burning.
4. Documentation of the dietary characteristics and subsistence round of the First Nations group and identification and description of linkages between these economically important plant communities and particular patterns of fire disturbance.

For this research initiative the guidance of contemporary elders provides the initial framework, and the research is focused on specific managed huckleberry patches that they have identified. Permission to conduct field research in these areas was sought from the appropriate owners (Hereditary Chiefs) of the traditional House (Yikh[4] or Wilp[5]) territory in which the patch is located. In some cases House members made trips to the field to assist with the research.

Interviews were arranged with advisors who were recommended as being knowledgeable about certain berry patches through first hand experience, or through information passed down to them from older relatives or community members. Interviews were essentially unstructured within a framework laid out in an introductory discussion about the nature and extent of the research as well as with a set of key questions. Advisors were encouraged to talk in a general sense about their experiences harvesting, managing and processing berries on the territories.

[3] *Delgamuukw* et al. vs. the Queen – for a thorough discussion of this case see Cassidy, Frank (editor).1992. Aboriginal Title in British Columbia: *Delgamuukw* vs the Queen. Oolichan Books, Lantzville, BC, and The Institute for Research on Public Policy, Montreal, PQ.

[4] Wet'suwet'en territories are traditionally known as "Yikh" referred to here as House - meaning the actual territory or the corporate group which "owns" this territory.

Field reconnaissance of these sites seeks to build on the knowledge of the elders, drawing out details about the ecology, fire history and successional status of these sites using standard ecological and fire history sampling methods. Field reconnaissance and sampling were carried out in a number of traditional huckleberry patches to gather ecological and fire history evidence, which remains on the landscape, the trees and in the soil decades after these landscape burning practices have ceased. This ecological and fire history information was then analysed in the context of relevant historical, ethnological and ethnobotanical literature to further reconstruct the strategies and techniques employed in the traditional management of huckleberry patches.

As the research objectives were focused on reconstructing an anthropogenic disturbance regime, it was important to locate and document cultural features as well as to conduct ecological and fire history sampling. Ground reconnaissance was conducted in areas that were predicted to have evidence of cultural use, exhibit fire history evidence, or in areas that represented an extensive, distinct ecological stratum. There were seven field sites surveyed in the course of the field data collection. Five of these sites are discussed as case studies in this thesis.

1.7.1 Identification and Delineation of the Traditional Huckleberry Patch

One of the first steps in the process of examining anthropogenic burning, as in any other fire history study, is to define the sampling frame. In standard fire history studies this is often an approximation of the total area, which could be burned in the largest fire event. This area is often difficult to define, as past patterns are at least partially obscured by subsequent fire disturbance. However, the areas managed by aboriginal landscape burning often had specific characteristics related to their suitability for specific plants species or communities attributable to underlying physiographic or topographic variables, allowing the areas managed to be identified

[5] Gitxsan traditional territories are owned by the "Wilp" referred to here as House - meaning the actual territory or the corporate group which "owns" this territory.

and defined. While the area of suitable habitat may not necessarily correspond to the area burned in any particular treatment, it will be the focus of repeated management efforts over time. The ability to identify the boundaries of managed areas provides researchers investigating anthropogenic burning with an opportunity to tailor their related research initiatives to a specific, relatively well defined sampling frame. In addition, analysis of stand structure, historical photographs and maps of other physiographic landscape features can provide incremental improvements in identifying areas which were managed through the application of landscape burning.

For the purposes of this initiative traditional huckleberry patches are defined as areas identified by two or more Gitxsan or Wet'suwet'en elders, and in one case (lower Harold Price Creek) an area identified through the location of berry processing camps. Using oral history as a framework, patch boundaries were defined more precisely using ecological, physiographic and fire history attributes.

1.7.2 Ecological Sampling

Areas identified as traditional huckleberry patches were selected for field sampling. Aerial photos of these areas were stratified[6] by timber type, slope, aspect and vegetation patterns to identify and delineate homogenous polygons.

Ecological sampling was conducted in many of the more extensive, broadly representative polygons on each of the huckleberry sites sampled. Plot locations were selected on the aerial photos, transferred to the map and then located on the ground. Vegetation, stand structure, soil and topographic information were collected from 20mx20 metre plots and recorded on standard Ground Inventory Forms according to the methodology outlined in the Field Manual for Describing Terrestrial Ecosystems (Anonymous, 1998). Fire history data and specific ecological

information regarding the vigour, stem density, competitive status and fruit yield of black huckleberry and other ericaceous species were also recorded on these forms. Additional ecological data including site series, aspect, vegetation assemblages and successional stage were recorded for the majority of fire history and cultural heritage sampling sites.

1.7.3 Fire History Sampling

One of the most significant challenges faced by researchers investigating the characteristics of aboriginal burning regimes is the low and moderate severity burns that often characterized these activities. It is difficult to identify and characterize a fire regime, which operated at finer scales both temporally and spatially than many fire regimes which originate only from non-anthropogenic ignition sources such as more coarsely grained stand initiating events. When two or more fire regimes coincide on the same landscape, the result is a mixed fire frequency distribution, which can occur, in the temporal and/or spatial dimension.

As Lertzman et al. (1998) suggest, mixed distribution fire regimes are not nearly as well understood as high intensity (crown fire) or low intensity (surface fire) dominated systems and development of a statistically rigorous sampling protocol for such a fire regime is difficult because the statistical methods and sampling strategies for each fire regime differ from one another. Mixed severity regimes are complex combinations of severities and investigation of these regimes must therefore utilize a combination of methodologies (often fire scar analysis and cohort age identification).

The exploration of the fire history of these traditional berry patches was undertaken using a methodological approach similar to that employed by Tande (1979) in his analysis of fire history in Jasper National Park. However, in contrast to the work conducted by Tande (1979), this study focused on an anthropogenic fire regime that affected a smaller area, and was located in forest

[6] Divided into homogenous polygons based on slope, aspect, vegetation type.

types with more fire sensitive species, and therefore fewer opportunities to obtain fire scar samples from living "veteran"[7] trees. The approach used in this study included analysis of the age structure of forest stands and dendrochronological analysis of fire-scarred living trees. Additional information was gathered from observations of snag and coarse woody debris characteristics, as well as the presence of charcoal in soil and humus layers.

Age structure analysis focused on the collection of age samples from as many distinct ecological strata as possible throughout the study areas. Plot locations were selected for ecological data collection and fire history sampling, with one or two age samples collected from large lodgepole pine in the vicinity of each plot centre. Additional age samples were taken, and fire scar samples were collected opportunistically throughout the course of the fieldwork. In several instances intensive reconnaissance was conducted at the boundaries of ecological strata and timber types to determine the nature of the difference between strata, particularly as these differences related to variability in ecological site characteristics and fire history. As in other fire history studies (Brown and Kaye, 1999; Gray and Riccius, 1999) this opportunistic approach was used in order to obtain fire scar samples for suitable for analysis and because fire scarred trees were generally scarce within the berry patch areas surveyed.

The benefits of opportunistic sampling of fire scarred trees include the ability to capture sample specimens that document fire history over a very long period or preserve high quality evidence of past fires and the opportunity to collect other data such as cultural heritage evidence that may be found in and around areas managed by aboriginal people using landscape burning. The major drawback is that the data is not gathered in a systematic or random manner and this reduces the opportunities to use this data for statistical analysis and to make inferences and generalizations from the results of data analysis.

[7] Trees that are significantly older than the trees in the main canopy. The species may have survived one or more fires as evidenced by fire scars. The veterans are usually isolated in distribution and often extend well above

Age samples were obtained using an increment borer. Samples were drilled at breast height (1.3 m) on the bole of the tree providing a conservative estimate of tree age. Breast height was measured vertically from ground level on the uphill side of the tree. Sampling at this height enters a potential source of error when estimating stand age, as the time between germination and growth to 1.3 metres will vary between species and sites. In addition, early suppression of seedlings can greatly extend the time required to reach breast height. However, it is expected that seedlings regenerating after fire will grow at a relatively rapid, even pace (Camp et al., 1997). Ages have therefore been corrected using average yearly height estimates derived from site index values (Anonymous, 1997a). Core samples were mounted and sanded for counting. The age estimates for core samples that did not hit the pith were geometrically corrected using a circular template to estimate the number of uncounted rings based on the average width and curvature of the innermost rings in the sample.

The objective of age structure sampling was to gather sufficient data to determine the cohort age (an average of the sample ages) of each timber type. The cohort age is used as a surrogate estimate of 'time since fire' for each stratum, and analysed collectively to get a broad picture of stand structure and dynamics for the site as a whole. In addition to sampling tree ages of younger vegetation types within berry patch areas, efforts were made to obtain sample ages from older stands in the vicinity of berry patch sites (often at the margins). Lodgepole pine was favored for age sampling due to its status as a suitable marker of fire events (Agee, 1993), based on its tendency to germinate quickly following fire events, and the ease of coring and counting its rings relative to those of other species.

Evidence of previous stand characteristics were inferred from snag size distribution and density. Indications of general characteristics of local fire intensity and flame height apparent on

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the main tree canopy. (Anonymous, 1990b)

remnant woody debris and snags were also documented. In some cases multiple scars on old snags gave an indication of past fire return intervals. Additional fire history information was collected by examining and recording charcoal layers in humus or soil samples and noting the occurrence and density of fire dependent or fire sensitive species in vegetation complexes.

Fire scar data and tree age cohorts were analysed together to estimate the occurrence of fire events within each of the five berry ground areas. This method is often used to identify the date of a stand replacing fire event but also has applicability to the study of low and moderate intensity fire regimes where relatively intensely burned pockets will experience stand initiation and the development of an identifiable cohort. In addition most forest types occasionally experience stand-replacing events after a long fire free period or during extreme fire weather. In the cases of forest remnants or older stands unburned only partially burned by previous fire events, cohort ages can be used effectively in concert with fire scar data to identify fire occurrence and the relative intensity and extent of these events (e.g. Tande 1979; Dansereau and Bergeron, 1993; Wills and Stuart, 1994).

In this study, corrected tree ages were broken into five-year age classes and plotted in frequency histograms for each case study site. All ages have been plotted on field maps, and in general, fire history sample sites are relatively evenly distributed across the reconnaissance area[8] of each site. However, sampling was not strictly systematic and significant areas of each site have not been sampled. In the interests of having as many tree ages as possible for analysis, all trees sampled were included in this analysis. These analyses therefore, are intended only to provide a general, largely descriptive account of fire history within these five berry patch areas. Additional age samples, and particularly fire scar samples, will be required to develop a more robust model of the fire regimes for these sites. Additional data, including

[8] Most sites were very extensive and field surveys generally covered a particular portion of the site.

vegetation growth patterns and topography, have also been used to provide additional context to the fire history analysis.

Analysis of fire history data from study sites will be examined as a composite of so called "natural" fire and traditional burning by First Nations. It is well known that Euro-Canadians have also had a marked impact on fire regimes in British Columbia (Parminter, 1995) during the historic period. In the context of this study, this Euro-Canadian influence is essentially "noise" which obscures the signs of First Nations management using landscape burning. This issue will be dealt with on a site-specific basis within each of the case studies, as the influence of other anthropogenic burning activity varies by site.

1.7.4 Cultural Heritage Surveying

Cultural heritage features such as bark-stripped cedar, pine or hemlock food trees, berry racks, berry buckets/boxes, cache pits, trails, blazes and campsites were all photographed and recorded as they were encountered in the field. Measurements and ages were recorded where possible. Efforts were made to survey older (age class[9] 8 and 9) stands at the perimeter of berry patch sites as there was often abundant evidence of past traditional use in these older forest types.

1.7.5 Interviews with First Nations Advisors

Detailed interviews were conducted with four Gitxsan and Wet'suwet'en advisors. Interviews were either recorded with a handheld cassette recorder or through handwritten notes depending on the interview location and the wishes of the advisor. A number of informal interviews and conversations with Gitxsan and Wet'suwet'en elders provided additional information and clarification of key points.

In addition to the interviews carried out as part of this project, a great deal of information about berry management, harvesting and processing has been collected by the researcher from Wet'suwet'en elders during a series of 25 landscape unit planning[10] field trips during the period 1998-2001. Numerous conversations with field ecologists and other researchers have also added baseline information and context to this research.

1.7.6 Historical and Ethnographic Research

Much additional information was collected from a number of primary and secondary sources and reviewed to provide context and improve the analysis and interpretation of field and interview information. *Delgamuukw* trial testimony, affidavits and exhibits, expert witness reports, historical photos, accounts of early travelers, and previous ethnographic studies have been used extensively in the development of this thesis.

1.7.7 Data Collection and Mapping

Point data representing ecological plot centres, timber type or ecological boundaries and cultural heritage features were collected with a handheld GPS unit (Garmin 12XL). GPS data was downloaded into ArcView 3.2 GIS for spatial analysis and mapping.

1.8 Thesis Summary

The body of this thesis will pull together cultural, historical and ecological context that will be used to analyse the field research data effectively. Analyses will focus on linkages between

[9] Age Classes: 1 (1-20yrs), 2 (21-40yrs), 3 (41-60yrs), 4 (61-80yrs), 5 (81-100yrs), 6 (101-120yrs), 7 (121-140yrs), 8 (141-250yrs), 9 (251+ yrs)

[10] Landscape unit planning is a British Columbia government process to create resource development planning guidelines at the landscape (often watershed) level within each provincial forest district based on stakeholder input and biodiversity objectives.

culture and environment to illuminate the resource stewardship strategies and techniques used in the management of black huckleberry gathering areas by the Gitxsan and Wet'suwet'en.

Chapter 2 will examine the ecological, historical and fire history aspects of the regional landscape to provide a well-defined backdrop upon which to analyze the research data. Chapter 3 will review Gitxsan and Wet'suwet'en cultural approaches to environmental stewardship with particular focus on strategies and techniques employed in the production of berry resources. Chapter 4 will focus on traditional huckleberry management linking the ecological niche filled by black huckleberry to the subsistence round of a number of First Nations and discussing the role of management in ensuring predictable, reliable harvests. The fifth chapter will cover the five case studies, summarizing and analysing the data from each site for ecological, cultural and fire history patterns. Chapter 6 is an analysis and discussion of the research results that will provide additional insights into the strategies and techniques traditionally used by Gitxsan and Wet'suwet'en to manage black huckleberry patches.

CHAPTER 2: THE REGIONAL ECOLOGICAL CONTEXT AND BLACK HUCKLEBERRY

2.1 Introduction

This chapter is intended to provide a contextual backdrop for the analysis of the role that anthropogenic disturbance has played in shaping and maintaining fire adapted vegetation assemblages within the study area. There is of course a particular focus on the importance and dynamics of the management of a single species, black huckleberry. This chapter will include a section focusing on the regional ecological character, based on a description of regional climate patterns as they have developed over time, as well as an overview of current vegetation assemblages and the role of fire disturbance in shaping some of these vegetation communities. A second section examines the historical landscape of the region with a focus on descriptions of landscapes from the historic period, as well as descriptions of past landscapes and observed changes in vegetation patterns drawn from Gitxsan and Wet'suwet'en accounts. A third section will provide an overview of regional fire regimes focusing on the roles of natural and anthropogenic fire, prior to active fire suppression efforts. Two final sections will detail the autecology of black huckleberry and the adaptations to fire disturbance that this species exhibits.

2.2 Ecological Context

This section will focus on describing physiographic and ecological characteristics of the study area, identifying the linkages between vegetation types and disturbance history, primarily fire disturbance. Following this is an examination of the climatic history of the region beginning at the end of the last ice age and focusing particular attention on the relationship of these climate patterns to regional vegetation patterns.

2.2.1 Regional Setting

The study area encompasses a large expanse in the lower Bulkley and upper Skeena drainages, and is centred on the southeastern portion of the "Hazelton variant" of the Interior Cedar - Hemlock biogeoclimatic zone (ICHmc2). This ecological type follows the valley bottoms of the central Skeena, lower Bulkley, Suskwa and Kispiox drainages. In general, the climate of the ICH zone is transitional between the coastal and interior plateau regions and is characterized by warm, moist summers, cool, wet falls, and cold winters with average annual precipitation between 500-1200mm (Banner et al 1993). The ICHmc2 variant is the warmest and driest of the ICHmc units, a function of its location in the rainshadow of surrounding mountain ranges, resulting in the common occurrence of summer moisture deficits (Banner et al., 1993; Haeussler et al., 1985). As Haeussler (1987) points out, this biogeoclimatic unit includes the centres of settlement and economic activity in the region. In addition, the largest Gitxsan and Wet'suwet'en villages are located in the ICHmc2.

While some of the huckleberry patches surveyed as part of this research fall within the ICHmc2 (Table 2.1), most are in adjacent biogeoclimatic units at slightly higher elevations (ICHmc1, ESSFwv) or more continental units (SBSdk, SBSmc2). As several authors have noted, fire was an important determinant of vegetation patterns in the ICHmc2 (Banner et al., 1993; Haeussler et al., 1985; Williams et al. 2000a), and we can infer that adjacent biogeoclimatic units were also influenced by this frequent fire regime to some extent.

BGC Unit	Full Name	Elevation Range	Climate	Precip	Vegetation
ICHmc2	Interior Cedar-Hemlock moist, cold subzone – Hazelton variant	100-750m	transitional - long growing season, summer drought	535-1136mm	HW, Cw, Bl, Sx, Pl, At, Ep, Act
ICHmc1	Interior Cedar-Hemlock moist, cold subzone - Nass variant	350-1100m (in study area)	transitional - wet snow, cool, moist	535-1136mm	Hw, Bl, Sx, Pl, Ep
SBSmc2	Sub-boreal Spruce moist, cold subzone - Babine variant	850-1350m (south*)	continental	416-724mm	Sxw, Pl, Bl, Sb, At, Act, Ep
SBSdk	Sub-boreal spruce dry, cool subzone	500-750m (north*)	continental	416-724mm	Sxw, Pl, Bl, Sb, At, Act, Ep
ESSFwv	Engelmann Spruce Subalpine Fir wet, very cold subzone	900-1550m	sub-continental	650-1000mm	Bl, Hm, Sxw, Hw

* SBS subzone elevations vary with latitude and aspect, the actual split is around 800m for study sites (adapted from Banner et al., 1993).

Table 2.1 Summary of biogeoclimatic unit characteristics for the study area.

2.2.2 Regional Climates Past and Present

Periods with cooler, wetter climates tend to reduce the frequency of fire disturbance, and therefore are characterized by a reduction in the occurrence of early seral habitats across the landscape. As these early seral habitats produce many of the plant and animal resources that formed an important part of the subsistence needs of the Gitxsan and Wet'suwet'en, these cool wet periods can be seen as times of relative scarcity. In these times, there would have been a strong incentive for native peoples to actively promote the creation and persistence of early seral vegetation types. It is therefore important to look at an extended ecological timeframe to better understand the circumstances under which anthropogenic burning may have been necessary, and to establish an additional reference point from which to evaluate other evidence of traditional burning by Gitxsan and Wet'suwet'en.

The study of the environmental history and debris flow activity from Seeley Lake near Hazelton (Gottesfeld et al., 1991) provides an indication of the post-glacial climate of the study area. This study examined pollen and macrofossil remains in lake-bottom sediment cores. The results of this research suggest that the early Holocene xerothermic or hypsithermal period occurred between approximately 9000 and 8000 years BP in the study area. This period was

characterized by a relatively warm, dry climate with associated early seral vegetation assemblages that reflected frequent disturbance by fire. A similar pattern has been found in other areas of BC (Hebda and Mathewes, 1984; Mathewes and King, 1990),

Paleoecological research from Vancouver Island indicates a warm, wet mesothermic interval persisted from 7000-4000 BP and was followed by neo-glacial cooling from 4000 years to present (Hebda, 1999). A cooling trend occurring after 6000 BP is evidenced at Seeley Lake by declining lodgepole pine pollen and increasing western hemlock (*Tsuga heterophylla* [Raf.] Sarg.) pollen, a trend that continues until approximately 2200 BP (Gottesfeld et al., 1991). This research also indicated that during this latter period (2200BP-present) there was a marked rise in the presence of lodgepole pine pollen, accompanied by a rise in western red cedar (*Thuja plicata* Donn ex D. Don in Lamb.) pollen indicative of continuing wet, cool conditions. The authors referred to this occurrence as "enigmatic" and postulate that the increase in cedar may reflect the prevailing climatic influence, while the increase in pine pollen may be related to the influence of anthropogenic burning by native peoples. Similarly, the persistence of abundant charcoal in the cooler, wetter mid-late Holocene at sites on southeastern Vancouver Island suggests that anthropogenic fire may have been a significant environmental influence there as well (Hebda, 1999).

2.3 Historical Landscapes

2.3.1 Early Accounts

Early Euro-Canadian visitors to the Skeena and Bulkley valleys provided telling descriptions of the regional landscape, the role of fire and the relationship between First Nations and the land. In 1891, A.L. Poudrier conducted a "crown land survey" on behalf of the provincial Department of Lands and Works. In his report, Poudrier (1891) describes the landscape as

seen from the Skeena River between Gitsegukla Village and the confluence with the "Watsonkwa" or Bulkley River at Hazelton:

> The fire has formerly destroyed the high timber and these terraces are now covered with a short growth, where aspen poplar predominates (*P. tremuloides*); it is one of the favourite spots where the Indians prepare their crop of small fruits for the winter use.

Returning two years later to survey land in the Bulkley Valley, Poudrier (1893) comments on the landscape approaching Moricetown and then on the relationship of the Wet'suwet'en to the land surrounding Moricetown or Kyah Wiget, their primary summer fishing village:

> The climate here seems to become somewhat drier, judging from the vegetation, and it was noticed that the fire had done much greater damage here than heretofore. The benches are generally bare of trees, and shrubs even are scarce, the most marked being the service berry. In approaching Moricetown, several fine open meadows were met with, but these were cut up by numerous small streams, with a fringe like border of willow and alder.
>
> Berries, like the service berry, high bush cranberries, wild cherries, of three species, wild currants, gooseberries, strawberries, raspberries, are all most prolific and plentiful. In no part of British Columbia have I found such a variety and quantity of these. To the Indians they are a staple...
>
> The abundance of berries of different kinds, and the proximity of the mountains, where cariboo, mountain goats and bears are plentiful, render this spot one of the most desirable homes for the Indians, and as a rule they live in abundance.

Poudrier's accounts of his 1891 and 1893 surveys of the Skeena and Bulkley drainages contain many additional references to a recently burnt landscape and extensive areas of early seral habitats including moist, rich meadows, prairie grasslands, young aspen thickets and stands of lodgepole pine.

2.3.2 Traditional Knowledge – Landscape Changes

Gitxsan and Wet'suwet'en elders have often remarked that many important habitat types have changed during the past decades so that they are no longer good places for gathering the resources that were once abundant in these areas. Huckleberry and blueberry patches are

Figure 2.1. Overgrown blueberry patch

examples that have often been raised, and many references to successional changes in these areas can be found in *Delgamuukw* testimony, oral history documentation and ethnographic research reports. Perry Sampson, a Gitxsan elder, made the following remarks about a managed blueberry flat on a glacio-fluvial terrace near the Skeena River that he had not visited for many years, until he returned with me in the fall of 2000:

> Last time I was here was in 1952. There was nothing here, no trees, just rosebushes, no pine or spruce – you could see a very long distance. The berries (*Vaccinium caespitosum*) were thick, very large. The ground was grey blue, you could see a trail where you picked.
>
> There was no moss before, just covered with blueberry and a little bit of grass – (there are still lots of bushes but they're not bearing very much fruit). There used to be the odd tree here and there (aspen trees), they were small, 12 inches in diameter and young aspen were really thick in here (at the base of the hill – edge of glaciofluvial terrace). Right down in a bit of a gully it used to be thick with blueberries. Fire went up the bottom part of the hillside (now heavily treed).

Accounts such as this indicate the profound influence that cessation of burning has had in a relatively short period of time. Another Gitxsan advisor, Walter Wilson remembers seeing this blueberry patch burned when he was a boy, thirty years ago (personal communication, 2001).

2.4 Regional Fire Regimes

The frequency, severity, size and duration of fires in an area are the variables that influence the fire regime. Agee (1998) has described fire regimes in terms of fire severity as determined by the effect of fires on dominant organisms within a vegetation community. This approach characterizes high severity fire regimes as those that involve stand replacement and low severity fire regimes as those that have little or no effect on the dominant organisms. Moderate severity regimes are a "complex mix of severity levels (Agee, 1998).

To a large extent the fire regime determines the ecological characteristics of an ecosystem by favoring species which are adapted to the disturbance pattern. The influence of burning on vegetation and soil characteristics is related to fire severity, which affects the survival of different species, the amount of humus consumed and the degree of soil heating (Hamilton, 1988). Fire effects are generally dependent on the following factors:

1. Weather conditions prior to burning (dry - wet),
2. Weather conditions at the time of burning (wind, rain, temperature).
3. Fuel loading (fine and coarse fuels).
4. Moisture content of fuels.
5. Moisture content and density of soil.

The relative importance of any of these factors is somewhat debatable and difficult to discern because of correlation between the variables. Essentially, these factors can be summarized to two primary factors: weather and fuel loading. In a study of upland conifer stands in the southern Canadian Rockies W.C. Bessie and E.A. Johnson (1995) found that weather was the primary determinant of surface fire intensity. The two main contributing factors identified were:

1. Weather prior to the fire as it affects fuel moisture.
2. Weather at the time of the fire, most importantly wind speed.

Fire frequency is also an important component of a fire regime, and is related to severity by fuel loading. Essentially, frequent fires consume available fuel, reducing fuel loads and the potential for high severity burns. Conversely, long intervals between fires allow fuels to accumulate, increasing the potential for severe fires.

Fire also has a major effect on the chemical and physical properties of soil. These effects depend to a large extent on the severity of the fire, which is a function of fire intensity and duration. In general the impacts of fire on soil are as follows:

1. Organic layer consumption.
2. Mineral soil exposure.
3. Alteration of soil temperature regime.
4. Alteration of the soil moisture regime.
5. Changes in the nutrient regime.

These fire effects have numerous implications for species composition by creating a variety of post-fire conditions favourable to different groups of species. For example, exposed mineral soil associated with very hot burns will favour off-site colonizers such as fireweed (*Epilobium angustifolium* L.) which reproduces effectively over long distances by way of wind-dispersed seed, while the abundance and vigour of plants which only reproduce clonally will likely be greatly reduced due to damage to underground rhizomes, corms or tubers caused by extreme heat.

The primary source for estimations of mean fire return intervals for biogeoclimatic units in British Columbia is the Forest Practices Code Biodiversity guidebook (Anonymous, 1995). These estimates were based to some extent on research into disturbance patterns for each biogeoclimatic zone (Parminter, 1992) which detailed the range of fire return intervals and patch sizes, as well as a characterization of fire type and intensity by forest type across the province of British Columbia.

Additional research in the Prince Rupert Forest Region (which includes all study sites) by Doug Steventon (1997) using forest cover age data has determined that the biodiversity

guidebook estimates of mean fire return interval for high elevation forests in the region, including the ESSFwv, likely underestimate actual values by a large margin.

Research in analogous forest types (ESSF wk2/wc3 and SBSvk) in northeastern BC have also indicated that the biodiversity guidebook mean return intervals for some stands (particularly higher elevation forests) may underestimate the true return interval values by a substantial margin (Hawkes et al., 1997). The findings of these other studies suggest that the return interval estimates for the subalpine forest types in the study area, primarily the ESSFwv, may also underestimate the actual return interval.

Available information for fire return intervals of biogeoclimatic units in this study area are summarised in Table 2.2. These fire return interval estimates are used in this research initiative as a benchmark estimate of the "natural" fire regime which can be loosely defined as fire activity and occurrence without the influence of anthropogenic ignitions.

Biogeoclimatic Unit	Biodiversity Guidebook (Anonymous, 1995)	Steventon (1997)	Biogeoclimatic Zone Estimates (Parminter, 1992)		
			minimum	average	maximum
ESSFwv	350	**1150***	150-200	200-300	350-500
ICHmc1	**200***		100-150	150-250	250-350
ICHmc2	200		**100-150***	150-250	250-350
SBSdk	125	**95***	75-100	125-175	175-250
SBSmc2	125	**148***	75-100	125-175	175-250

Table 2. 2. Summary of available information for fire return intervals for biogeoclimatic units in this study area. * Bold numbers are return interval values used as benchmark fire return intervals in this study.

2.4.1 ICH Fire Regimes

A review of fire history and ecology of the Prince Rupert Forest Region by Parminter (1983) found that the fire pattern in ICH forests is variable, creating a mosaic of burned, partially burned and unburned forests. The characterization of wildfire in the ICH (Parminter, 1992)

indicated that in cedar hemlock types, both low intensity surface fire and medium to high intensity surface/crown fires could be expected. In addition, this study found that the sizes of existing fire initiated patches in the ICH are extremely variable, ranging from a minimum of .1-5 to an average of 150-500 and a maximum of >25,000 hectares.

A 1994 review of the fire ecology of analogous interior cedar-hemlock forests in northern Idaho (Shiplett and Neuenschwander) described the role of fire in initiating five "idealized successional chronologies" which reflect the variable nature of fire events in these wet interior forest types. They cite the influence of seed source and species survival in creating variable successional pathways. Observations from this study also found the fire patterns in ICH forests to be variable, a reflection of variations in fire intensity which results in the initiation of multiple successional pathways. The influence of anthropogenic burning adds another layer of complexity to fire history and fire ecology interpretation in these forest types.

Bessie and Johnson (1995) have shown that weather is the primary determinant of fire intensity. Elevation affects fire behaviour as it is a determinant of temperature (Agee 1993) and precipitation. The ICHmc2 and ICHmc1 are known to be different from one another with respect to climate, the higher elevation ICHmc1 being cooler and moister with a shorter growing season than the ICHmc2 (Banner et al., 1993). Therefore, the rating of both of these units with an equivalent estimated mean fire return interval of 200 years (Anonymous, 1995) seems inappropriate. For the purposes of this study the 200 year fire return interval for the ICHmc1 is accepted (Anonymous, 1995) but for the ICHmc2 the shorter estimate of minimum fire return interval for the ICH zone as a whole of 100-150 years (Parminter, 1992) is used as a benchmark.

2.4.2 SBS Fire Regimes

Parminter (1992) describes SBS fire regime characteristics as medium to high intensity surface and crown fires with an average patch size of 50-500 hectares. Delong and Tanner (1996) indicate that the SBSmk1 fire regime is heterogeneous, and that the majority of pre-suppression fires were larger than 500 hectares. Research in the wet (1250 mm/year average precip.) SBSvk subzone in northeastern BC indicates that the return interval for stand replacing fire events in this ecological type likely ranges from 1200 to 6250 years (Hawkes et al., 1997). This type of fire return interval is in sharp contrast to the intervals calculated for the SBS subzones in the study region (Steventon, 1997) indicating that there may be a very large degree of heterogeneity among fire regimes within the SBS zone. Research by Delong (1998) further emphasizes the variability in fire cycle amongst several "plateau" and montane SBS variants[11].

Due to wide variation in reported fire cycles it is difficult to clarify the fire regime characteristics of SBS forest types in the study region through an examination of fire regimes in other SBS ecosystems. However, the estimates provided by Steventon (1997) are considered to be the most appropriate estimate of the natural fire regime for use in this study due to his focus on the study region (the western extremity of the SBS biogeoclimatic zone).

2.4.3 ESSF Fire Regimes

Parminter (1992) identifies the fire regime in the ESSF biogeoclimatic zone as one characterized by low to medium intensity surface fires as well as medium to high intensity surface and crown fires and an average patch size between 50 and 500 hectares. The biodiversity guidebook (Anonymous, 1995) estimates a mean fire return interval of 350 years. Research in the ESSF wk2/wc3 indicates that fire return intervals for these types range from

[11] The SBS variants studied by Delong (1998) do not include the SBSmc2 or SBSdk variants surveyed in this study.

532-1429 years (Hawkes et al., 1997). As noted previously, analysis of local ESSFwv forests by Steventon (1997) has indicated a mean return interval of 1150 years.

There seems to be agreement between recent fire history research in the ESSF that mean return intervals of stand replacing fires are far longer than biodiversity guidebook estimates. Therefore, the work of Steventon is assumed to be a more accurate estimate of fire cycle and will be used as a benchmark of the natural fire regime in these forest types for the purposes of this study.

2.5 Ecological Characteristics of Black Huckleberry

2.5.1 Species Description

Black huckleberry (*Vaccinium membranaceum* Dougl. ex Hook) is an ericaceous, deciduous shrub with pink, urn-shaped flowers, and round black to dark blue fruits. Black huckleberry has a distribution, which is concentrated in the northwestern US and western Canada, primarily west of the continental divide, with a few outlying populations in eastern Canada. Reproduction of black huckleberry is primarily clonal through lateral rhizome spread and resprouting following disturbance. These rhizomes form extensive networks and generally support several clones (Minore, 1975), with new plants being formed when rhizomes become separated through decay or disturbance (Haeussler et al., 1990). *Vaccinium* rhizomes often develop in response to vigorous aerial growth (Kenner, 1967 in Miller, 1977).

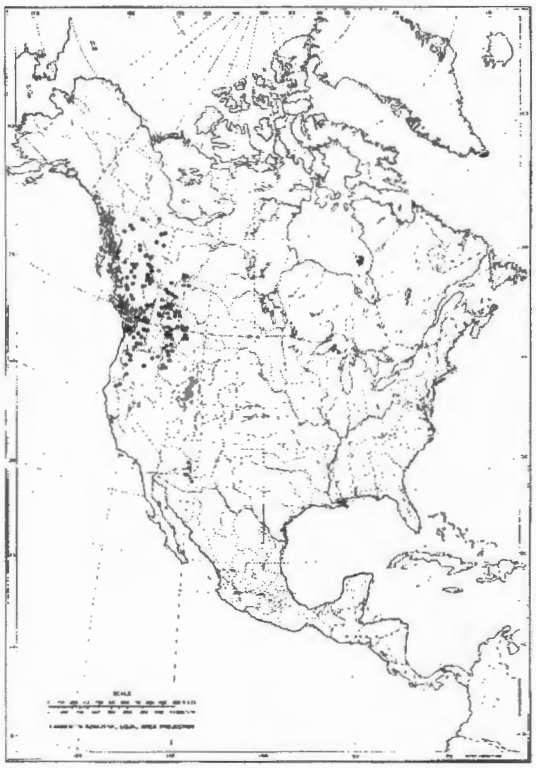

Figure 2. 2. Distribution of V. membranaceum (taken from Vander Kloet, 1988).

2.5.2 Climate

A review of the autecology of a number of British Columbia plant species (Haeussler et al., 1990) found that in general, the distribution of black huckleberry coincides with areas experiencing at least moderate snowfalls and without pronounced summer drought. Black huckleberry occurrence increases with increasing elevation and continentality (Klinka et al., 1989). This is likely due to the noted ability of black huckleberry to tolerate a short growing season (Haeussler et al., 1990) and cold temperatures (Beaudry et al., 1999).

2.5.3 Environmental (Site) Relations

Black huckleberry favours mesic sites and is typically found on well-drained substrates with acidic soil types and mor humus forms (Haeussler et al., 1990). Black huckleberry is capable of surviving in a wide range of environmental conditions by virtue of its dependence on rhizomes for reproduction and nutrient storage. This species tends to have quite wide ecological

amplitude in many biogeoclimatic subzones; notably, black huckleberry occurs on a wide range of site types in the ESSFwv (Beaudry et al., 1999) a biogeoclimatic subzone which encompasses a significant portion of the subalpine study sites. Recent research in northwestern BC (Burton et al., 2000) has led to the development of a predictive berry habitat model. This model predicted that high quality black huckleberry habitat should have the following attributes:

1. Within the ICHmc1 biogeoclimatic variant.
2. On south aspects.
3. On slopes between 16.1%-28.0%.
4. Located in an elevation band from 931.5-1047.1 metres.
5. Soil saturation index between 0.317 and 2.00.
6. Site index value between 11.2 and 15.0 metres at 50 years.
7. Subalpine fir (Abies lasiocarpa (Hook.) Nutt.) dominated stands.

2.5.4 Light Relations

Black huckleberry is able to persist as an understorey shrub in most forest stands, but is most vigorous and productive (for berries) in open, early seral habitats. Research into light relations of berry producing shrubs (Burton, 1998) indicated that black huckleberry exhibits depressed berry yield below 60% irradiance, and maximum productivity at 90% irradiance. Following is a summary of Burton's research findings:

1. Black huckleberry is most productive at global irradiance values of 75% to 90%.
2. Productivity drops off sharply below 60% irradiance.
3. There is a proliferation of black huckleberry stems at the highest light intensities but these are largely small and unproductive.
4. Berry size is insensitive to variation in light.
5. Black huckleberry productivity appears to be more sensitive to moisture status than to light levels.

Burton (1998) also indicated the need for moderate shading for highest levels of productivity. This requirement for shade for *Vaccinium* health and productivity has also been

documented for *Vaccinium vitis-idaea* L. and *Vaccinium myrtilloides* Michx. in Alberta (Smith, 1962).

2.5.5 Nutrient Relations

In northern ESSF subzones black huckleberry occurs across the full range of nutrient regimes, while in the SBS its occurrence varies, being found in all but the very rich nutrient regime in the SBSmc. It is limited to the poor and medium nutrient regimes in the SBSdk (Beaudry et al., 1999). In coastal biogeoclimatic types, black huckleberry is described as growing on nitrogen poor soils (Klinka et al., 1989).

Fertilization trials with black huckleberry conducted by Nelson (1974) indicate that additional nitrogen, applied as ammonium nitrate increases shoot and root growth, and that without nitrogen addition, increases of phosphorous and potassium will not increase growth. Nelson also found that black huckleberry had a wide tolerance for variable soil pH, but observed optimal growth at a pH of 5.0. Field observations by Minore and Dubraisch (1978) on Mount Adams, Washington documented highest black huckleberry productivity on sites with a soil pH value of 5.5.

Vaccinium species form symbiotic associations with ericoid mycorrhizae, which facilitate the acquisition of nitrogen for the plant (Read, 1995). In addition, the activity of nitrogen fixing bacteria is stimulated by the influx of nutrients following a burn and the increase in pH associated with the release of base elements in the ash (Barbour et. al., 1987). These factors give *Vaccinium* species an adaptive advantage in the low nitrogen conditions associated with frequent burning and nutrient poor sites in general. The living rhizome network of *Vaccinium* species also acts as an effective means of capturing and recycling nutrients released by burning (Miller, 1977).

2.5.6 Huckleberry Productivity

In a study of environmental variables influencing the productivity of black huckleberry, Minore and Dubraisch (1978) found that huckleberry cover is strongly influenced by succession and the degree of shading. As noted previously (Burton, 1998), high levels of shading severely restrict black huckleberry productivity.

In addition to shading, research indicates that black huckleberry productivity is affected more by year-to-year weather conditions than by site characteristics (Minore and Dubraisch, 1978). Factors affecting fruit yield include: late or early frost, drought, excessive rain, pollinator failure (Haeussler, 1987) and extreme cold weather with inadequate snowpack (Nelson, 1974). Other factors may include insect pests, a rationale cited by some First Nations as a primary motivation for burning huckleberry patches (Lepofsky et al., in press).

Black huckleberry yields of 720-935 litres/hectare were recorded for sites in Washington and Oregon (Minore et al., 1978) and James Agee (1993) states that production can reach 1,000 litres/hectare in a high quality field. Research in northwestern BC documented yields averaging 200 grams/square metre for sites with 60-80% full sunlight, and this is reported to be almost 10 times the productivity level reported by Minore et al. for Washington (Burton, 1998).

2.6 Fire Adaptations

Black huckleberry is well adapted to environments with relatively frequent fire disturbance by virtue of its extensive rhizome network. Studies by Minore (1975) found that rhizomes of *Vaccinium membranaceum* were located between 8 and 30 centimetres below the soil surface, largely protecting them from most fire damage. These rhizomes bear dormant buds, which sprout vigorously when the aerial portions of the plant are removed. Soil heating is dependent on burn intensity, duration and soil moisture (Hamilton, 1988), and is the primary determinant of

survival of underground plant organs such as rhizomes (Flinn and Wein, 1977). Rhizomes of *Vaccinium* species experience mortality after 10 minutes of heating by temperatures in the 55-59° C range (Schimmel and Granstromm, 1996). In a study of two clonal *Vaccinium* species (Mallik and Gimingham, 1985) found an inverse relationship between fire temperature and post-fire regeneration and growth performance of *Vaccinium* species. In a study of the effects of short duration, low intensity fires in areas with moist soils in the SBS biogeoclimatic zone, temperatures above 60° C were found only in the upper few centimetres of the soil horizon (Hamilton, 1988). From this we can infer, that the deeper buried rhizomes of black huckleberry generally survive low intensity fire. However, higher intensity burns in huckleberry shrub fields of the US northwest have been observed to result in long recovery periods followed by markedly lower huckleberry abundance and yields relative to control plots (Minore et al. 1979).

Haeussler (1987) rates black huckleberry along with lowbush blueberry and high-bush cranberry (*Viburnum edule* [Michx.] Raf.) as being "intermediate" in their adaptations to fire, showing best response to moderate fire return intervals, and stating that more frequent fire would be detrimental to these species. Studies of black huckleberry response to burn treatments have documented that, seven years post-burn, black huckleberry had not regained its pre-fire levels (Minore et al., 1979). Based on observations and sampling from a variety of populations, Haeussler (1987) indicates that the best berries are produced 10 to 25 years after a burn or canopy removal.

In a description of prescribed fire trials with a closely associated species, *Vaccinium globulare* Rydb., the foliage of this species is noted as being "very nonflammable' and in addition, "plants are consumed by fire only after being dried and pre-heated by woody fuels" (Miller, 1977). Several efforts to conduct prescribed burns in huckleberry types in the US Pacific

northwest by Don Minore[12] led him to comment (1997) that, "except in extreme high-hazard conditions that do not occur every year, huckleberry fields in the Cascades of Oregon and Washington are almost fireproof".

The prescribed fire trials with *V. globulare* (Miller, 1977) noted that spring fires resulted in increased numbers of shoots, and fall burns often resulted in a decrease in total numbers of sprouts. In addition, it was observed that the depth of heat penetration controlled the number of sprouts produced. Plants burned off above the ground produced several sprouts from dormant axillary buds on existing root crowns, whereas plants killed below the ground functioned as separate plants. The study concludes that, "a fire treatment most beneficial to *V. globulare* will remove senescent stems but cause minimal rhizome damage".

2.6.1 Successional Status

Black huckleberry typically occurs in montane and subalpine forests (Haeussler et al. 1990). Both of these habitats occur in this study area, and are represented by the ICHmc1 and ESSFwv, respectively. Black huckleberry is often found as a component of an ericaceous shrub complex, which, in the study area generally includes the ericaceous associates, false azalea (*Menzesia ferruginea* Sm.) and oval-leaved blueberry (*Vaccinium ovalifolium* Sm.). These two species have been observed singly or sparsely distributed under closed canopies in mature and maturing hemlock – subalpine fir forests. In higher light environments, false azalea most often dominates this complex with oval-leaved blueberry, and black huckleberry is most often relegated to understorey status. Both false azalea and oval-leaved huckleberry are fire sensitive species that do not respond quickly or vigorously after disturbance by fire (Haeussler et al., 1990).

[12] Forest ecologist USDA Forest Service – Pacific Northwest Research Station (retired).

On middle and lower elevation sites in, or immediately adjacent to the ICH mc2 in this study area, black huckleberry has been observed to persist as an understorey component below coniferous overstory (mostly lodgepole pine). However in deciduous (trembling aspen [*Populus tremuloides* Michx.] dominated) complexes, black huckleberry was generally observed to be absent or to persist only at very low levels of abundance.

2.7 Summary

The environmental setting of the upper Skeena and lower Bulkley drainages is one characterized by transition. Middle and lower elevation sites (ICHmc2, ICHmc1 SBSdk, SBSmc2) experience relatively frequent disturbance, but rapid succession and competition from herbaceous and deciduous species often reduce opportunities for productive huckleberry patches to persist without additional disturbance. Higher elevation sites have harsher climates, shorter growing seasons and fewer species that can compete successfully with black huckleberry. Black huckleberry is known to be relatively well adapted to short growing season and cold temperatures in these ecological types. Ericaceous shrub complexes can persist in these areas (upper ICHmc1 and ESSFwv) for extended periods. However, encroachment by fire-sensitive shrubs and conifers and the very long natural fire return intervals mean that productive (for black huckleberry) early seral habitats will be rare in these types under the influences of only the natural fire regime.

Historical accounts of regional landscapes indicate that many were influenced by anthropogenic fire. These accounts are in agreement with descriptions of traditional berry patch sites by First Nations elders, as remembered from their youth. The current recognition of drastic change in the character and productivity of these berry patches, is one indication of the degree to which the reduction in anthropogenic burning (Native and non-Native), during the last century, has changed some landscapes and vegetation communities in the region.

CHAPTER 3: SIM MAIY OR DEGII: THE CULTURAL CONTEXT AND THE ROLE OF BLACK HUCKLEBERRY

> For us, the ownership of the territory is a marriage of the Chief and the land. Each Chief has an ancestor who encountered and acknowledged the life of the land. From such encounters come power. The land, the plants, the animals and the people all have spirit – they all must be shown respect. That is the basis of our law.
>
> *Gisday Wa and Delgam Uukw, 1990*

Figure 3. 1 Berry Pickers, Hazelton, BC

Figure 3. 2 Drying cooked berries at Moricetown, BC

3.1 Introduction

In order to begin to reconstruct the traditional management of black huckleberry by the Gitxsan and Wet'suwet'en it is necessary to first develop a clear understanding of the traditional systems of governance and territorial management that informed and guided human-environment interactions in these cultures. It is particularly important to look at huckleberry harvesting and management as components of a seasonal round of subsistence activities in which all activities had to mesh. In addition, it is instructive to consider the dietary and

commercial value of this fruit in order to more fully appreciate the relative importance of the berry harvest and management activities to the Gitxsan and Wet'suwet'en.

3.2 Gitxsan and Wet'suwet'en Culture

The Gitxsan and Wet'suwet'en speak entirely different languages, an indication of their distinct cultural origins. The Gitxsan are a Tsimshianic group related to other coastal First Nations such as the Tsimshian. The Wet'suwet'en are an Athapaskan culture related to inland Carrier groups and speaking a unique dialect that they share with the Nat'oot'en or Babine people. Despite the fundamental linguistic and ethnic differences, the Gitxsan and Wet'suwet'en share many common cultural structures and approaches to stewardship of carefully defined traditional territories.

Both the Gitxsan and Wet'suwet'en are matrilineal societies organized into a number of exogamous clans. Within each clan are a number of kin based groups known as Yikh (Wet'suwet'en) or Wilp (Gitxsan) but often referred to as house groups. Each house group is an autonomous collective that "owns" one or more defined geographical areas known as the house territory. Within the context of both Gitxsan and Wet'suwet'en societies, this ownership is considered to be a responsibility rather than a right. It is a common belief of both the Gitxsan and Wet'suwet'en that the people belong to the land, the land does not belong to the people. Further to this point, hereditary Chiefs are entrusted with a responsibility as stewards of a territory by virtue of the hereditary name they hold, and they are the caretakers of these territories, for as long as they hold the name. It is the responsibility of a head Chief to ensure that the house territory is managed in a responsible manner so that the territory will always produce enough game, fish, berries and medicines to support the subsistence, trade and customary needs of house members. The house is a partnership between the people and the

territory and it formed the primary unit of production that supported the subsistence needs of the Gitxsan and Wet'suwet'en.

The rights and responsibilities of Chiefs to manage and harvest resources within the house territory on behalf of their house members are validated in the feast, the central governance institution of both the Gitxsan and Wet'suwet'en. The resources from the territories are brought into the feast hall and distributed to witnesses by the host clan to validate their ownership of the territories and show respect for their guests.

3.2.1 Role of Black Huckleberry

Black huckleberry was utilized by dozens of First Nations groups throughout its western range where it was highly valued as a dietary staple and item of trade. In BC it was utilized by all interior First Nations wherever it was available (MacKinnon et al., 1992). The high value of this fruit to First Nations groups is reflected in a variety of ways, including names for *Vaccinium membranaceum* which identify the fruit as "the one, the true berry" in the Gitxsan language (People of K'san, 1980) and simply as "berry" in the Nuxalk language (Turner, 1975). In addition, the high value of black huckleberry to many First Nations is indicated by the performance of first fruit rituals among the Klikitat (Norton et al., 1999) and the Yakama and Warm Springs Indians of Washington State (Mack and McClure, in review). Annie York, a Thompson elder, considers black huckleberry as, "the head of all fruits" and notes that, "if somebody gave you a little handful of huckleberries, you have to give....the old people always tell you...something in return" (Turner, 1990).

Berries, particularly black huckleberries, have played and continue to play a critically important role in the exercise of Gitxsan and Wet'suwet'en governance and ceremonial life through the feast system. Feast bowls, such as those that can be seen at K'san in Hazelton would hold many gallons of fresh berries for distribution. The Wet'suwet'en perform a berry

dance to distribute huckleberries and celebrate and validate the conferring of a hereditary title on a new Chief. At a recent feast hosted by the Wet'suwet'en Gitdumden (Wolf) clan, 30 gallons of huckleberries were distributed to honour guests who had assembled to witness and validate the conferring of the hereditary name "Skedans" on Andrew George Jr. (Rita George personal communication, 2001).

Some of the reasons for the importance of this fruit are summarised in the following excerpt from People of 'Ksan (1980):

> They are the favourite for drying, retaining their fine flavour through the drying process, and they are easy to roll when dried. Also, they preserve well in grease. We can even keep them for quite a while by putting them away in a cool place in boxes without any preservative.

Black huckleberry played a key role in the cultural life of many First Nations groups, an indication of its universal appeal and the important role black huckleberry played in aboriginal subsistence economies wherever it was available.

3.3 Gathering

Gitxsan and Wet'suwet'en people collected, preserved and stored a wide variety of plant and animal foods for winter consumption and trade with neighbouring First Nations groups. Each resource was available at specific times and places within the territories of a house group. It was therefore critically important to develop strategies of resource harvesting, which allowed each family to gather and preserve sufficient quantities of necessary foods to see them through the winter months. By following a seasonal round tailored to the specific physical attributes and resource availability patterns within their house territories, each house group attempted to gather, process and store sufficient provisions to last the winter. Inherent in these seasonal

rounds were a number of resource stewardship strategies that facilitated the efficient use of the skills and resources available to each house group.

3.3.1 Seasonal Round

Documentation from several First Nations indicate that huckleberry harvesting excursions to upland berry grounds commonly lasted a month or more and involved gathering a variety of plant and animal resources (Lepofsky et al., in press; Norton et al., 1999). The following excerpt provides some insight into these excursions from the Gitxsan perspective:

> In the month of September when the huckleberries are ripe, the housewives make plans to go berry picking. All in the house help prepare and gather food such as fish and meats, put them in boxes, enough to last a month or until the berries are picked and dried. Early in the morning they start off with the large Indian Boxes and cedar and spruce root baskets. They reach the cabin in the mountains, called wilp ha'nii jokx (house for all the world), the place where the berries are dried. They start to pick the berries.
>
> *People of 'Ksan, 1980*

Berry ripening occurred coincident with salmon runs and Gitxsan and Wet'suwet'en people had to fit the harvest and processing of these two resources together within their subsistence patterns. Sometimes this could be easily achieved when berry patches were proximal to fishing sites. However, this was generally not the case for montane and subalpine black huckleberry grounds. Several reports indicate that among the Gitxsan and the Wet'suwet'en, huckleberry harvesting and other upland resource harvests would take place after the critical sockeye salmon runs had passed and the fish had been processed (Daly, 1988). Well-used huckleberry patches were often located in upland areas in relatively close proximity to summer fishing stations. Art Loring a Gitxsan Chief in the Eagle clan house of Sakxswmhigook, reports that for the Fiddler Creek territory, a person would travel ahead to the huckleberry patch and monitor berry ripeness, lighting a signal fire to summon the people from the riverside fishing village when the berries were ready (personal communication, 2000). This berry patch was located directly behind and above the fishing village on the Skeena, approximately a one day walk up

very steep slopes. This type of strategy would have allowed maximum utilization of the fish and the berry resource, with a minimum of wasted effort or time.

For both the Gitxsan and the Wet'suwet'en, huckleberry harvesting coincided with the gathering of a number of root foods and medicinal plants as well as hunting for a variety of upland game species. The ability to access a number of upland habitats and harvest the many species associated with the early seral types in and around the berry patch made these upland berry camps "hubs" of resource gathering in the late summer and early fall.

3.3.2 Gathering Strategies

While each house group had a unique combination of resources, gathering sites and logistical challenges, resulting in many different variations on the seasonal round, there were some strategies that were widely employed to achieve efficiencies and ensure abundant harvests.

One strategy was that of specialization, where an individual or group with specific knowledge or skills, or with access to an abundance of a particular resource, would focus a relatively large amount of time and effort on the collection and processing of that item. Similarly, other groups would focus on other resources readily available to them. In the fall these items would be traded or bartered for other goods (Cassidy, 1987).

Another strategy was the practice of caching food which would allow continued collection at a site or moving on to another gathering site (this was often done with berries). Perry Sampson related that Gitxsan people travelling to the fishing site at Kisegas would stop at a blueberry flat on a terrace above the Skeena River between the outlets of Sediesh and Sterritt Creeks. Blueberries would be picked at this site and cached after which the people would carry on to Kisegas for several weeks of fishing. Berries would be collected from cache pits on the return

journey several weeks later. (personal communication, 2000). Several cache pit depressions were observed at this site during fieldwork in the summer of 2000.

A third resource gathering strategy was to gather berries in areas that afforded access to two or more important resources. By setting up remote gathering and processing camps, a variety of plant and animal resources could be collected and preserved. Late summer and fall berry camps were often the base for hunting goat, caribou and groundhog as well as gathering and processing medicinal plants and berries.

3.4 Processing

Gitxsan elders report that black huckleberry was held in high esteem, in part due to its fine storage qualities. As noted previously, the attributes included maintaining its flavor when dried, being easy to roll when dried, storing well in grease and keeping fresh (without processing) for long periods (People of the K'san, 1980).

Berry pickers would make their way to the berry patch where they would camp for a period of several days or weeks. Berries were processed and dried on site on drying racks, often housed in the berry drying house. Productive huckleberry patches were regularly maintained and often used every year when they were in productive condition. As a result of this regular pattern of harvesting of productive sites, berry drying racks, picking containers and storage boxes were often left on site in the berry drying house (People of 'Ksan, 1980). Berry racks, a large bent box and old kerosene tins (used in historic times for berry collection) were found within a berry patch area in the lower Harold Price watershed in 1998 (Rabnett, 1999). First Nations advisors have reported finding evidence of other berry processing camps in areas known to have been montane huckleberry sites (Perry Sampson, personal communication 2000).

3.5 Stewardship

3.5.1 Ownership

Most First Nations advisors indicate that berry patches were in fact owned by the House or Wilp or by members of the House or Wilp in whose territory the patch is located. Art Mathewes Jr., Chief Tenimgyet, explains that women from other house groups would pay for the right to harvest huckleberries from Win luu mesxw, a huckleberry patch in his house territory, by bringing "vast amounts of prepared fruits to his grandmother". The women who were given permission to harvest in this area were given woven tumplines with a special pattern signifying that they had been granted access to these gathering areas (*Delgamuukw* et al. vs. the Queen, SCBC transcript volume 73, pp.4719-4721). The exercise of similarly strict controls over access and use of berry patches is also reported for the Huna Tlingit at Galcier Bay, Alaska (Thorton, 1999)

Other reports indicate that permission to harvest was required but was more freely given, almost as a matter of course, suggesting a more communal approach governed the use of some huckleberry gathering areas. The following excerpt from the commission evidence of Johnny David, Chief Maxlaxlex of the Wet'suwet'en Laksilyu (Small Frog) clan provides some insight into the practice and time depth of this approach for a berry patch near Moricetown:

> Q: Were there particular places in your territory where you would pick huckleberries or soapberries or blueberries?
> A: The area on the other side of the Hudson Bay Mountain where all the berries grew.
> Q: Are these berries still picked by the Wet'suwet'en people today?
> A: Yes.
> Q: Are they still used at the feast today?
> THE INTERPRETER: He said they're one of the mountains near Hudson Bay was called Kengitlow't. That's the area near Dowdey, about five-six miles from here.
> THE WITNESS: That area belonged to Mrs. Peter Alfred, who's known as Dzee, and when the berries would ripen she would invite all people from the village to go pick berries.

> Q: Before Mrs. Alfred held that name, did the previous Dzee also do that and invite the people from the village to go and use the berry grounds?
> A: Yes, they did. This was a Madalyn's predecessor, they did the same thing as she had done. It went quite a ways back.
>
> *Delgamuukw et al. vs. the Queen*
> *Johnny David Commission Evidence*
> *Vol. 1, Text 1, p. 66*

There are several other examples of communal use of huckleberry patches. Rita George indicates that for the huckleberry patches of Matthew Sam, the late Chief Woos of the Wet'suwet'en Gitdumden (wolf) clan near Topley, he would invite people from other clans to harvest in his berry patches in years with exceptionally abundant yields (personal communication, 2001).

The implications for berry patch management relate to the responsibilities for management versus the rights and benefits of being able to harvest from a productive huckleberry patch. Active management of huckleberry patches requires significant effort on the part of house members who were required to monitor weather and fuel conditions to determine an appropriate burn window and then carry out the burning of the patches. In some cases this required separate trips to the patches to carry out the burning (Rita George personal communication, 2001). Exclusive huckleberry patch ownership would provide a strong incentive for each house or wilp to actively manage productive huckleberry sites to ensure sustainable, abundant harvests, as berries would not be available to them in other areas.

3.6 Economic Importance

The importance of dried huckleberries as an item of trade is an important consideration when trying to understand the role of this fruit in the traditional subsistence economies of the Gitxsan and Wet'suwet'en. The excellent drying and storage qualities of these berries facilitated their use as trade goods. Berry cakes were cut into squares, packed in bentwood boxes and transported to trading fairs in the fall at Skeena Forks and in the early spring at the Nass

oolichan grounds (People of 'Ksan, 1980). The Gitxsan traveled to the Nass every spring to trade for oolichan grease, making a difficult journey despite late winter conditions as "the lure of grease was like the lure of gold.....with trade in mind, we had put our dried berries into boxes which were designed to fit the racks of dried clams and oolichans that we hoped to bring home in the same boxes" (People of 'Ksan, 1980). Trading of berries to coastal peoples continued throughout the 20th century. Such trading activities were often facilitated when Wet'suwet'en people traveled to the coast to work at tidewater fish canneries (Fred George[13], personal communication, 2001).

Another aspect of the economic importance of huckleberries was their distribution and use as an important food in feasts. In Gitxsan "G'yaba" is a term sometimes applied to "lavish food gifts given to the highest Chiefs at feasts, and usually took the form of an immense ladle full of oolichan grease or crushed berries". Other indications were that women provided, "many, many rolls of dried berries" and, "every Chief expected to take home at least one giant box of dried fruit". (People of 'Ksan, 1980).

A further indication of the economic importance of berries comes from the Hudson Bay Company clerks, who recorded that salmon and berry cakes provided by Native people were the two dietary staples upon which they subsisted at Fort Kilmaurs on Babine Lake (Ray, 1985). Ray's research into the food utilized by traders at Fort Alexandria in the middle Fraser Valley found that in 1824 approximately 300 berry cakes were consumed by company clerks, indicating that berries were a widespread staple at early fur trade posts.

[13] Fred George, Chief Bistae of the Wet'suwet'en Likhts'amisyu (Fireweed) clan.

3.7 Scale of Huckleberry Harvest

3.7.1 Introduction

In order to fully understand the traditional management of the huckleberry resource, it is helpful to gain some perspective on the scale of this activity. What volumes of berries were being processed? We know from oral history accounts that large numbers of people traveled to upland berry camps to gather plant foods and hunt upland game species. We know that there was a distinct division of labour, with women and young children largely engaged in the gathering and processing of berries (People of 'Ksan, 1980, Perry Sampson, personal communication, 2000). We also know that these upland gathering expeditions lasted in the neighborhood of four weeks. What is uncertain however, is the volume of berries that were harvested and processed. In an attempt to estimate the scale of the huckleberry harvest the following berry model has been assembled from a number of different sources in an attempt to define two key variables:

1. Precontact population estimates for Gitxsan and Wet'suwet'en.
2. Average volume of huckleberries required per person for food and trade.

While these two variables seem relatively simple, they are not easily determined. The population estimates I have left to Arthur Ray (1985) and Antonia Mills (1994), based on interpretations of accounts by Peter Skene Ogden and William Brown. It is a challenge to estimate the average volume of berries harvested per person due to the variability of the evidence, the ambiguity of some references, and the large number of component variables required to define reliable numbers. However, some of the documented numbers provide a basis for an approximate estimation of the scale of the berry harvest These figures also allow one to estimate the scale of environmental management that may have been required to support this critical part of the subsistence economies of the Gitxsan and Wet'suwet'en.

The following excerpt was related by Martha Brown, Chief Xhliimlaxha, in an interview with Richard Daly in 1976.

> About August 20th we'd leave and go berry picking. Mom and Grandma would pick up to 60 packloads of berries in late August and in September (they had been boiled using heated rocks and water, then smoke-dried on special racks over a small light smoke fire till dry, then rolled as "fruit leather") – for packing.

This reference is an example of the ambiguity of the references available. We do not know whether 60 packloads are dried or fresh berries. With an estimated fresh/dry conversion rate (based on volume) of 10.25:1, this is an important distinction. Following are the available references to berry harvesting and processing taken from a variety of references:

3.7.2 Indications of Scale of Harvest

Boxes/per family or person
1. 60 packloads – probably dried (Daly, 1986).
2. 8-10 cakes per family (Sim Maiy = *V. membranaceum*) same number of mii yhel (*V. caespitosum*) – family of 10 (Overstall and Sterritt, 1986).
3. 40 packloads per family (source unknown).

Berry Box (gal enk)
1. 80-100 litres (Overstall and Sterritt, 1986).
2. Berry boxes vary in size – some are giant sized (People of 'Ksan, 1980).
3. Bent box from Harold Price berry camp measures 42cmx43cmx62cm(tall) (Rabnett, 1999) – given the thickness of 2cm for each side, this box would hold 89 litres (23.5 gallons) of fruit.

Berry Cake
1. .25 - .5 inch thick (People of 'Ksan, 1980).
2. 4-5 loads of 80-100 litres makes 2 berry cakes (Overstall and Sterritt, 1986) – therefore 320-500 litres of fruit are required to make 2 berry cakes.
3. Cake is 200 cm by 40 cm by 2.5 cm(wet), 2cm (dry) (Overstall and Sterritt, 1986) – therefore each cake = 20 litres of dry fruit.
4. *V. mem* is 86% moisture (Gottesfeld, 1995).
5. fruit is generally dried to 15-20% moisture (below microbial threshold) (Haeussler, 1987).

Berry rack dimensions
1. 6'(1.83m) long x 18"(46cm) wide (People of 'Ksan, 1980).
2. berry rack (assembled) is 200 centimetres by 50 centimetres (Overstall and Sterritt, 1986).
3. Harold Price berry racks averaged 1.85 metres long (Rabnett, 1999) – possibly rotted down.

Berry Roll
1. 12 inches in diameter (people of Ksan, 1980).
2. rolled until it would fit in a "gal enk".

Other
1. Berry cakes were dried in the camp and then cut in squares and put in the Indian box – take them home and store them - done mainly for trade (People of Ksan, 1980).
2. Often rolls were "just left that way" – rolled up (People of Ksan, 1980).

3.7.3 Population Estimates

When Peter Skene Ogden visited Moricetown or "Hotset" as he called it in the late 1820s he observed 28 lodges each housing 6-7 families (Ray, 1985). Antonia Mills (1994) estimates that there may have been 6 people in each family for a total population of 1092. It should be noted that some of the Wet'suwet'en house groups occupying the southeastern territories may not have traveled to Moricetown, choosing instead to use fishing stations on the Morice and Nanika Rivers (Warner Naziel[14] personal communication, 2001). The figure of 1092 is therefore likely to be conservative.

Arthur Ray (1985) estimates a Gitxsan population of 7000 based on an analysis of the journals of William Brown, Hudson Bay Company clerk at Fort Kilamurs (Babine), based on his account of a trip from Fort Kilamurs down the Babine and Skeena Rivers towards the confluence with the Bulkley River. On this trip Brown visited a number of Gitxsan villages and provided information on the inhabitants.

3.7.4 The Potential Scale of the Traditional Huckleberry Harvest

Huckleberries were eaten fresh, dried for winter consumption, as well as being dried and traded for coastal foods. Based on the work of Overstall and Sterritt (1986), an estimate of the dried huckleberry requirement is one huckleberry cake per person/year, at an average fresh volume of 200 litres of huckleberries per cake. Therefore, each person required approximately 200 litres, or 53 gallons (13 four gallon pails) of fresh huckleberries each year.

[14] Warner Naziel, Chief Toghestiy of the Wet'suwet'en Fireweed (Likhts'amisyu) clan.

It is assumed that large volumes of berries were also harvested to be eaten fresh and dried for trade. Therefore, it seems reasonable to suggest that the total huckleberry harvest was likely at least once again the volume harvested for winter storage. Based on early population estimates of 1092 for the Wet'suwet'en and 7000 for the Gitxsan, these groups would have required a minimum of 57,700 gallons (218,400 litres) and 370,000 gallons (1,400,000 litres) of fresh huckleberries respectively for subsistence purposes (winter storage). Based on an average huckleberry yield of 827 litres/hectare (average of range reported by Minore et al. 1979) these harvest levels correspond to a need for at least 264 hectares and 1693 hectares of productive huckleberry harvesting area maintained each year for the Wet'suwet'en and Gitxsan respectively. As black huckleberry requires a significant time to recover from burn treatments, the actual area under management would have been at least two, likely three times as large as the minimum annual productive area. When one further considers the increase in the scale of harvest and management necessary to accommodate the harvest of additional fresh berries for consumption and berries to be processed for trade purposes, it is probable that the total area under management for huckleberry production would comprise several thousand hectares. This level of environmental interaction would have required a tremendous effort on the part of the Gitxsan and Wet'suwet'en and would have constituted significant and substantial environmental management of the landscape.

3.8 Summary

It is clear that black huckleberry played a very important role in the subsistence, economic and cultural life of both the Gitxsan and the Wet'suwet'en. It was critically important that large volumes of this fruit be harvested and preserved every year to meet the nutritional needs of the communities, both through use as an important food but also to facilitate the acquisition of highly nutritious oolichan grease and seafoods through trade with coastal neighbours.

CHAPTER 4: WHEN YOU CAN'T SEE YOUR FOOTSTEPS AMONGST THE BERRIES: TRADITIONAL HUCKLEBERRY MANAGEMENT

4.1 Introduction

The practice of landscape burning By Gitxsan and Wet'suwet'en people to promote reliable, abundant harvests of fruit in predictable locations was a logical approach to improving the harvest of a patchy resource such as black huckleberry. That this practice was widely used for the management of black huckleberry (Boyd, 1999a) is a testament to its efficacy, and perhaps necessity in the montane and subalpine habitats where this species is most prolific.

Following are three excerpts from a Gitxsan elder, Martha Brown, the late Chief Xhliimlaxha in her commission evidence for the *Delgamuukw* court case, providing context for this chapter:

> Q: Did you burn part of your territory so that the berries would grow there?
> A: That's what they used to do in the old days. Whenever there's not a good crop of berries on one side of the river grandfather used to burn and it's the same on the other side of the river. If there's a poor crop they will burn and just move over, to and fro.
>
> Q: How often would you burn one part of the valley up the river? How much of a period of time before you would go and burn the other side?
> A: They go by the crop of the berry patch. If you don't see your footprints amongst the berries.
>
> Q: Do you remember your grandfather burning the territory so that berries would grow, in your lifetime?
> A: I remember when my grandfather burned the area at Luumina axa Asa'anseegit. And how — Pretty well burned the area every two years because this is their livelihood where they pick their berry crop. The berries are used for a feast that is why they take care of the patch,
>
> *Delgamuukw et al vs. the Queen*
> *Commission Evidence of Martha Brown*
> *Volume 1, Text 2*

4.2 First Nations Management of Black Huckleberry

An initial review of some of the ethnobotanical literature containing references to First Nations management of black huckleberry (French, 1999; Turner et al., 1990,; Turner, 1991; Norton et al., 1999; Boyd, 1986; Ross, 1999; Gottesfeld, 1994a; Lepofsky et al., in press) reveals that (at least) ten First Nations groups, throughout the western range of *Vaccinium membranaceum,* managed this species using landscape burning practices (Table 4.1). Furthermore, many of these groups reportedly considered this berry an important staple and dried large quantities that were then stored for winter consumption. Other studies (Mack and McClure, in review) have emphasized the critical role that berries played in meeting vitamin C requirements during winter months, indicating that only a single cup of dried berries is required to meet daily vitamin C requirements. Leslie Johnson (1997) reported that entire Gitxsan villages would move to upland berry camps to pick and dry berries for winter use. Some of these First Nations cultures reported that special knowledge of weather patterns was needed to determine when and how to burn berry patches (Gottesfeld, 1994a; Ross, 1999; Lepofsky et al., in press). This knowledge was likely critical for successful berry management, as *Vaccinium* shrubfields are known to be a relatively fire resistant vegetation type (Minore, 1997; Miller, 1977).

Group	Location	Indication of Importance	Landscape Burning	Time of Burning	Burn Interval	Source(s)
Gitxsan	Skeena Valley	Name means "true berry"	Yes	Fall	4+ years	Gottesfeld, 1994a
Wet'suwet'en	Bulkley Valley	Ceremonial – "berry dance"	Yes	Unknown		Gottesfeld, 1994a
Sto:lo	Lower Fraser Valley	Burn specialist	Yes	Fall	3-5 years	Lepofsky et al., in press
Stl'atl'imx	Mt. Currie		Yes	Fall	5-6 years	Turner, 1991
Nlaka'pamux	Nicola Valley		Yes			Turner, 1991
Secwepemc			Yes			Turner, 1991
Spokan	Eastern Washington	Burn specialist	Yes	Spring/late Fall	4-5 years	Ross, 1999
Sahaptin and Chinook	Columbia River		Yes	Fall		French, 1999
Klikitat	South-central Washington State	Name of the season means huckleberry time	Likely			Norton et al., 1999
Thompson	Fraser Valley	"Head of all fruits"	Yes			Turner et al., 1990

Table 4. 1. Summary of huckleberry management by First Nations.

Many First Nations people have commented on the role that prescribed fire played in encouraging abundant yields of large, sweet, high quality huckleberries. Sto:lo elders report that in the past (not like today) it was easy to fill a basket (approximately 165 litres) at berry gathering sites that were managed by burning (Lepofsky et al., in press).

Given the high light requirements of black huckleberry and the forest conditions that generally develop in moist, montane environments where it grows, the practice of traditional berry patch burning can be viewed as an ecological imperative for groups dependent on the huckleberry resource. Actively managing this species would provide increased reliability and predictability of huckleberry crops, ensuring sufficient quantities could be harvested at predictable locations to meet subsistence needs. The huckleberry harvest had to fit into a busy seasonal round that required the Gitxsan and the Wet'suwet'en to be "in the right place at the right time" to acquire a wide range of critical resources which were spatially and temporally

transitory. The intense gathering activities that occurred during July, August and September would have left little time for misspent efforts thereby heightening the value of the predictability and reliability factors for important resources such as black huckleberry.

The system of house territories as the primary unit of production restricted the area available for huckleberry harvesting for each individual house group. The need to ensure constant and consistent availability of huckleberries within the confines of territory boundaries created an incentive for active environmental management by each house group.

4.3 Antiquity of Burning Practices

In a study of Sto:lo burning (Lepofsky et al., in press), the large number of references to burning by First Nations on the northwest coast for a variety of resources is cited as an indication of the significant time depth associated with this practice. This study further predicts that the intensification of the salmon resource utilization that occurred approximately 2400 years BP was accompanied by an intensification of other resources such as berries. They therefore expect to see evidence of increased anthropogenic fire beginning at that time. This would correspond to results reported from Seeley Lake (Gottesfeld et al., 1991) that document an increase in pyrophytic species approximately 2200 years ago despite a cooling climate, which Gottesfeld et al. postulate is indirect evidence of increasing anthropogenic burning.

Mack and McClure (in review) note that intensification of resource use among the Columbia River and plateau peoples is known to have begun sometime in the mid Holocene, between 3000 and 5000 years BP, characterized by a move from general foraging to, "a more logistically organized system". They indicate that large scale berry processing was a part of that shift and contributed to maintenance of populations of Columbia River peoples in semi-permanent villages.

4.4 Gitxsan and Wet'suwet'en Huckleberry Management

Leslie Gottesfeld (1994a) has provided a well-researched description of huckleberry management and utilization by the Gitxsan and the Wet'suwet'en, including maps indicating locations of several traditional, managed huckleberry patches, as well as documentation of other burning activities for a variety of purposes. In addition to this paper, the accumulated historical, ecological and anecdotal evidence for traditional management of maintained huckleberry patches in this region is substantial. A great deal of this type of information has been documented (Gottesfeld, 1994a; Burton et al., 2000), however, a couple of additional references, not cited elsewhere, are included here to provide context for the field summaries and discussion that follows.

This excerpt is taken from the 1934 annual report of the Prince Rupert Forest District from a section entitled "Cause of Fires":

> *Campers and travelers – [caused] 35 fires* - This is a slight increase over last year and fires caused by Indian berry pickers are included. As soon as the fish canning season closes the Indians take to the hills hunting and gathering berries. Owing to the very dry season, fires lighted anywhere except on gravel or rock were nearly impossible to extinguish. On August 24th, the weather turned very dry and windy. Numerous fires sprang up in isolated areas frequented by Indian berry pickers, no doubt caused by neglected campfires. Every year that we have a late fall this trouble occurs and the only way to cope with it is to keep our patrol on until the hazard is definitely over.

References to native incendiarism were a common and consistent feature of the Prince Rupert Forest District annual reports from the 1930's (Anonymous, 1932-35, 1937). As other authors have documented (Gottesfeld, 1994a), a concerted effort was made by the forest service to discourage human ignitions (particularly by Indians) under threat of criminal charges and fines. Apparently, these policies were effective, as forest district annual reports from the early 1940's do not cite any additional incidence of Indian ignitions (Anonymous, 1940-44).

The pattern described in the Prince Rupert Forest Region annual report for 1934 reflects the traditional pattern of berry patch management described by many Gitxsan people. Art Matthews, Chief Tenimgyet, provided a succinct overview in his *Delgamuukw* testimony:

> These berry patches, I said that the berries only grow where it was burnt, so what they did was every time there was a growth, like every about six to seven years, they would burn these over again so -- so that they maintain the taste because if you would leave it too long these berries would begin to lose their taste and sweetness.
>
> *Delgamuukw et al. vs. the Queen*
> *Supreme Court of BC*
> *Transcript Volume 76, pp. 4718- 9*

Later in his testimony, Art Matthews named six huckleberry patches within the house territory of Tsihl Gwellii. Two of these were actively managed by his mother and grandmother with permission of the high Chief or Sim'oogit of this house. He reported that these berry patches had camps equipped with berry drying racks. Similarly, within the relatively small area including the west flank of Caribou (Sidina) Mountain and the southwest flank of Mt. Tomlinson (east side of the Skeena River, north of Hazelton), there have been three large huckleberry gathering areas identified, all associated with campsites, including one area with reported evidence of a berry processing site (Perry Sampson personal communication, 2000). The total area covered by these three sites is estimated to be between 600-800 hectares. In The Wet'suwet'en territory of Tsekalkaiyax (House on Top of a Flat Rock) under Chief Ut'akhgit, six distinct, named, traditional huckleberry patches have been documented. Based on these three areas, it appears that huckleberry management traditionally involved a large number of sites, and likely a large number of hectares of montane and subalpine habitats within Gitxsan and Wet'suwet'en territories.

4.5 Summary

From the evidence assembled in these preliminary chapters it can be amply seen that both the Gitxsan and the Wet'suwet'en relied to a very large extent on abundant harvests of black

huckleberry as well as other berries to meet their caloric and nutritional needs, particularly during the winter. Processing of berries did not detract from their vitamin C value making them a valuable source of this crucial nutrient through the winter. It is has also been illustrated that the regional climate does not favour the persistence of the early seral environments which are necessary for productive black huckleberry. The role of fire in creating and maintaining seral shrubfield complexes productive for black huckleberry has been indicated. Therefore, both the Gitxsan and the Wet'suwet'en shared a strong incentive to maintain this resource to promote abundant, predictable and reliable harvest of fruit every year.

In addition, it has been shown that First Nations groups throughout the natural range of this species included it as a very significant component of their seasonal round, likely owing to its abundance, ease of processing, palatability, nutrient value and possibly, its response to management. It has also been illustrated, that throughout the western range of black huckleberry, First Nations people managed this species through the application of landscape burning. This evidence mirrors the myriad reports by Gitxsan and Wet'suwet'en about their use of landscape burning to manage black huckleberry as well as a number of other plant and animal resources. Descriptions of the regional landscape by early visitors to the Bulkley and Skeena Valleys indicate the influence of extensive fire on the vegetation patterns, and the abundance of berries and other plant foods, which they observed were very important to Native subsistence economies.

Evidence of frequent fire and seral habitats is found at considerable time depth in the paleoecological record of the region, likely indicating the importance of landscape burning as an environmental management tool from ancient times until the mid 20th century, consistent with reports of Wet'suwet'en and Gitxsan elders. Now that this basis has been established with some degree of certainty, it is possible to move on to a more detailed examination of the

characteristics of this management regime based on the results of field reconnaissance from five traditional Gitxsan and Wet'suwet'en huckleberry sites.

CHAPTER 5: PIECES OF THE PUZZLE: CASE STUDIES - FIELD RECONNAISSANCE OF FIVE TRADITIONAL HUCKLEBERRY PATCHES

The following five case study summaries detail the results of field reconnaissance and ecological and fire history sampling from five traditional huckleberry patches. These sites represent a relatively small sample of the many traditional huckleberry patches that have been identified in oral history accounts by Gitxsan and Wet'suwet'en elders.

Each case study summary will detail the ecological, cultural and fire history data collected on site in the context of any available background information available, particularly interviews and recorded oral history.

Ecological classification and inventory was conducted using the biogeoclimatic ecosystem classification system that is the standard for British Columbia. All classification is based on the field manual, "Field Guide to Site Identification and Interpretation for the Prince Rupert Forest Region, Land Management Handbook #26" (Banner et al., 1993). Hardwood dominated forests in the moist cold subzone (Hazelton variant) of the Interior Cedar-Hemlock biogeoclimatic zone (ICHmc2) and the dry cool subzone of the Sub-Boreal Spruce zone (SBSdk) are classified according to the "Field Guide to the Identification of Hardwood Dominated Ecosystems in the SBSdk and ICHmc2 of the Prince Rupert Forest Region: Insert #1 to Land Management Handbook No. 26 (Williams et al., 2000b). The distribution of biogeoclimatic variants in the study region and the study sites themselves are illustrated in following map (Figure 5.1).

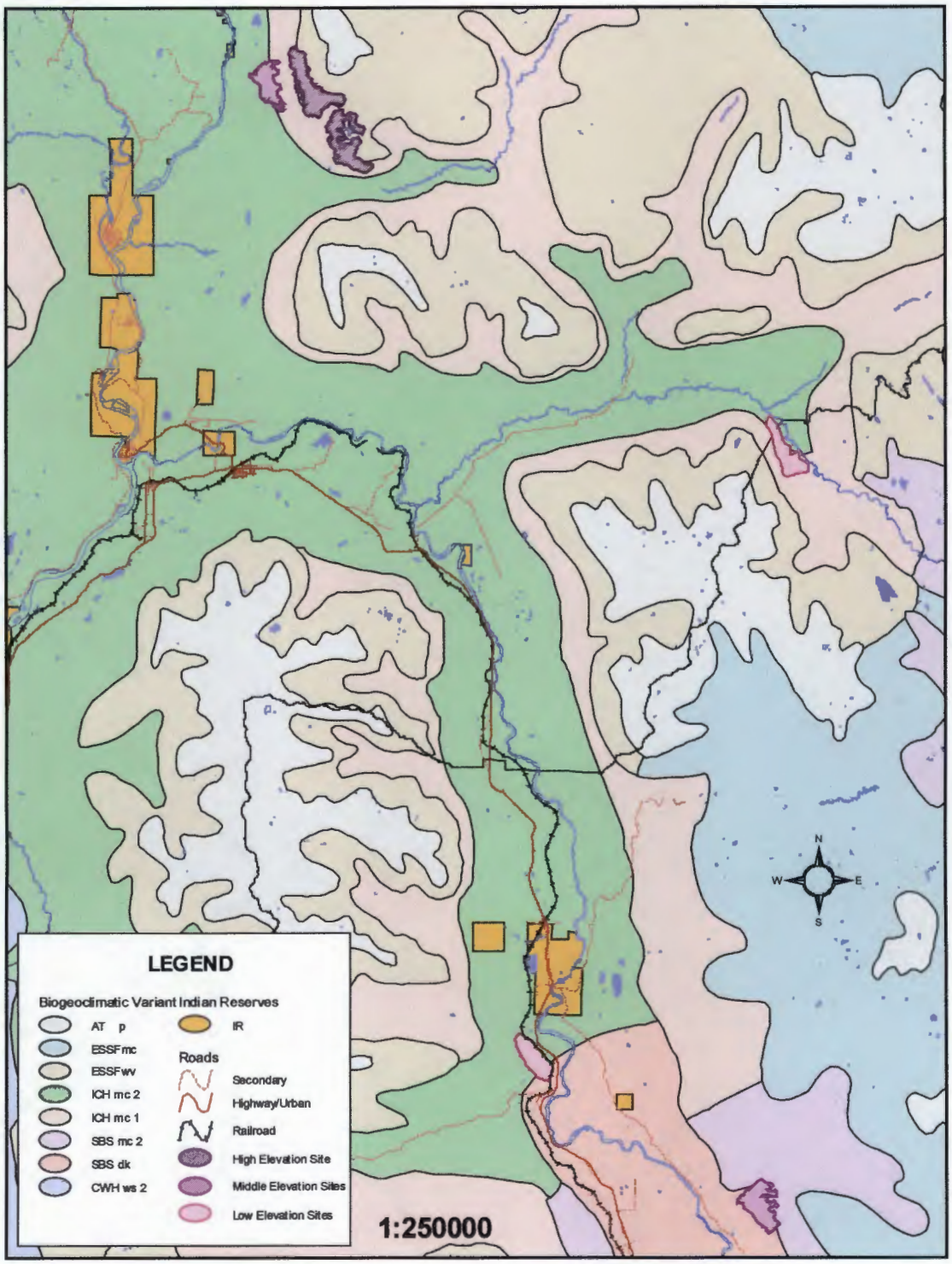

Figure 5.1 Huckleberry Patch Study Sites and Biogeoclimatic Variants

5.1 Bek'et Degii Ts'ooyiin: Case Study

5.1.1 Introduction

This berry harvesting area is located in the Bulkley Valley near Doughty, a former railroad stop midway between the town of Smithers and the Wet'suwet'en village of Moricetown. This site is characterized by a prominent basalt ridge, east of the Bulkley River, trending northwest to southeast, locally known as Cow Hill. According to several Wet'suwet'en advisors, an important traditional berry ground was located on the northeast slope of this ridge, encompassing the area from the ridge crest down to the base of the slope. The 1949 air photo (Figure 5.2) shows the basalt ridge and the mosaic of coniferous and hardwood dominated stands on and around the ridge. Important Wet'suwet'en sites discussed in this case study are labeled on the photo with the Wet'suwet'en names.

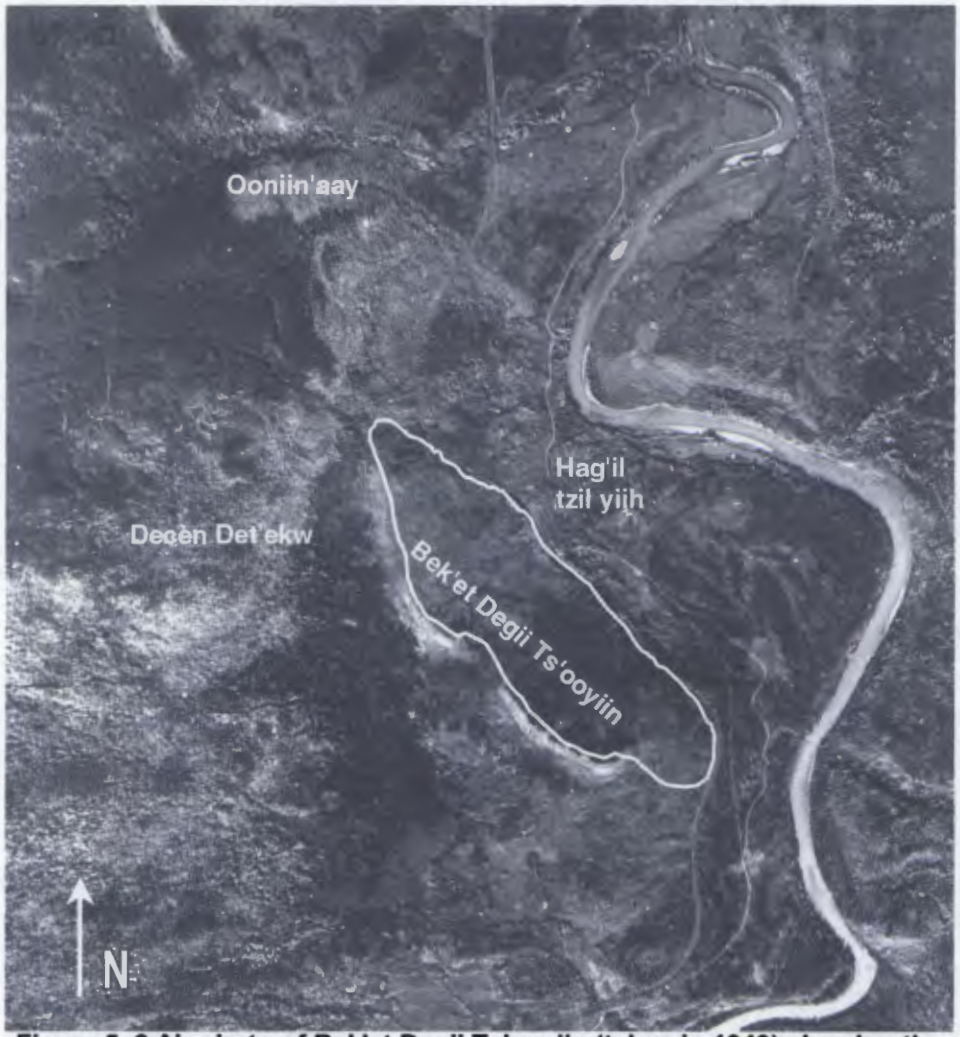

Figure 5. 2 Air photo of Bek'et Degii Ts'ooyiin (taken in 1949) showing the basalt ridge and the mosaic of coniferous and hardwood dominated types on and around the ridge (airphoto scale is approximately 1:40,000).

5.1.2 Ecological Overview

The site ranges in elevation from 440 to 635 metres above sea level, and is located in the ICHmc2 biogeoclimatic variant, just north of the boundary with the SBSdk biogeoclimatic subzone. There are a number of distinct ecological communities located on and around the ridge. This ecological variability is related to physical site factors, particularly aspect and soil parent material as well as to the fire history of this area.

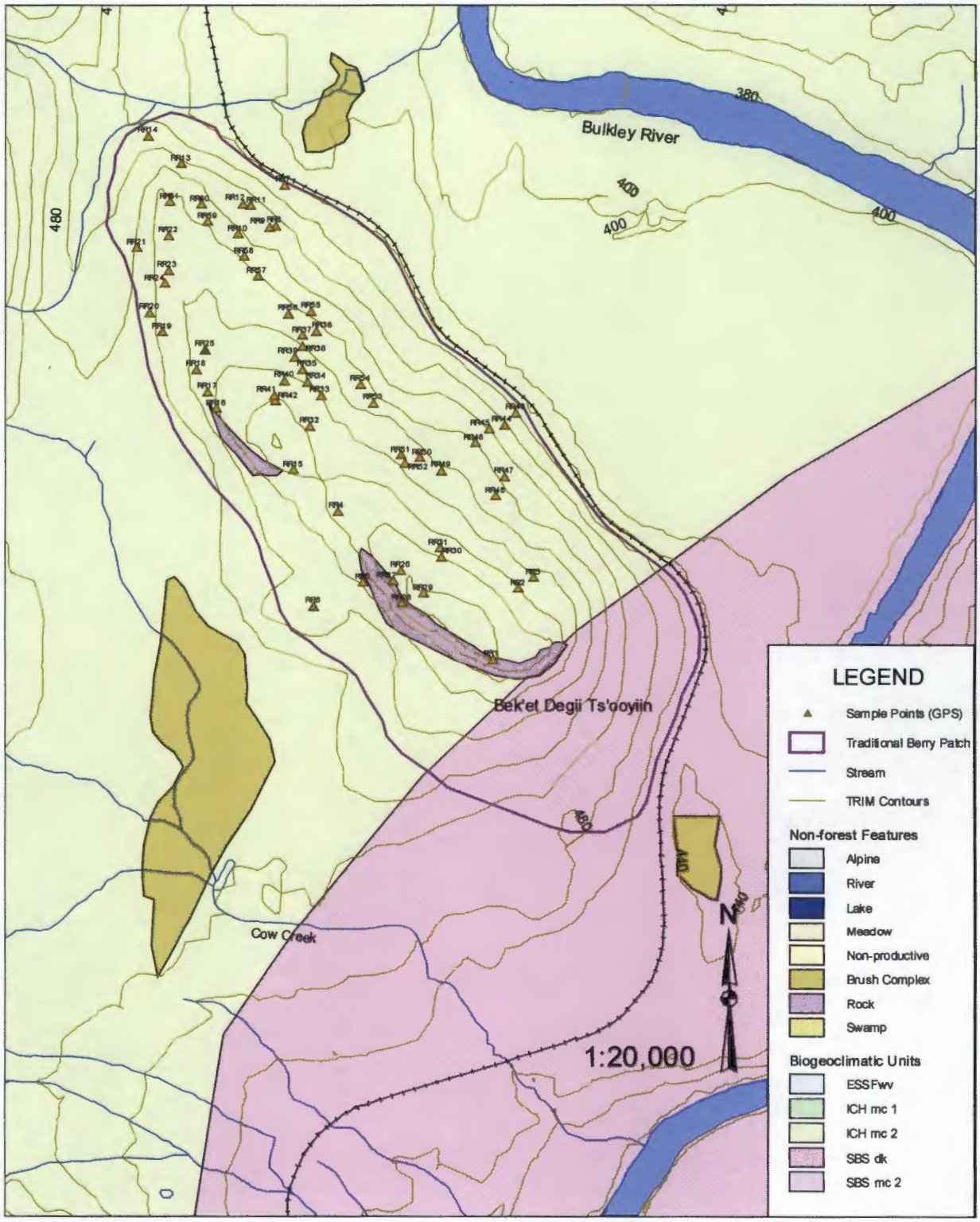

Figure 5. 3 Bek'et Degii Ts'ooyiin (Cow Hill) Huckleberry Area

The following tables (Table 5.1, Table 5.2) summarize the data from five ecological plots established on this site during field reconnaissance.

Area	Plot ID	BGC Unit	Site Series	*Stand Structure	Crown Closure	Slope (%)	Aspect (deg.)	Elev. (m)	Dominant tree	Dominant shrub
NE slope	△RR25	ICHmc2	/Atpw	YF Bt	40	10	340	547	Ep	*R. parviflorus*
Ridge crest	△RR28P1	ICHmc2	/01b	MF Ct	35	14	014	613	Pl	*A. lasiocarpa*
NE slope	△RR38	ICH mc2	/Atpw	YF Bt	65	21	015	535	Ep	*R. parviflorus*
NE slope	△RR46	ICH mc2	/01	MF Cm	65	12	045	482	Hw	*T. heterophylla*
NE slope	△RR58	ICH mc2	/55	YF Bs	55	20	032	523	Ep	*R. parviflorus*

**YF= young forest, MF= mature forest, LS= low shrub, B= broadleaf, C= coniferous, t= two storied, m=multi-storied*

Table 5. 1. Ecological/Site Summary for Cow Hill (Rocky Ridge).

Area	Plot ID	Drainage	Soil Texture	Humus Form	Coarse Frag. (%)	% V. mem	Snags & CWD	Charcoal Presence
NE slope	△RR25	moderate	loam	mullmoder	35	1	few CWD and snags	in H layer
ridge crest	△RR28P1	rapid	sandy loam	hemimor	40	7	no stumps	none
NE slope	△RR38	moderate	loam	leptomoder	10	4	some CWD	in F layer
NE slope	△RR46	well	fine sandy loam	mormoder	35	0	sparse CWD	in humus
NE slope	△RR58	moderate	silty loam	mormoder	15	0	sparse stumps	black humus

Table 5. 2. Soil/Huckleberry/Fire Summary for Cow Hill (Rocky Ridge).

5.1.2.1 Ridge Crest

The majority of the ridge crest area is classified as the dry (submesic) Western hemlock - Step moss (ICHmc2 /01b) site series (Figure 5.4), often in complex with minor components of the drier (xeric – subxeric) Western hemlock, Lodgepole pine – Kinnikinik – Cladonia (ICH mc2 /02) site series (Figure 5.5). This /02 site series is a rare vegetation community in the Bulkley-Cassiar Forest District (Haeussler, 1998a). According to the rare ecosystem maps prepared for the Bulkley-Cassiar Forest District this ecological type occurs as the major ecological type at southeast end of the ridge. Field reconnaissance confirmed the existence of this site series in

this area. This subxeric–xeric site series is most prominent on south facing portions of the ridge and may require intermittent fire to avoid succeeding to western hemlock (Haeussler, 1998a).

Figure 5. 4 ICHmc2 /01b on NE slope near ridge top

Figure 5. 5 ICHmc2 /02: lodgepole pine with fire scar

The vegetation of the large ICHmc2 /02 area identified on the southeast portion of the ridge was characterized by mature lodgepole pine, with an understorey dominated by kinnikinik (*Arctostaphylos uva-ursi* [L.] Spreng.) and dwarf blueberry. There was some evidence of fire scarring on mature pines in this stand, particularly on mature trees located on or very close to the edge of the ridge crest.

The more common ICHmc2 /01b sites were characterized by open lodgepole pine stands growing on relatively shallow, coarse textured soils with a sparse shrub and herb layer and a dense moss layer composed primarily of feather mosses. Shrub cover was relatively light with representation from a number of xerophytic species such as soapberry (*Shepherdia canadensis* [L.] Nutt.), saskatoon (*Amelanchier alnifolia* Nutt. [Nutt.]), falsebox (*Pachistima myrsinites* [Pursh.] Raf.), and prince's pine (*Chimaphila umbellata* [L.] Bart.) as well as black huckleberry. These areas characteristically had thin mor humus forms often containing charcoal fragments.

Black huckleberry was present in these dry ridgetop associations at cover levels between five and fifteen percent. Black huckleberry cover increased to very high levels in canopy (windfall) gaps, particularly in areas transitional to more mesic types on gentle slopes with a northeast aspect. The dense cover of black huckleberry on the mesic – submesic site in the transmission line clearing at plot △RR24 (Figure 5.10) is an indication of the high suitability of these sites to support vigorous growth and high cover of black huckleberry in an early seral setting. However, despite their apparent vigour, huckleberry shrubs in the hydro cut had not produced fruit in the summer of 2000.

5.1.2.2 Northeast Slope

Figure 5. 6 ICHmc2 /Atcv: NE slope

Birch and aspen dominated hardwood communities extend over most of the northeast slope on the northern half of the ridge, and are primarily classified as the Trembling aspen – Pink wintergreen (ICH mc2 /Atpw) site series and the Trembling aspen – Canada violet (ICHmc2 /Atcv) site series (Figure 5.6) with some richer areas in wet depressions and shallow draws classified as the Mountain alder – Mitrewort site series (ICH mc2 /55). There was very little coniferous regeneration observed in these hardwood stands with a notable exception being a dense cedar hemlock thicket immediately north of plot △RR37. Paper birch (*Betula papyrifera* Marsh.) was the dominant species in the majority of these hardwood complexes with an increasing trembling aspen component on the drier, poorer /Atpw sites toward the upper slope and crest areas of the ridge. The understorey layer was characterized by well developed shrub communities dominated by thimbleberry (*Rubus parviflorus* Nutt.), prickly rose (*Rosa acicularis* Lindl.) and red osier dogwood (*Cornus stolonifera* Michx.) on most sites with some moister, richer ICHmc2 /55 areas on mid and lower slopes dominated by devil's club (*Oplopanax horridus* [Smith] Miq.). Generally speaking, the herb layer was less well developed than the shrub strata and bunchberry (*Cornus canadensis* L.) was the dominant herbaceous species on many sites.

Overall, the percent cover of black huckleberry was very low in the hardwood stands on this site. However, it was generally present on mesic and submesic hardwood sites as was observed in the two /Atpw plots which had covers of one and four percent. Black huckleberry was generally non-existent in the permesic and subhygric hardwood types, an observation which was confirmed at the ICHmc2 /55 ecosystem plot. On the majority of sites in the hardwood complexes, huckleberry exhibited a diminutive growth form and sparse distribution.

5.1.2.3 Southwest Facing Slope

Abundant colluvium, droughty soils, and dense brush complexes dominated by xerophytic species, and abundant evidence of fire, characterized south and west facing slopes close to the base of the basalt ridge. This south side of the ridge was dominated by a combination of trembling aspen and paper birch dominated stands with smaller proportions of pin cherry (*Prunus pensylvanica* L.f.) and Scouler's Willow (*Salix scouleriana* Barratt ex Hook.). Douglas maple (*Acer glabrum* Torr.) and saskatoon dominate the increasingly xerophytic habitats on scree slopes towards the base of the cliff (Figure 5.8). Xeric and submesic ecological types in the steeper areas at the cliff base were classified as the Paper birch – Douglas maple site series (ICHmc2 /Epdm) and the Trembling aspen – Kinnikinik site series (ICHmc2 /Atki). Beaked hazelnut (*Corylus cornuta* Marsh.) was observed in this area, but was far below the expected abundance for a warm aspect site with recent fire history. It is postulated that this reflects the transitional nature of this site to the more continental climate of the sub-boreal spruce biogeoclimatic zone where beaked hazelnut is generally absent.

Figure 5. 7 ICHmc2 /Atpw: SW slope, fire scarred aspen

Figure 5. 8 ICHmc2 /Atss: SW slope, colluvium

Moving south, away from the ridge, stand characteristics reflect increasing moisture and the rich nutrient status of this area. Large diameter aspen and birch dominate the overstory with a vigorous understorey layer comprised of prickly rose, red-osier dogwood and thimbleberry. These sites were classified as ICHmc2 /Atpw (Figure 5.7). Well developed examples occurred on the bench area near plot △RR6. This plot is in the middle of a small fire-skip area treed with large lodgepole pine fire veterans, as well as some large spruce, and was classified as the mesic Western hemlock – Step moss site series (ICHmc2 /01).

This fire-skip area supported abundant black huckleberry in the understorey. However, black huckleberry was absent from all of the hardwood associations on this southwest aspect apparently due to the extremely vigorous competition from other woody, fire-adapted shrubs.

5.1.2.4 Cow Creek Draw

The small north-south valley to the west of Cow Hill is the source area of Cow Creek. There is a rich wetland area in the draw which is classified as the western red cedar, Hybrid white spruce – Horsetail – Skunk cabbage site series (ICHmc2 /07) (Figure 5.9) which has significant occurrence of skunk cabbage (*Lysichiton americanum* Hult. & St. John).

Figure 5. 9 ICHmc2 /07

This locally rare plant community is blue-listed in the Bulkley Forest District (Haeussler, 1998a). The occurrence of skunk cabbage at this site extends the known range of this species inland in the Bulkley Valley based on the reported distribution and outlying occurrences of this species described in a report on rare plant communities of the Bulkley valley (Haeussler, 1998a).

5.1.2.5 Black Huckleberry Suitability

Figure 5. 10 Vigorous huckleberry along powerline

A south-facing aspect is one of the predictors of high suitability huckleberry habitat, based on an analysis of current and historic black huckleberry patches, (Burton et al., 2000). The Bek'et Degii Ts'ooyiin berry ground is situated primarily on slopes with cool northeast aspects. This is seemingly inconsistent with the expectation that traditional huckleberry patches would be located on sites with the highest potential for huckleberry growth and berry production. However, black huckleberry establishes and grows most vigorously on sites that do not have a summer moisture deficit (Haeussler et al., 1990). The valley bottom SBS dk subzone and ICHmc2 variant areas are very much drier than the higher elevation sites where black huckleberry is more extensively distributed and generally more abundant. Summer moisture deficits on warm aspects are common in these valley bottoms sites and cool aspects in these warmer drier climates may therefore provide better conditions for huckleberry growth and berry production. This is further corroborated by the existence of two other nearby, low elevation traditional huckleberry areas at Decen De'tekw and Ooniin'aay (Figure 5.1) which are both located on largely cool (east) aspects.

5.1.3 Cultural Context and Field Data

The Wet'suwet'en call this ridge "Bek'et Degii Ts'ooyiin"[15] meaning "we pick huckleberries on it" This site is widely recognized by this name among Wet'suwet'en speakers and it is a prominent valley landmark, visible from Highway 16 travelling north, just past the Trout Creek store. This ridge is one of three hills west of the Bulkley River in the vicinity of the Trout Creek/Bulkley River confluence reported as being traditional Wet'suwet'en huckleberry patches. The other hills named Ooniin'aay and Decen Det'ekw are north and west of Bek'et Degii

Ts'ooyiin (Figure 5.2). These traditional huckleberry areas are all within the Laksilyu house territory of Tsekalkaiyax (House on Top of a Flat Rock). The Chief of this house is Ut'akhgit, a name currently held by Henry Alfred of Moricetown. Several advisors report that they had often harvested huckleberries on this site in their lifetimes although huckleberry harvesting here seems to have stopped or declined markedly since approximately 1960[16].

Bek'et Degii Ts'ooyiin is located on an old trail which links the ancient Wet'suwet'en fishing site at Kyah Wiget (Moricetown) to the Gitxsan village of Gitsegukla through the Trout Creek and Gitsegukla valleys. This trail also provided the main linkage to the Wet'suwet'en (Laksilyu) territory of Kilwoneets in the McDonnell Lake area, an important trading site. This trail therefore linked the Wet'suwet'en with coastal groups and trade goods through the Copper River drainage and to the southwestern Wet'suwet'en territories via the Telkwa River and Burnie Lakes.

This Kilwoneets trail reportedly ran in the small valley between Bek'et Degii Ts'ooyiin and the other two adjacent huckleberry areas located on the east end of the Rocky Ridge. The trail ran through a rich wetland area that is the source of Cow Creek, an area that is significant because it is one of the few places where people from Moricetown could come to harvest skunk cabbage leaves to use in the drying of berries. Another significant skunk cabbage swamp occurs on northeast side of Bek'et Degii Ts'ooyiin between highway 16 and the Bulkley River. In *Delgamuukw* testimony, the late Madeline Alfred, former holder of the Chief name D'zeeh, refers to a named skunk cabbage harvesting area near Cow Hill at Doughty called, "Hag'il tzil yiih" (Madeline Alfred testimony *Delgamuukw et al. vs the Queen*, SCBC Transcript 40 p. 2658, 2659). This traditional harvesting site is quite likely the twenty hectare skunk cabbage swamp identified in Haeussler's 1998 rare ecosystem inventory and classified as ICHmc2 /07, a blue listed (locally rare association). The relative rarity of skunk cabbage in Wet'suwet'en territory, its

[15] This name is reported by a number of Wet'suwet'en advisors including Henry Alfred, Alfred Mitchell, Johnny David, Sarah Tait and Stanley Morris.

importance in berry drying and other food preparation processes, as well as the fact that this area is a named plant harvesting area, underline the cultural importance of this site. Furthermore, the proximity of two rare skunk cabbage sites to three important huckleberry picking areas would surely have added to the overall appeal of this general area as a destination for huckleberry harvesting and processing.

Figure 5.11. Melana Bazil with skunk cabbage leaves from Hag'il Tzil Yiih.

There was a great deal of physical evidence of traditional use documented on Bek'et Degii Ts'ooyiin. This included several sections of old trail, pockets of culturally modified lodgepole pine "food"[17] trees and two possible camp locations. A ridgetop trail running the length of the ridge crest had a clearly identifiable trailbed that was particularly well defined in the drier areas. Consistent blazes were found along sections of trail that ran through mature pine stands. In addition, there were several concentrations of culturally modified lodgepole pine trees (CMTs) adjacent to the trail. It is likely that the trailbed has been maintained by wildlife and occasional hikers but the antiquity of the blazes and the adjacent CMTs definitely confirm use of the trail by First Nations people. An additional section of trailbed was located running north-south along the contour in the middle of the north half of the slope. This trail was characterized by a very well defined trailbed. However, no blazes were observed even when the trail entered mature timber at the extreme north end of the ridge. It is expected that these trails branch off from the Kilwoneets trail although the linkage was not identified on the ground. It appears that the ridgetop trail enters the hydro cut at several locations and it is possible that the trail junction is lost in this disturbance.

[16] Most advisors discuss using this area in the 1950s or earlier, it may have been used later but it has not been reported.

Several pockets of pine "food" trees were found scattered in mixed pine, spruce, and hemlock stands on the north slope as well as in larger pockets of fifteen to twenty trees apiece in the mature pine stands which dominate the south end of the ridge. Lodgepole pine "noodles" were harvested in early spring (likely May at this low elevation) indicating that Wet'suwet'en made some use of this area in early summer prior to the berry picking season. Most CMTs were located in pine stands ranging in age from 100 to 135 years of age. However, some CMTs were observed to be in the younger 60 – 70 year old pine stands and were likely harvested in the 1950's or 60's. One pine CMT (Figure 5.12) located in an older hemlock/pine type at △RR45 was aged at 188 years and had a harvesting date of 1846 when the tree was 34 years old. The existence of seral stands of pine on some areas of the ridge may have attracted the Wet'suwet'en to make use of this accessible site in the early spring. Spring use of Bek'et Degii Ts'ooyiin was reported by a Wet'suwet'en advisor who indicated that the young seral areas around the ridge were used for bear hunting in the spring (Stanley Morris[18], personal communication, 2001).

Figure 5. 12 PI CMT: stripped in 1846

Henry Alfred recalls that this was the first place to find ripe huckleberries within this house territory, and picking took place here early in the season. Later in the season, members of Tsekalkaiyax house would travel to other huckleberry harvesting sites such as Reiseter ridge (Sool Nii) and an area across from Moricetown on the ridge between Gramophone Creek and Causqua Creek known as We'til Xoos. By utilizing a variety of sites, the members of this house group were able to extend the productive huckleberry harvesting period, providing additional

[17] Gitxsan and Wet'suwet'en people traditionally stripped the bark from lodgepole pine in the spring to scrape off the sweet phloem which was an important staple food.

[18] Stanley Morris, Chief Caspit of the Wet'suwet'en Cilhts'ekhyu (big frog) clan.

opportunities to gather and process sufficient berry supplies, and facilitating the integration of this activity with other aspects of the seasonal round.

The apparent importance of Bek'et Degii Ts'ooyiin as a huckleberry harvesting site is likely related to a number of locational, topographic and ecological factors. First and likely foremost, the proximity of this site and the two other nearby huckleberry hills to the major Wet'suwet'en summer fishing village (Moricetown), would have made this an ideal gathering site. Huckleberries ripening early on Bek'et Degii Ts'ooyiin would have been available at the height of the summer sockeye fishing season when most Wet'suwet'en, many from distant house territories, were gathered at Kyah Wiget to catch and dry their winter fish supply. Without straying too far from the fishing activities, Wet'suwet'en people could collect fresh huckleberries for feasting or easy drying in the valley bottom during some of the best mid-summer drying weather. In addition, the location of this site on two main travel corridors, the Bulkley River and the Kilwoneets trail made it very accessible and an easy stop going to or from Kyah Wiget (Moricetown).

The availability of skunk cabbage leaves, a locally rare and extremely useful resource, particularly for berry drying, must have added to the importance of this site as a berry gathering area. In historic times, berries from this site were transported back to Moricetown for drying (Alfred, 2000a), but prior to motorized access, berries may well have been dried on site.

An additional factor favoring this was likely its topography, as the basalt ridge forms a very effective firebreak. One can see a great deal of variability in the fire history of different areas around the ridge very clearly in the 1949 aerial photograph (Figure 5.1). The topography of this site therefore lends itself very well to a process of rotational burning to maintain productive berry patch areas on this site on a continual basis. In addition, the various aspects and relatively dry

climate in this valley bottom site would create many good opportunities to burn one or another berry patch area on the ridge in any given year.

Another Laksilyu Chief, the late Pat Namox (Wah'tah'kwets), indicated that the Wet'suwet'en managed black huckleberry areas using landscape burning techniques and that Bek'et Degii Ts'ooyiin or one of the other nearby huckleberry harvesting sites was managed in this way:

> People would burn certain areas. One area that is close to town is Doughty near Moricetown. The place is a big hill near Gitsegulka Lake Rd. on the west side of Hwy 16, this side (south) of Moricetown and behind the train crossing on the hillside
>
> *Wintergreen Consultants 1998*

Other Wet'suwet'en elders have also indicated that this site was managed using landscape burning.

5.1.4 Fire History

The abundant fire history evidence on this site suggests the influence of relatively frequent, low – moderate intensity fires. The existence of this type of fire regime was inferred from the following site factors:

1. Very little coniferous regeneration within the deciduous dominated stand.
2. Much older age classes in pockets at the bottom of the slope.
3. Very sparsely distributed large old stumps, particularly in the deciduous dominated stand.
4. Very sparse, large coarse woody debris which pre-dated the most recent fire.
5. An abundance of small charcoal fragments and ash in humus layers in soil pits and a general lack of large charcoal fragments.
6. Living coniferous trees at the edges of seral hardwood stands exhibiting fire scars.
7. Old coniferous snags within hardwood dominated complexes showing evidence of two fire events (Figure 5.13).
8. A variety of coniferous and deciduous stands representing different initiation dates in a relatively small area on and around the ridge.

9. Existence of large area of ICH mc2 /02 site series on the ridge, a community which likely requires maintenance by regular fire.
10. Areas at the edge of seral hardwood complexes, treed with coniferous species (Hw) with low branches intact (not burned) - no evidence of scarring.
11. Light charring on the surface of coarse woody debris that survived the last fire event.

Figure 5. 13 Pine snag records two fire events

Based on several tree core age samples and a number of fire scar dates, four distinct cohorts of trees were identified on this site, with a possible fifth cohort represented by only a single sample. These cohorts are associated with a series of stand initiating fires that have occurred over the past 225 years revealing a general pattern of fire frequency for this period.

The following cohorts were identified; 1) 65-75 years, 2) 101-109 years, 3) 118-139 years, 4) 165-216 years with another possible cohort based on a single sample, 5) 146 years (Figure 5.14). An accurate fire scar date was obtained from a tree stump in the harvested opening at △RR4 yielding a fire scar age of 120 years and indicating a fire event in 1880, the likely origin of cohort two. The age of this tree was 142 years suggesting a stand initiation date in the period from 1855-57[19], a date that fits well with the sample ages from cohort three. A group of older trees (cohort four) was located near the base of the slope in the area around △RR46 with the oldest sampled age being 216 years for an estimated initiation date between 1775-1785 or possibly earlier. The fire scar lobe at △RR42 is aged 58 years and was sampled with an increment borer, likely underestimating the scar date. This fire scar is believed to coincide with cohort one. This cohort is estimated to have originated from a fire event between 75 and 80 years ago, for a fire date between 1920 and 1925. The additional age sample of 146 years would coincide with an initiation date of approximately 150 years ago. It is however possible that

[19] This stand initiation period is an estimate based on the assumption that seedbanks of serotinous pine will germinate within 1-3 years of a fire event and allowing for a years growth hidden below stump height.

this individual tree (lodgepole pine) initiated in the understorey after the establishment of cohort four and may not be closely associated with a fire event.

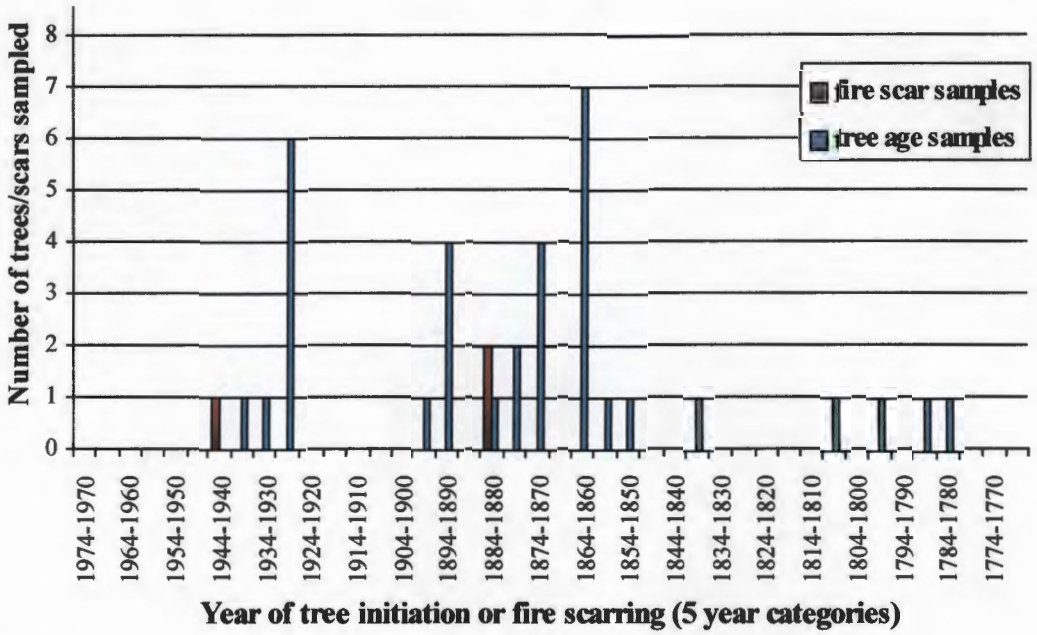

Figure 5. 14 Tree age cohorts from trees sampled at Cow Hill (Rocky Ridge).

In summary, there is significant evidence to support the occurrence of four fires on this site between approximately 1780 and 1925, after which active fire suppression began in the region (Gottesfeld, 1994a). Four fires over a 145 year period yields an average fire return interval of approximately fifty years with two fires occurring at an interval of 23-25 years. This fire return interval is markedly different than the 100-150 year mean event (fire) interval (Parminter, 1992) which is used in this study as the benchmark for the ICHmc2 variant and also much different from the 98 year return interval which is expected for the adjacent SBSdk biogeoclimatic subzone (Steventon, 1997). The fire return interval estimate for this site is conservative, and it is quite likely that other fires occurred on this site between these more significant events, but little evidence may remain to confirm this. It should be noted that all of the fire history evidence collected at this site is dated in the historic period when the influence of non-Aboriginal human ignition sources was also a cause of fires (Parminter, 1995).

5.1.5 Site Summary

Bek'et Degii Ts'ooyiin is an early season traditional huckleberry site, conveniently situated near the major Wet'suwet'en fishing village of Kyah Wiget and in close proximity to two other named traditional huckleberry harvesting areas. In addition, this site is located near two important skunk cabbage swamps. Opportunities for berry drying at or near this site during the early huckleberry harvest were likely excellent given the time of year (height of summer) and the dry, valley bottom location. The proximity of this site to major travel trails would have made it a very convenient stop even for a short period while enroute to or from Kyah Wiget. Reports from Wet'suwet'en advisors indicate that this site was well used and is still commonly recognized and referred to by its Wet'suwet'en name.

The ecological data collected confirms that the majority of this site is highly suitable for huckleberry production during early seral stages. Huckleberry was observed to be growing vigorously on suitable habitats and persisting in many mesic and submesic hardwood stands despite low light levels and strong competition.

The fire history evidence for this site indicates a relatively frequent fire regime in the historic period. Wet'suwet'en elders indicate that this general area was managed for huckleberries using landscape burning, most likely referring to the Bek'et Degii Ts'ooyiin ridge. Site characteristics such as the lack of old stumps and coarse woody debris on the site suggest that a frequent fire regime has influenced site characteristics for a significant period of time, quite likely predating the historic period.

5.2 Reiseter Ridge (Sool Nii): Case Study

5.2.1 Introduction

This berry harvesting site is located on a southwest facing slope at the northwest end of Reiseter ridge (Sool Nii) on the south side of Reiseter Creek. This area is located on the east side of the Bulkley River, approximately 10 km south of the traditional Wet'suwet'en fishing village of Moricetown (Kyah Wiget).

While field reconnaissance data for this site is somewhat inconclusive on its own, when combined with interview information as well as historical and ethnographic research there are strong indications that this site and Reiseter Ridge as whole were very important berry gathering areas for the Wet'suwet'en

This site is characterized by predominantly deciduous complexes (aspen dominated) on the lower areas (below 750 metres), and seral pine communities on the upper slopes. Some of the older lodgepole pine communities are succeeding to subalpine fir and hybrid white spruce (*Picea glauca x engelmannii*), particularly at higher elevations. The entire hillside was reportedly used as a berry gathering area, with saskatoons harvested at lower elevations and along the Telkwa High Road and black huckleberries harvested on the upper slopes (Alfred, 2000a). The aerial photo (Figure 5.15) shows the extensive deciduous vegetation complexes that existed on this site in 1949. Much of the area continues to be occupied by deciduous vegetation communities.

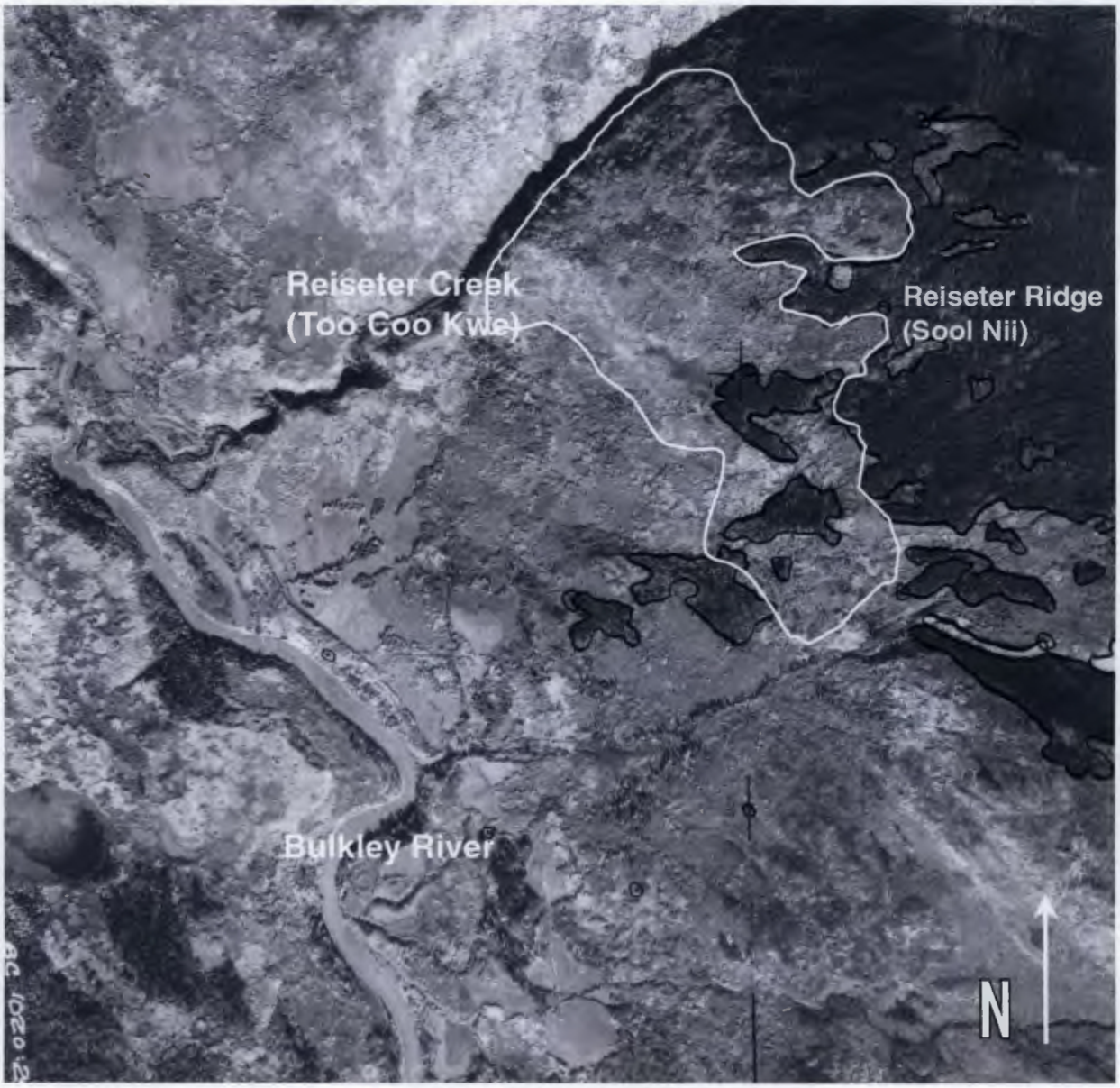

Figure 5. 15 Air photo depicting Reiseter Berry Patch (taken in 1949). Photo shows the extensive deciduous vegetation complexes that existed on this site in 1949 (airphoto scale is approximately 1:33,000).

A.L. Poudrier, surveying this area in the summer of 1892 included the lower reaches of this berry harvesting site and the entire lower (southwest facing) slope of Reiseter Ridge (between Reiseter and Driftwood Creeks) in township two. Poudrier (1893) made the following comments on the landscape of this township:

> ...On the hills the spruce and balsam predominate, but on the lower land the vegetation is composed of a light thicket of aspen poplar, balsam poplar and small birch. There are also numerous extents of open country covered with a rich growth of hay where from two to three tons can be cut to the acre. Several tons have been cut by the Indians...

5.2.2 Ecological Overview

The Reiseter ridge site ranges in elevation from 600m to 1300m (near the top of the ridge). However, the early seral vegetation types (within the study site) that would have been used for berry harvesting in historic times (within the memories of Wet'suwet'en elders) were generally located below 1100m. This berry harvesting area is located within the Sub-Boreal Spruce (SBS) biogeoclimatic subzone. The lower area of the berry patch is located in the dry, cool (SBS dk) subzone and the upper slope in the "Babine" (SBS mc2) variant. The site series encountered during the fieldwork were primarily mesic and submesic, although wetter areas are located in and around seepage zones, and depressional areas that make up a relatively minor portion of the overall landscape of this site. Ecological data for the ground inventory plots installed on this site are included in tables 5.3 and 5.4.

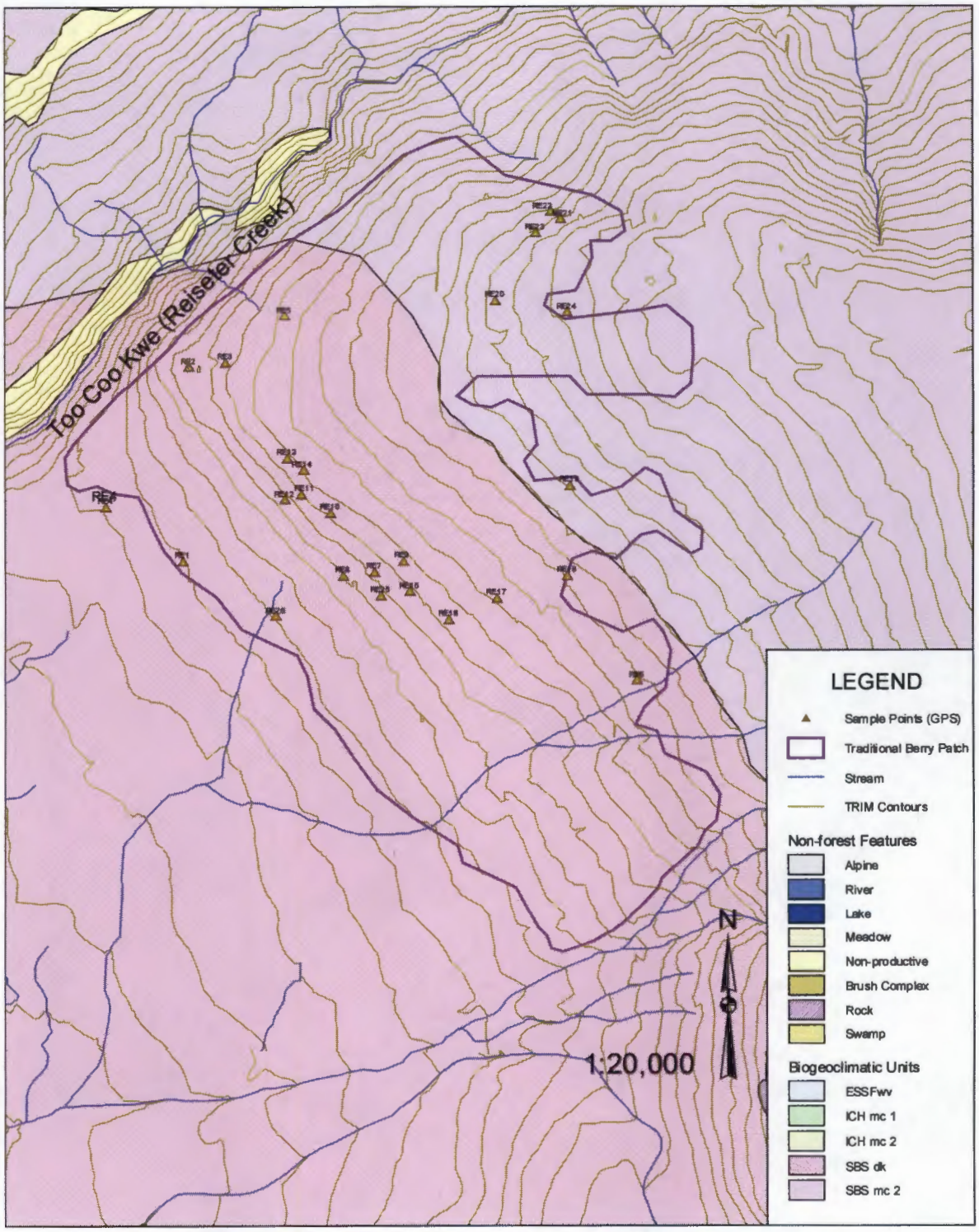

Figure 5. 16 Sool Nii (Reiseter Ridge) Huckleberry Area and Field Sample Points

Area	Plot ID	BGC Unit	Site Series	*Stand Structure	Crown Closure	Slope (%)	Aspect (deg.)	Elev. (m.)	Dominant tree	Dominant shrub
Lower slope (transitional)	△RE9	SBS dk	/05	YF Ct	35	40	230	749	Pl	*R. acicularis*
Upper slope	△RE22	SBSmc2	/01c	YF Ct	75	34	003	878	Pl	*V. membranaceum*
Lower slope	△RE25	SBS dk	/Atcv	YF Bs	80	25	232	715	At	*S. albus*

**YF= young forest, B= broadleaf, C= coniferous, t= two storied, s= single-storied*

Table 5. 3 Ecological/Site Summary for Reiseter Ridge.

Area	Plot ID	Drainage	Soil Texture	Humus Form	Coarse Frag. (%)	% V. mem.	Snags&CWD	Charcoal Presence
Lower slope (transitional)	△RE9	rapid	sandy loam	mormoder	15	10	some old rootwads (CWD)	in F layer
Upper slope	△RE22	rapid	loam	hemimor	65	12	some snags and stumps	in F layer
Lower slope	△RE25	moderate	silty clay loam	mullmoder	0	0	no stumps or CWD	in F and H layers

Table 5. 4 Soil/Huckleberry/Fire Summary for Reiseter Ridge.

Ecological summaries for the upper and lower sections of this area are provided in the following sections.

5.2.2.1 Lower Slopes (Deciduous Complexes)

Seral aspen stands with a significant component of Scouler's willow and some black cottonwood (*Populus balsalmifera ssp. trichocarpa* [T.&G.] Brayshaw) dominate the lower slopes. These hardwood dominated stands typically have a vigorous shrub layer characterized by snowberry (*Symphoricarpos albus* [L.] Blake), thimbleberry, prickly rose and red osier dogwood. Drier exposed openings had significant populations of pin cherry, saskatoon and rocky mountain juniper (*Juniperus scopulorum* Sarg.). In most cases, these fire dependent species were observed to have been overtopped by aspen and birch and generally exhibited declining vigour. Coniferous regeneration was sparse to non-existent in most of these hardwood

ecosystems indicating, as others have postulated, the influence of a fire regime with a return interval short enough to preclude seed production and regeneration of coniferous species (Williams et al., 2000a). In some cases, single or small groups of lodgepole pine veterans were scattered within the stand. The herb layers of these hardwood stands were dominated by peavines (*Lathyrus* species) with variable components of showy aster (*Aster conspicuus* Lindl. in Hook.), blue wildrye (*Elymus glaucus* Buckl.) and fireweed. Generally speaking these hardwood stands have little or no moss/lichen layer apparently due to low light levels and deep annual deposits of deciduous and herbaceous litter.

Figure 5.17 SBSdk /81 and view to the NW

The hardwood dominated stands on the lower hillside are a mosaic of the Trembling aspen – Saskatoon – Snowberry site series (SBS dk /Atss), the Trembling aspen – Kinnikinik site series (SBS dk /Atki) and the Trembling aspen – Canada violet site series (SBSdk /Atcv). An occurrence of the red listed Saskatoon-Slender wheatgrass scrub/steppe (SBSdk /81) site series was recorded at △RE11 (Figure 5.17). In addition, there are three other occurrences of rare seral grassland scrub communities (SBSdk /81[1 site], Bluegrass – Slender wheatgrass grassland site series (SBSdk /82 [2 sites])) identified on this site(Haeussler 1998a). The predominant site series in the area was the submesic, medium-rich SBSdk /Atss (very high snowberry component) with a few areas of the subxeric SBSdk /Atki site series in areas with steep slopes and rocky or shallow soils. Sites toward the toe of the slope were dominated by the subhygric, rich-very rich SBSdk /Atcv site series with scattered large cottonwood veterans and vigorous shrub layers.

Black huckleberry was conspicuous by its absence throughout most of the hardwood complexes on this site, occurring only in the drier SBSdk /Atki associations and then only in very low abundance with patchy distribution. It appears unlikely that black huckleberry would

colonize any but the driest areas of the deciduous stands following future disturbance, as most sites have deep, rich moder humus forms, dense covers of other fire adapted rhizomatous species such as snowberry and thimbleberry and little or no huckleberry cover at present.

5.2.2.2 Upper Slopes (Coniferous Stands)

Figure 5. 18 Remnant pine stand succeeding to subalpine fir

The upper slopes (above 800 metres) were forested with a variety of lodgepole pine dominated stands, which varied with respect to age class and species composition, depending on elevation, aspect and disturbance history. The lower elevation coniferous areas are located in the transition zone between the SBSdk and SBSmc2. They were predominantly young lodgepole pine stands of recent fire origin with some fire-skip areas dominated by widely spaced lodgepole pine veterans and substantial ingress of subalpine fir poles and saplings (Figure 5.18). Pure seral pine stands (Figure 5.20) were generally located on sites with well drained, coarse textured soils on warm aspects. Ecological associations were a mosaic of SBSdk /01b and /05 types with a moderately developed, relatively sparse, low shrub/herb layer. Higher elevation pine dominated stands in the SBSmc2 were characterized by an understorey with dense coverage of subalpine fir regeneration and canopy layers containing few deciduous stems. The cool northwest facing slope above Reiseter Creek was characterized by areas of coarse colluvial parent materials and a significant amount of western hemlock in the subcanopy and understorey layers, an indication of the proximity of this area to the Interior Cedar-Hemlock biogeoclimatic zone, more specifically, the ICHmc1 (Nass variant).

Generally speaking, these higher elevation coniferous forests had low to moderate cover of black huckleberry with a fairly even distribution. In some areas black huckleberry cover was quite high (Figure 5.19) although it was not observed to bear fruit in any of these areas in 2000.

Black huckleberry was observed to grow very vigorously on disturbed roadside areas on coarse textured substrates in upper slope areas above Reiseter Creek.

Figure 5. 19 Vigorous huckleberry and Pl vets in a fire "skip"

Figure 5. 20 Vigorous huckleberry in a young pine stand

5.2.2.3 Ecological Summary

Coniferous and deciduous forest stands are stratified by elevation on this former berry patch site. However, these vegetation types also roughly correspond to variations in soil texture with hardwood stands dominating areas with finer textured, clayey soils and pine dominated coniferous stands dominating on coarser textured soils and in areas with a high coarse fragment component. The vegetation assemblages on this site reflect the influences of the predominantly warm southwest aspect, relatively frequent fire events as well as historic disturbance factors such as logging and grazing. Generally speaking, these topographic and disturbance factors have encouraged the growth of the deciduous complexes and other early seral types on this site, favouring the persistence of these communities over long periods.

5.2.3 Cultural Context and Field Data

This site is located within the Laksilyu house territory of Tsekalkaiyax (House on Top of a Flat Rock) under Chief Ut'akhgit, a name currently held by Henry Alfred of Moricetown. It is one

of several traditional Wet'suwet'en huckleberry harvesting areas reported on the slopes and ridges east of the Bulkley River from Kwun Creek to Driftwood Creek. This site is part of a large ridge called "Sool Nii" (Reiseter Ridge) which runs northwest to southeast between the Reiseter and Driftwood Creek drainages. This site is reported to have ripe huckleberries later in the season than Bek'et Degii Ts'ooyiin (discussed earlier) and traditionally was the main huckleberry site for Tsekalkaiyax (Alfred, 2000a).

This site is located to the northwest of an old Wet'suwet'en trail which joined the ancient fishing village of Kyah Wiget (Moricetown) with the Tsekalkaiyax traditional winter village at "Deets'il yee" now known as Glentanna. This trail later became the Telkwa High Road. A second trail connects the old Wet'suwet'en village at Glentanna to the goat hunting area and fish trap site at Reiseter (Two Bridge) Lake, crossing Reiseter Ridge in the vicinity of a large grassland/meadow mosaic now commonly known as "Moose Meadows".

Near the west end of Reiseter ridge and immediately south of the former berry patch area is an area named "Gguus Cen" meaning literally "Cow parsnip at the base of a hill". Tender stalks of cow parsnip were harvested as an early spring vegetable by the Wet'suwet'en, and the name suggests they may have used this area early in the year to harvest this important food as well as during late summer for berry picking. The lower slopes of Reiseter ridge and the level areas along what is now the Telkwa High Road were commonly used for picking saskatoon berries (Alfred, 2000a).

Henry Alfred (2000a) relates a story about picking berries at this site with his family and other house members in the 1950's:

> We would leave Moricetown with two wagons and travel south along the Telkwa High Road until we got to the bridge over Reiseter Creek. We would cross the bridge and stop the wagons. My Dad would walk to the ranch house that was

> owned by Gertie Douglas to ask permission to access the berry patch on the hillside, behind her ranch. With permission granted, the berry pickers moved the wagons to the base of the hill and set up camp. The adults and able youngsters would make the journey up the hill to the huckleberry areas, younger children and older people would pick saskatoons along the Telkwa High Road. The group would stay at this spot for about two days, until they had enough berries to fill the spare wagon (about the size of a pickup truck box). The berries would then be taken back to Moricetown (fresh) and processed at home. I remember my mother and grandmother drying berries in Moricetown using the traditional berry racks. I would have to collect thimbleberry leaves (no holes!) to line the racks. Dried berry cakes were then stored in elevated cache boxes to avoid spoilage. In later years my mother jarred or froze our berries.

There was very little cultural evidence encountered during field reconnaissance on this site. It should be noted that the majority of the field time was spent surveying early to mid-seral stands where there is much less opportunity to encounter cultural evidence than in older timber types. Also, this site has had a longstanding history of significant non-native use by prospectors, hunters and recreationalists and is crisscrossed with a number of roads, used most recently to access two cutblocks higher on the slope. Evidence of prospecting cabins and small mining operations were found in several areas on this site. There were also some blazes encountered on the upper slope: age samples indicated that they were made within the last 50 years and it is not possible to determine their origin. Agricultural developments and grazing activities associated with an active ranch operation located at the base of the hill may have erased signs of the camp area reported by Henry Alfred.

5.2.4 Fire History

This site is located within both the SBSdk and SBSmc2 biogeoclimatic variants. Mean fire return interval estimates for the SBSdk are 98 years and for the SBSmc2, 148 years (Steventon, 1997). Other research has found that large ridges are susceptible to higher fire frequency than the surrounding landscape (Heinselman, 1973). This topographic propensity to burn, the southwest aspect and the drier climate at lower elevations in the Bulkley Valley have likely all contributed to a relatively short natural fire return interval, as compared to other sites in this area. Conversely, the location of this site at the boundary with the wetter interior cedar hemlock

biogeoclimatic zone would suggest a slightly wetter climate than other areas of the SBSdk and SBSmc2 and possibly a fire frequency longer than the average for these sub-boreal biogeoclimatic variants.

The fire history of this berry patch area is defined to a large extent by a significant fire event occurring around 1925[20] (Figure 5.21). Fire scar lobes from three lodgepole pine veterans distributed across this site were counted at 74, 75, and 76 years. The very high occurrence of age class 3 and 4 stands (40-80 years) on the southwest face of Reiseter Ridge as a whole, is an indication of the large amount of fire activity which took place here during this time period. An additional pine fire scar lobe at △RE1 was sampled with an increment borer yielding an approximate fire date of fifty three years ago (1947). However, increment borer samples of fire scars are often inaccurate (unless several samples are taken) and it is quite possible that this scar also records the 1925 fire event.

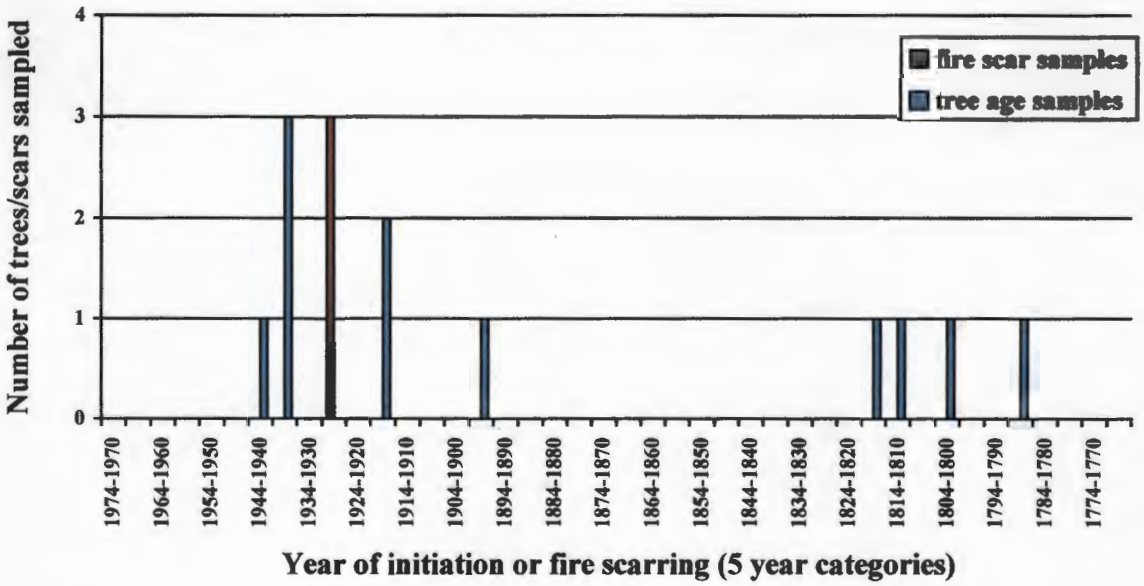

Figure 5. 21 Tree age cohorts from trees sampled at Reiseter Ridge.

[20] This date is used for the purposes of discussion, actual fire date could be between 1924-1926 based on the fire scar evidence collected during field reconnaissance.

Cohort ages for many of the pine stands on this site seem to correspond to a fire disturbance in 1925. Older fires are recorded in core samples from lodgepole pine veterans located in upper slope areas and fire-skip patches and from single lodgepole pine veterans within the hardwood types indicate that there may be a variety of older age classes, as ages of 181, 187 and 211. The age of the pine fire snag at △RE5, likely killed by the most recent conflagration is 88 years, and based on the assumption that it was killed by the 1925 fire, would correspond with a current age of 163 years. A living pine also located at △RE5 was aged at 84 years and a nearby aspen at △RE3 was 82 years, both pre-dating the most recent fire event (based on fire history sampling) and indicating the probable occurrence of an earlier fire in the early 1900s. On the whole, it appears that there have been at least three fire events between 1775 and 1925 with fire events apparently occurring in the following time periods: 1) 1771-1786, 2) 1906-1916 and 3) 1923-1926. However, without many more ages, from a variety of stands on this site, it is difficult to determine cohort classes with a sufficient degree of certainty to reconstruct the fire history of this site prior to the 1925 fire.

Figure 5. 22 Cottonwood with fire scar in SBS dk /Atcv

Figure 5. 23 pine fire snag

Figure 5. 24 Fire scarred pine in SBS dk /Atpw

In summary, the fire history evidence confirms a significant fire event at this site between 1924-1926 which was apparently the origin for the majority of the seral hardwood and pine stands in the study area. Adjacent older pine dominated stands and fire-skip areas yielded a

number of older stand initiation dates which correspond to one or more fire events in the late 1700s and possibly the early 1800s. An additional intermediary age class was identified, corresponding to a stand initiating event prior to the 1924-26 period, likely in the period between 1910 and 1920. The field data indicates that there were at least three, and possibly four stand initiating events on this study site in the 150 year period between 1771 and 1925. It is likely that other stand initiation events occurred in the area such as the one which created the young seral aspen stands observed by Poudrier in the summer of 1892.

The long term fire history of this site may be inferred from the predominance and persistence of hardwood communities over the majority of the lower elevation areas. These areas were observed to have little or no coniferous regeneration, an indication that these communities have likely developed under the influence of a relatively frequent fire regime. In theory, these fires would have recurred at short enough intervals to preclude the production of a coniferous seed source by fire-following coniferous species such as lodgepole pine. Increasing occurrence of pine stands in higher elevation areas of this site may be related to longer fire return intervals (cooler, wetter climate) and or the proximity to seed sources in the older coniferous stands dominating the higher elevation areas of the ridge. Lower intensity fires likely contributed to the maintenance of early seral hardwood, shrub and grassland communities on this site, including the locally rare scrub/steppe communities.

The fire history data from this site indicate a fire return interval that is significantly different (more frequent) than that expected for the "natural" fire regime. The data indicate a fire return interval of approximately 50 years or less as compared to the average of 98 years for SBSdk and 148 years for the SBSmc2 as identified by Steventon (1997). It is important to recognize that this mean fire return interval estimate is derived from evidence of fires that occurred in the historic period, and the impacts of non-aboriginal land management activities that likely affected the fire regime on this site, cannot be discerned from aboriginal burning activities.

5.2.5 Site Summary

The large amount of early seral habitat on this northwest end of Reiseter Ridge would have provided good opportunities for huckleberry picking from the 1930's through until the 1960's when this site was reportedly used by Wet'suwet'en advisors and a number of other valley residents. Al Fletcher, a long time valley resident testifying in *Delgamuukw* vs. the Queen identified an area near Deer Meadows (further south on Reiseter Ridge) as a huckleberry harvesting site used by early pioneer families in the Driftwood and Glentanna area:

> Q: When you were growing up, was there any place that you or your family went for berries or other pioneers?
> A: Yes, we went for huckleberries up on the mountain about two miles, an old place called the Deer Meadows. Some clearings up on the hills a couple of miles from there we used to pick huckleberries....Between Driftwood and Glen Tanna.
> Q: But it would be up higher?
> A: Yes.
> Q: And how would you get there?
> A: It was an old trail....From Driftwood
> Q: Okay. And it cuts in up to these berry grounds?
> A: Yes.
> Q: Was that an area, do you remember, did it look like an area that had been burned?
> A: Yes -- I don't know. Those meadows have been there since I can remember....there is a lot of burnt windfalls around -- there could have been a fire there.
> Q: Do you remember that there were -- there are trails above the Deer Meadows going northeast -- or northwest and southeast?
> A: It's possible. I have seen trails on top of the mountain, but you know I just assumed they are game trails.
> Q: Okay. I would like to show you Exhibit 164 again. And I would just like to point to you the dotted line from Glen Tanna numbered six going up to Two Bridge Lake and then circling over to the number 3 and coming down at a place labeled IR number 3, which is -- it goes along Gramophone Creek. Now, do you -- have you seen -- you have traveled, as I understand it, up to Two Bridge Lake on many occasions?... And have you seen this trail?
> A: I am pretty sure I have seen it. Where we used to pick huckleberries on those meadows up there....Up above a mile above that, I'm sure there is some old blazes in this trail there. It's on the height of land.
> Q: Do you recall seeing on this trail the left fork of the trail going up on your trapline towards Two Bridge - do you recall seeing blazes on that trail...I understood there was an Indian blaze with Indian names ... in that area. You remember that?
> A: Yes, I think so.
>
> *Delgamuukw et al. vs the Queen*
> *Commission Evidence of Allen Fletcher*
> *Exhibit 355, pages 49, 52, 83*

Given the apparent suitability of this ridge as a huckleberry producing area it is quite probable that Wet'suwet'en people once used a large portion of this area as a berry ground. The following evidence supports this hypothesis:

1. The current existence of extensive fire dependent seral vegetation complexes on the ridge.
2. The existence of early seral vegetation throughout the lower reaches of the ridge prior to the turn of the century (as reported by Poudrier).
3. The proximity of this site to the main Bulkley Valley travel trail (Telkwa High Road) and to the Reiseter Lake hunting/trapping trail.
4. The proximity of this site to the traditional Wet'suwet'en winter village site at Glentanna.
5. The existence of other known huckleberry patches on this ridge as reported by early settlers and the reported existence of trails near these areas.
6. Several other Wet'suwet'en huckleberry patches located on similar ridges in the area.

The Reiseter ridge huckleberry harvesting area remains a bit of a mystery, for although it was used in historic times, Wet'suwet'en advisors do not mention it nearly as often as other huckleberry sites further north such as Bek'et Degii Ts'ooyiin and Wetil Xoos. This could be related to the forced removal of the Wet'suwet'en from their winter village at Glentanna (Henry Alfred, personal communication, 2000; Mills and Overstall, 1996) and the alienation of virtually all of the land at the base of Reiseter ridge to private holdings in the early 1900s. These factors likely favored the use of other sites closer to Moricetown and the Wet'suwet'en summer places at Hudson Bay Ranch (Oschawinna IR #3). Despite the limited amount of current anecdotal evidence and the relative paucity of cultural heritage evidence at the site, the ecological, historical and fire history information assembled supports the longstanding importance of this site as Wet'suwet'en huckleberry gathering area. The final word goes to Henry Alfred, Chief Utakhg'it who explains, "A long time ago, Reiseter was the main place for berries, the people would always go there".

5.3 Harold Price: Case Study

5.3.1 Introduction

This berry harvesting area is located on a northeast facing slope of Blunt Mountain in the lower Harold Price drainage, immediately south of the confluence of Harold Price Creek and the Suskwa River (Figure 5.25). The site ranges in elevation from approximately 500 metres at Harold Price Creek to approximately 1200 metres at timberline. The vegetation of this site is largely characterized by mature hemlock dominated forests on moderate northeast slopes.

5.3.2 Ecological Overview

This area is located on the cusp of the transition between the extensive, rolling uplands of the Nechako plateau and the deeply incised topography and moderate climate of the coastal mountains. Lower elevation sites within the study area are classified within ICHmc2 and ICHmc1 variants. The ICH mc2 variant is predominant on the north end of the site, while the ICH mc1 biogeoclimatic variant covers the southern portion, both ICH variants giving way to the ESSFwv biogeoclimatic subzone at elevations above 1000 metres based on recent biogeoclimatic mapping for the Bulkley Forest District (Figure 5.26). The berry area is located on a moderate northeast slope, which gradually increases in pitch as one moves southwest, away from Harold Price Creek. The site is predominantly mesic and submesic, particularly on upper slopes and toward the steeper northwest end of the berry area, with some extensive submesic types on well-drained sites with loamy soils. Small, isolated seepage sites, wet benches and depressional areas supporting richer permesic and subhygric site associations were found across the slope, increasing in frequency and extent toward the southeast end of the berry patch area.

Figure 5. 25 Airphoto of Harold Price huckleberry Area (1960), scale is approximately 1: 23,000

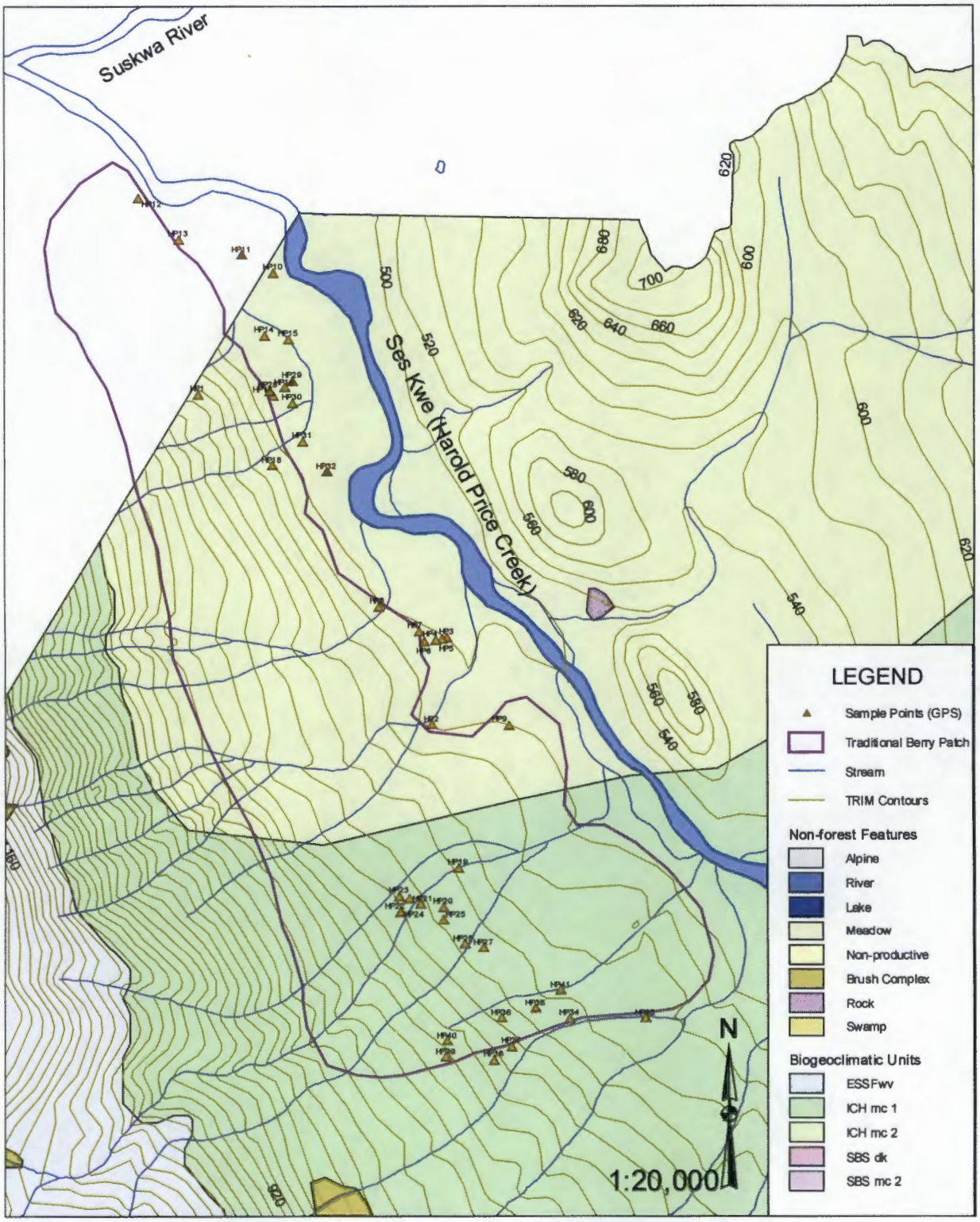

Figure 5. 26 Lower Harold Price Huckleberry Area and Field Sample Points

At present, the site is heavily timbered with western hemlock, Roche spruce (*Picea x lutzii* Little), western red cedar, subalpine fir and lodgepole pine, with some pockets having a significant deciduous component comprised of black cottonwood, trembling aspen and scattered paper birch. Western hemlock and lodgepole pine dominated stands were predominant in submesic areas on well drained soils, with some lodgepole pine dominated stands on the driest sites (ICHmc2 /01b) such as the extensive pine/hemlock stand (Figure 5.27) located south and east of the berry camp (△HP21). To the southeast and on lower slopes, the deciduous component becomes more prevalent with increasing moisture status and more open stand characteristics. Cedar and spruce began to form a larger component of the stand in these moister, richer areas. The following tables (Table 5.5 and Table 5.6) summarize the results of four ecosystem sample plots installed across the site:

Area	Plot ID	BGC Unit	Site Series	*Stand Structure	Crown Closure	Slope (%)	Aspect (deg)	Elev. (m)	Dominant tree	Dominant shrub
Hillslope	△HP12	ICHmc2	/01	YF Cs	90	45	060	495	Hw	none
Hillslope	△HP20	ICHmc1	/01b	YF Ct	60	19	038	595	Hw	*M. ferruginea*
Hillslope	△HP24	ICHmc1	/01a	MF Cm	75	20	040	630	Hw	*T. plicata*
Hillslope	△HP41	ICHmc1	/01a	YF Ct	70	12	015	575	Hw	*T. heterophylla*

*YF= young forest, MF= mature forest, C= coniferous, s= single-storied, t= two storied, m= multi-storied

Table 5. 5. Ecological/Site Summary for Harold Price.

Area	Plot ID	Drainage	Soil	Humus	Coarse Frag. %	% *V. mem*	Prev. forest	Charcoal
Hillslope	△HP12	moderate	Silty loam	lignomoder	50	0	sparse old stumps	charcoal in humus
Hillslope	△HP20	well	loam	hemimor	35	10	no stumps or CWD	no charcoal
Hillslope	△HP24	moderate	loam	hemimor	20	4	few stumps	no charcoal
Hillslope	△HP41	moderate	Silty loam	mormoder	15	2	no stumps some CWD	charcoal in humus

Table 5. 6. Soil/Huckleberry/Fire Summary for Harold Price.

5.3.2.1 Mesic Hillslope

Ecological sampling was carried out primarily in the mesic and submesic sites which dominated this area. These zonal sites were primarily situated on moderate slopes (10%-40%) with northeast aspects. The well drained soils on these sites were formed on morainal parent materials and classified as dystric brunisols. Soil texture varied from silty loam to loam and the coarse fragment component was moderate, generally in the 20-30% range.

These sites were classified As ICHmc2 /01 and ICHmc1 /01b (Figure 5.27) and ICHmc1 /01a. Vegetation communities were characterized most prominently by dense covers of feather mosses, primarily stepmoss (*Hylocomium splendens* [Hedw.] B.S.G.). Shrub layers were generally sparse and weakly developed and were often dominated by coniferous regeneration but most areas had at least some coverage of ericaceous species such as false azalea as well as black huckleberry. The herb layer was very sparse and was primarily represented by diminutive species such as bunchberry and five-leaved bramble (*Rubus pedatus* J.E. Sm.).

Figure 5. 27 ICHmc2 /01b: Hw/moss

Fairly high levels of crown closure were observed in the predominantly hemlock dominated stands on these mesic and submesic sites, drastically limiting light transmission to understorey layers. Ecological plots had crown closure values from 60% to 90% (Table 5.5) with an overall average of about 70%, which was a result of the dense overstory as well as the influence of high numbers hemlock poles and saplings in many areas.

Black huckleberry was generally present on these mesic sites and had a relatively even but sparse distribution. Most huckleberry shrubs exhibited a low, reduced growth form and low to moderate vigour (Figure 5.28). Canopy gaps generally exhibited increased cover of huckleberry

Figure 5. 28 Huckleberry in low light environment

relative to other areas but were often also associated with higher levels of competitive coniferous regeneration. The drier submesic types such as the area at plot △HP20 appear to afford the best opportunities for huckleberry growth and persistence as stand densities and coniferous regeneration are both relatively low. This plot had the highest black huckleberry cover values of the four sample plots, and in general, huckleberry in this submesic type was observed to have higher cover and better vigour than other areas within the patch as a whole.

Reconnaissance of a nearby cutblock on a mesic - submesic site revealed that canopy removal alone will not necessarily result in a return of black huckleberry to these sites. This cutblock had been harvested approximately ten years ago and was planted with lodgepole pine seedlings. A transect of the block revealed that the site was dominated by the following species; raspberry (*Rubus idaeus* L.), fireweed, paper birch, and thimbelberry. Black huckleberry was not observed in this opening at this time. The surrounding forest was classified as ICHmc2 /01 and was characterized by a dense hemlock stand (100 years approx.) with few shrubs or herbs and a continuous carpet of feathermosses. Huckleberry was present at low densities in this (adjacent) mature stand, persisting as a low shrub as it had throughout similarly mesic areas on the nearby study area.

Reports from fieldwork carried out in 1986 on "fresh unburned clearcut" sites in this area, at slightly higher elevations (800m) revealed fruiting black huckleberry growing in relatively open vegetation communities, apparently free from strong competitors (Haeussler, 1987). It is quite possible that black huckleberry had initially been present on the clearcut area surveyed in 2000, and responded well to canopy removal but was later displaced due to competition from other shrub species.

5.3.2.2 Toe Slope and Other Receiving[21] Sites

Moister, richer sites were located in receiving areas such as toe slope, small benches, depressional areas and adjacent to drainage features. These sites were increasingly common toward the south end of the area, particularly on lower slopes. Common site series were the Western hemlock, Subalpine fir – Oak fern site series (ICHmc1 /03) and the Western hemlock, Subalpine fir – Devil's club site series (ICHmc1 /04) with the drier, poorer /03 association being most common and covering extensive areas south and east of △HP34. A large Cottonwood / devil's club site classified as ICHmc1 /04 is also located 100 metres north of the berry camp located at △HP21. Toe slope areas and terraces adjacent to Harold Price Creek at the northeast end of the area surveyed were largely comprised of complexes of Western hemlock, Western red cedar – Oak fern site series (ICH mc2 /03) and the Western hemlock, Western red cedar – Devil's club site series (ICHmc2 /04), which are the corollaries of the ICHmc1 rich, subhygric types. Some mesic areas were also found on these terraces in areas of coarse glacio-fluvial deposits.

Black huckleberry was conspicuous by its absence on these wetter, richer sites. It was occasionally observed in the permesic ICHmc1 /03 and ICHmc2 /03 associations but generally only as individual occurrences exhibiting a low growth form and reduced vigour.

5.3.2.3 Successional Dynamics

Several sections of the stand, particularly the mesic and richer sites, had declining aspen persisting as single stems or small patches, as well as snags of aspen and Scouler's willow scattered among thrifty conifers. These dead and declining deciduous remnants are an indication that seral, deciduous species had formed a significant component of the stand in the past. Wetter areas and lower slopes still supported healthy, mature stands of black cottonwood evident as yellow foliage in the aerial view of the area (Figure 5.29).

[21] "receiving" refers to sites which receive (and retain) seepage.

The stands on the hillslope are generally even-aged and dominated by western hemlock. The regeneration of these stands is of interest in the context of this study due to the seeming incongruence of a densely stocked, even-aged coniferous stand existing on a site that has been influenced by what appears to have been a series of relatively frequent fire events. If this area had been maintained as a seral shrubfield by such a fire regime, one would expect conifer regeneration to be relatively sparse at least in the initial stages of stand establishment, due to the consumption of available coniferous seed source by recurring fires. Deciduous dominated stands observed on other berry patch areas in the ICHmc2 (Bek'et Degii Ts'ooyiin) exhibited evidence of this effect. Other authors have postulated that a lack of coniferous regeneration in these deciduous dominated stands is due in large part to a frequent fire regime (Williams et al., 2000a). Post-fire ingress of coniferous species would therefore be expected to progress relatively slowly, resulting in a multi-aged stand that reflects the gradual nature of coniferous establishment. As this is not the case, fire history and ecological data from this site must be more carefully scrutinized.

Figure 5. 29 Aerial view of the berry patch slope

It is possible that the attributes of western hemlock, the dominant species in the stand, in combination with the physical site characteristics, may have facilitated the rapid regeneration of a relatively even-aged hemlock stand on this site. Western hemlock produces many small, winged seeds (Farrar, 1995) which are well suited to wind dispersal over long distances, having been observed to disperse as far as 1.6 km from the parent tree (Anonymous, 1990a). Western hemlock requires adequate soil and atmospheric moisture in order to germinate and grow vigorously (Pojar and MacKinnon, 1994; Anonymous, 1990a), conditions which likely existed on the cool northeast slopes on this site. Hemlock is also reported to have improved regeneration

success on recently burned sites, seeding in much more thickly on burnt over sites than on unburned areas (Anonymous, 1990a). According to the forest cover data for this site, several old growth hemlock stands are located within two kilometres (south) of these younger hemlock stands in the study area. These older hemlock stands are at similar and higher elevations on the hillside relative to the sites surveyed and could possibly have provided a seed source for the regeneration of the dense, even-aged hemlock stands on this site.

Despite the potential for developing scenarios to explain observed stand characteristics, reconciling the existence of a densely treed, even-aged coniferous stand on a site with evidence of frequent fire remains problematic.

5.3.3 Cultural Context and Field Data

This site is located within the Wet'suwet'en house territory of "Cees Ng'heen", which translates from Wet'suwet'en as "grizzly head". This territory belongs to the "Sa Yikh" or sun house of the Likhts'amisyu (Fireweed Clan). The head Chief for this house and consequently this territory is Smogelgem, a hereditary name currently held by Leonard George of Hagwilget. This is the northernmost Wet'suwet'en territory bordering on Gitxsan territory to the west and Nat'oot'en (Babine) territory to the north. It is interesting to note that the adjoining Nat'oot'en (Babine) house territory is also owned by a Fireweed clan house group. This arrangement would have encouraged peaceful relations between nations and likely afforded opportunities for the Wet'suwet'en and the Nat'oot'en to work cooperatively within the framework of the clan on these territories.

Historical data assembled by Mills and Overstall (1996) indicate that a home place carrying the territory name "Cees n'gheen" was located at a site five miles above the bridge on Twenty Mile Creek (Suskwa River), and that there were five people living there in 1910. A second

reference in this report indicates that there was a camp located at the mouth of Harold Price Creek, the confluence with the Suskwa River.

This house territory was located in close proximity to the Babine trail, a traditional trade route and "grease trail" from Gitxsan villages near Hazelton to the neighbouring Babine territory, by way of the Suskwa Pass and down Tsezekwa Creek to Fort Babine. There are many traditional Gitxsan huckleberry patches located along this route (Burton et al., 2000). Early travelers report that the entire upper Suskwa country was a landscape shaped by fire. George Dawson (1881) travelling this trail enroute to Fort Babine in 1879 commented on the country approaching the confluence of the Suskwa River and Harold Price Creek:

> The hillsides generally have been almost denuded of trees by fire, and exhibit a rank growth of wild grass, wild pea, *Heracleum* and *Epilobium,* in some places already shoulder high...

Similarly N. B. Gauvreau (1891) travelling the same route in 1890 remarked:

> From the sixth to the sixteenth mile the north portion is good grazing land; on the south it is heavily timbered from the sixth to the twelfth, and from the twelfth up to the twenty seventh the country is burnt and barren; on the north from the sixteenth to the twenty seventh it is the same. At the twelfth mile the river comes from a direction S. 56 ° E taking its water from a small lake in the range

The river Gauvreau speaks of at 12 mile is Harold Price Creek. What is now known as the upper Suskwa was then referred to as "Oo-at-zan-li". The Wet'suwet'en name for Harold Price Creek has always been "Ses kwe" meaning "bear river". It is apparent from the historical references that the Gitxsan territory of Gyetm Galdoo (Figure 5.30) adjacent to Cees Ng'heen was a landscape shaped by fire, a legacy that persists to the present day in the extensive deciduous stands which dominate this area.

Figure 5. 30 Gyetm Galdoo territory viewed from lower Harold Price Creek

The house territory of Cees Ng'heen has a number of other important gathering and habitation sites which provide important context for the interpretation of this berry harvesting area. An important traditional fall coho fishing site (Neenli) is located approximately eight kilometres upstream at a set of falls on Harold Price Creek. This site was reportedly used for harvesting coho and steelhead. East of these falls are the Netazul meadows complex, a lake named Mesdzii Delmuh (Owl Hooting) both featuring old Wet'suwet'en habitation sites (Wintergreen Consultants, 2000). Further west in a high pass below Netazul Mountain are the Netazul Lakes, site of a former Wet'suwet'en winter camp area.

To the west of the falls, up on a high plateau is "Xoots Wenii" or Touhy Lake, site of an important winter whitefish fishery, trapping hub and a winter camp for members of Chief Goohlat's house of the Wet'suwet'en Cilhts'ekhyu or big frog clan. This site was reportedly shared by people from different clans in historic times (Stanley Morris, personal communication, 2001). A clearly defined trail connects Xoots Wenii with the Harold Price drainage near the south end of the berry patch area (Rabnett, 2001). Approximately fifteen kilometres north of the falls at the confluence of Harold Price Creek and Blunt Creek there was reportedly a traditional winter village called Lhaydii (Rabnett, 2001). The berry patch area is therefore located in the midst of a large number of winter habitation sites and close to an important fall fishing site. Trails link this berry gathering area with these other sites.

In *Delgamuukw* testimony, Antoine Tom, a member of Smogelgem's house and holder of the name G'ee Yeeh Ghun indicated that he had used this territory extensively with his uncle Johnny Dominic (G'wis da). Antoine stated that they maintained and used a smokehouse in the territory as a base of trapping and hunting activities, and that they lived there for some time. He also testified to the existence of a berry picking area in the Cees Ng'heen territory:

> There is a place called Saa wig'us ai, that's where we pick berries and because the woman's picking berries there, they call it woman's camp.

Antoine does not specifically identify the location of this site but does mention it together with an unidentified mountain called "Tsa G'es". He indicated that in more recent years they had been able to travel to this berry picking site by road:

> ....we were able to travel up there by cars and they will go picking berries and around August time we go up in the most to go and hunt for groundhogs"
>
> *Delgamuukw et al. vs the Queen*
> *Exhibit 465, pages 9965, 9966*

It is not clear whether Saa wig'us ai is the berry picking area surveyed in this study. It is possible that this is the case based on the cultural evidence that was found on and near this site. However, there seem to be some problems with the timelines for berry harvesting, as the study site is heavily timbered with 100-130 yr old hemlock and pine it is almost certain that this area would not have been a productive huckleberry patch at lower elevations in the last fifty years. Additional context comes from anecdotal information collected by Ken Rabnett (1999) in an interview with Ben McKenzie who recalls seeing the bent box and berry racks on the study site in the 1940's describing it as a "regular berry camp". However, Ben's father, ninety one years old in 1999 and having grown up in the vicinity could not remember anyone picking berries on the study site in his lifetime.

It is likely that higher elevation (unsurveyed) areas of this berry harvesting area may have retained a more open character and remained productive (for black huckleberry) longer than the more densely timbered areas lower on the slope. Upper elevation areas observed near △HP39 appeared younger and more open (Sparse pine and large patches of dense, younger hemlock) and an age of 82 years was obtained from a pine at this site. It appears likely that the lower slope areas at least would have ceased to be productive berry areas before 1950, as the stand

is quite densely stocked and even-aged. The 1960 air photo (Figure 5.25) shows a heavily stocked stand that would not likely have been productive huckleberry ground at that time.

The meaning of the name Saa wig'us ai is reported to refer to setting sun or shadows falling[22]. An area bearing a similar name, "Saa Wek'es'aay" is located in the adjacent Gitxsan fireweed territory of Gyetm Galdoo. According to *Delgamuukw* maps on file at the Office of the Wet'suwet'en, this site is a ridge west of the Suskwa River with the old Babine trail running along the base, directly west and slightly north of Netazul Mountain. It is possible that this was the site being discussed by Antoine Tom.

Another Wet'suwet'en who was familiar with this area was Tommy Tait, holder of the Likht'samisyu name Amgyet. He is reported to have trapped this territory in the late 1930's from a cabin located at the point of land formed by the confluence of Harold Price Creek and the Suskwa River (Adam Gagnon[23], personal communication, 2000). *Delgamuukw* maps on file at the Office of the Wet'suwet'en have this cabin site marked as "Xlydlii" which was reportedly a shared Gitxsan / Wet'suwet'en spiritual site (Ken Rabnett, personal communication 2000). This cabin was reportedly removed during logging of this area.

There was a great deal of physical evidence of traditional use found on this site during field reconnaissance conducted in the summer and fall of 2000, and by other individuals in recent years. The most significant find with respect to berry harvesting was the discovery of a berry-processing site in this area. This berry processing camp was located on the north side of the largest creek, which flows through the berry patch. The initial discovery was made by a prospector who happened on the camp and removed a large cedar bentwood box measuring

[22] Stanley Morris and Theresa Tait, personal communication 2001
[23] Adam Gagnon is Chief Dsahayl of the Wet'suwet'en Fireweed (Likhts'amisyu) Clan

42cm x 43cm x 62cm and with sides 2 cm thick (Rabnett, 1999) which could hold as much as 23 gallons (89 litres) of berries.

Later investigation of this site turned up a large number of cedar splits which had been carefully shaped to even, uniform dimensions being approximately six feet in length, one inch across and half an inch deep with light charring in places (Figure 5.32). Traditionally, these splits were bound to a pair of cross braces to form a rack for drying berries or hemlock bark (People of 'Ksan, 1980). These cedar splits had been placed leaning against two large spruce trees estimated to be approximately 115[24] years old. Many of the berry rack slats remained standing while others had fallen to the ground and were in various stages of decay. Also found near each of these spruce trees were a number of 4 gallon kerosene tins of the type used for transporting eulachon grease and collecting and transporting berries in historic times. The two berry rack trees were in close proximity to one another, one located just on the north side of the creek at △HP21 and the other located on a rise fifty metres to the northwest. There was a well-defined trailbed running NW to SE across the contour through this site although no blazes were found. In addition to this berry camp area, a report from a hiker in the 1985 indicates that fully assembled berry racks and cedar bentwood berry boxes were located to the east of this berry camp on a terrace close to Harold Price Creek (Rabnett, 1999). The combined physical and anecdotal evidence therefore suggests the existence of at least two berry processing camps in this berry harvesting area suggesting that this area was once a productive and heavily used berry gathering area.

Reconnaissance of old hemlock forests at the toe of the slope near Harold Price Creek revealed a great deal of additional evidence of longstanding traditional use of this area. A large number of hemlock food[25] trees were located which appeared to have been harvested

[24] Tree age is estimated based on ages of nearby spruce trees of similar diameter.
[25] Hemlock cambium was used traditionally as winter provisioning food and was often dried in cakes.

approximately 100 years ago. Tree cores taken from two hemlock cambium harvesting scars indicate harvesting dates of 98 and 89+ years ago, placing these activities in the early 1900s. Two types of bark stripped western red cedar trees were also encountered, one a common partial strip type and a second type with all of the bark removed to a height of approximately 12 feet (Figure 5.33). The late Mary Joseph, a Wet'suwet'en Likht'samisyu elder and holder of the name Skokumhalyte, indicated that cedar bark stripped in this manner was often used for the production of cedar feast regalia (personal communication, 2001). Bark removed in this manner would also have been suitable roof material for the berry drying houses used to shelter drying berries from rain. In addition to a variety of culturally modified trees, a well-defined trailbed and multiple blazes of various ages were found along the low terraces near the south bank of Harold Price Creek. An older blaze on this trail (Figure 5.31) was accurately dated at 85 years placing the activity in 1915. It is likely that this blazed trail was one of the main access routes into this territory branching from the Babine trail. For a detailed summary of cultural heritage resources in the Lower Harold Price including trail and camp locations see Rabnett, 2001.

Figure 5.31
1915 blaze

Figure 5.32
berry racks

Figure 5.33
"barked" cedar

A portion of the seasonal round in this house territory might have begun with berry picking and processing on the study site and other nearby berry patches in the late summer, possibly

combined with goat hunting on the Blunt massif. These activities would likely have been followed by fall fishing for coho and steelhead at the Harold Price falls, and then the move to winter home places for trapping and lake fishing. Having access to this suite of important subsistence resources within a relatively small area would have allowed the house group to efficiently gather and store their winter food supply.

5.3.4 Fire History

Two distinct areas with markedly different stand characteristics define the fire history of the lower Harold Price site. Timber stands on the extensive northeast facing slope in the berry area appear to have regenerated from one or more fire events within a span of approximately 50 years. The stands on this hillslope area comprise several relatively even-aged areas which generally contain few remnants of earlier stands. Toe slope areas and the glacio-fluvial terraces adjacent to Harold Price Creek support old growth stands of hemlock, spruce and cedar that exhibit signs of fire activity in the form of single, and in several cases, multiple fire scars. Stands in this area are characteristically multi-aged and multi-layered with windfall and decay agents appearing to be the predominant disturbance agents driving successional processes.

The most distinctive fire history characteristic of the slope area was the conspicuous lack of evidence of previous forest stands on this site. While there were a number of veteran cedar trees and cedar snags located primarily on lower slopes as well as in moist depressional areas and shallow draws, the vast majority of this hillside area was devoid of old snags, stumps or coarse woody debris. One possible explanation for this could be the existence of at least one very intense fire event that could have consumed the bulk of the woody debris. A more plausible explanation is that frequent fires occurring over an extended period of time have precluded the development of large trees (and remnant snags or large woody debris) on most areas of this hillside.

In the toe slope area, one large hemlock veteran cored at △HP18 was over 320 years of age and there are many stems in these older types which appear to be in a similar age class, however heart rot is common and precludes accurate age sampling in most cases. Several large western hemlock and cedar in this area were observed to have as many as three fire scars (Figure 5.34), apparently with a fairly short return interval (judged by the thickness of inter-scar lobes).

Figure 5. 34
△HP10: hemlock with 3 fire scars

It is possible to develop an approximate fire history reconstruction for this site based on the fire scar record and the cohort ages of sampled trees from various areas of the site. Age sampling and fire scar analysis indicate that at least four cohort classes are located within the study area. These cohort classes are defined as follows 1) 85-101 years, 2) 106-112 years, 3) 118-153 years, 4) 300+ years.

The cohort ages are bracketed by the fire scar record. A fire scar lobe of a veteran cedar at the toe of the slope at △HP3 was aged at 104 years, indicating a fire event around 1896. A second cedar veteran at this site carried 2 fire scars recording the 1896 fire and a second fire event 13 years earlier in 1883. A fire-killed cedar snag located in a midslope area at △HP27 exhibited evidence of a previous fire scar. An age sample revealed a total tree age of 168 years when it was killed by fire and a wedge sample of a fire scar lobe indicated an inter-fire interval of approximately 13 years between the time of the scar and the fire event that apparently killed the tree. Based on the assumption that the thirteen year fire return interval recorded by this snag corresponds to the thirteen year inter-fire interval recorded by the living cedar veteran near the base of the slope at △HP4[26], I postulate that two fires occurring in 1896 and 1883 encompassed these areas of the slope.

[26] This method follows an approach used by Wills and Stuart, 1994.

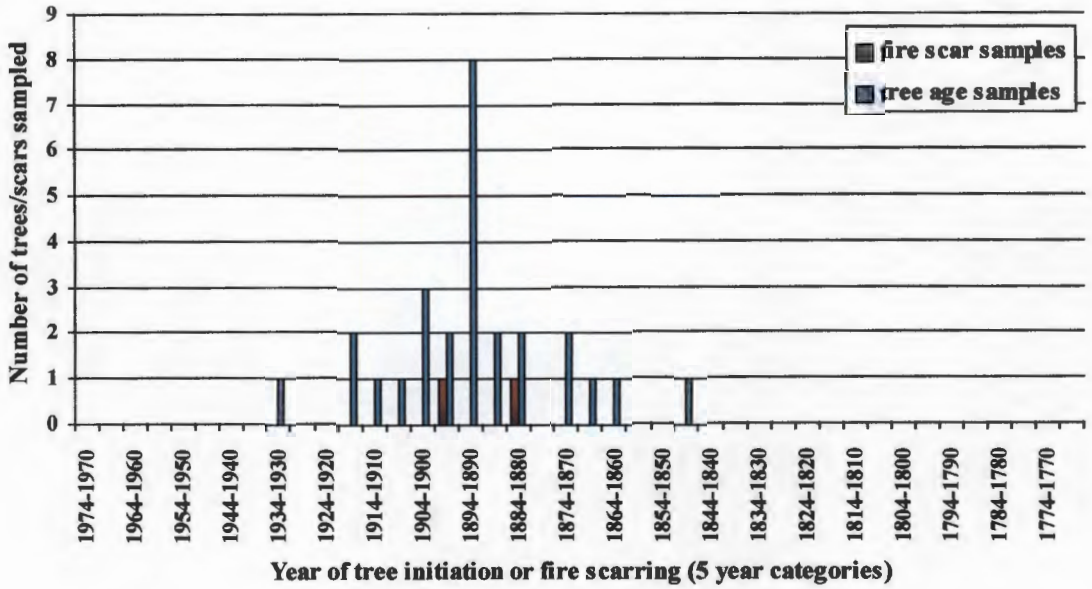

Figure 5. 35 Tree age cohorts from trees sampled at Harold Price.

The fire scar dated from 1896 corresponds to several trees in cohort one. The fire scar from thirteen years earlier likely corresponds to the large number of samples that fell into cohort two. There were five age samples between 118-131 years that may represent a separate cohort and possibly another fire event. However, these samples have been combined with two older samples (138+ and 153 years) from a fire-skip area at △HP34 to form cohort three. It is possible that a single fire event initiated all of these sampled trees, however, it is more likely that they represent two different origins. Cohort four represents the old growth stands found at the toe of the slope and on valley bottom sites which are typically age class nine stands, the oldest trees in these types are typically over 300 years of age.

Age class and fire scar analysis reveal that there have been at least three stand initiating fire events within a period of fifty years (1846-1896) assuming that age class three corresponds to a fire event after 1846. It appears likely that other fire events have occurred on this slope, but this is difficult to determine without additional fire scar evidence. The fire history data collected indicates a mean fire return interval of approximately twenty five years for this relatively short

period of time. This type of fire regime is consistent with several site characteristics, particularly the lack of evidence of previous mature stands (few stumps or CWD) and the remnants of formerly abundant fire adapted deciduous tree species (Scouler's willow and trembling aspen). The dense coniferous stands which now occupy this site are seemingly inconsistent with a frequent fire regime which persisted over long time periods, however, nearby seed sources and the silvics of western hemlock suggest possibilities for reconciling the current stand characteristics with the fire history reconstruction.

The data collected indicates that for the past 150 years the fire return interval for this site is markedly different (more frequent) than the 100-150 year mean event interval expected for stands in the ICHmc2 (Parminter, 1992) and the 200 year mean fire return interval expected for the ICHmc1 (Anonymous, 1995). This suggests that anthropogenic ignitions have likely influenced the fire regime.

5.3.5 Site Summary

The territory of Cees Ng'heen is difficult to research due to the fact that there are very few living Wet'suwet'en elders who have personal experience of using this area for traditional activities. However, the wealth of cultural heritage evidence that remains on the ground in the lower Harold Price drainage adds a great deal of context and detail to existing oral histories.

The ecological data indicate that this extensive mesic hillslope is highly suitable for huckleberry production, and has maintained huckleberry coverage, although at low vigour and density, for many decades under low light levels. Due to the apparently rapid ingress and high survival of western hemlock on this site, as well as the potential for development of vigorous thimbleberry and fireweed communities as evidenced in the nearby cutblock, frequent fire disturbance would have been required to maintain conditions suitable for huckleberry production.

Extensive areas of fire maintained gathering landscapes exist in the adjacent territory of Gyetm Galdoo. This suggests that similar landscape burning techniques would likely have been used on Cees Ng'heen territory to promote abundant berry yields close to winter home places.

The presence of substantial evidence of berry camps on this site is the best indication available that this area was important for berry harvesting. The location of this berry ground in close proximity to Wet'suwet'en winter home places, as well as fall and winter fishing sites, and known goat hunting areas increases the likelihood that it was intensively utilized over a long period of time.

5.4 Stakaiyt: Case Study

5.4.1 Introduction

This site encompasses a large, mildly sloping hillside area located on the south and west facing flank of Caribou (Sidina) Mountain on the east side of the Skeena River, northwest of the Gitxsan village of Kispiox. The name Stakaiyt means "half a wing" (Perry Sampson, personal communication, 2000) and territorial affidavits identify it as being an area on the south end of Sidina Mountain in the Gutginuxw territory of Lax Xsin Djihl (*Delgamuukw* et al. vs. the Queen, exhibit 609). Stakaiyt was identified as a managed berry ground by a Gitxsan elder (Gottesfeld, 1994a), a status that has been confirmed in *Delgamuukw* testimony and through conversations with Gitxsan advisors during the course of this research. This site includes two distinct areas of relatively recent fire origin, which have been reported as huckleberry gathering areas used by Gitxsan people in the past. One of these areas is an extensive subalpine shrubfield complex, while the other area occurs at lower elevation on the mid-lower slopes of Caribou Mountain and is now densely forested in young conifers. These two areas are delineated in the following aerial photograph (Figure 5.36) and are described separately within each of the following sections.

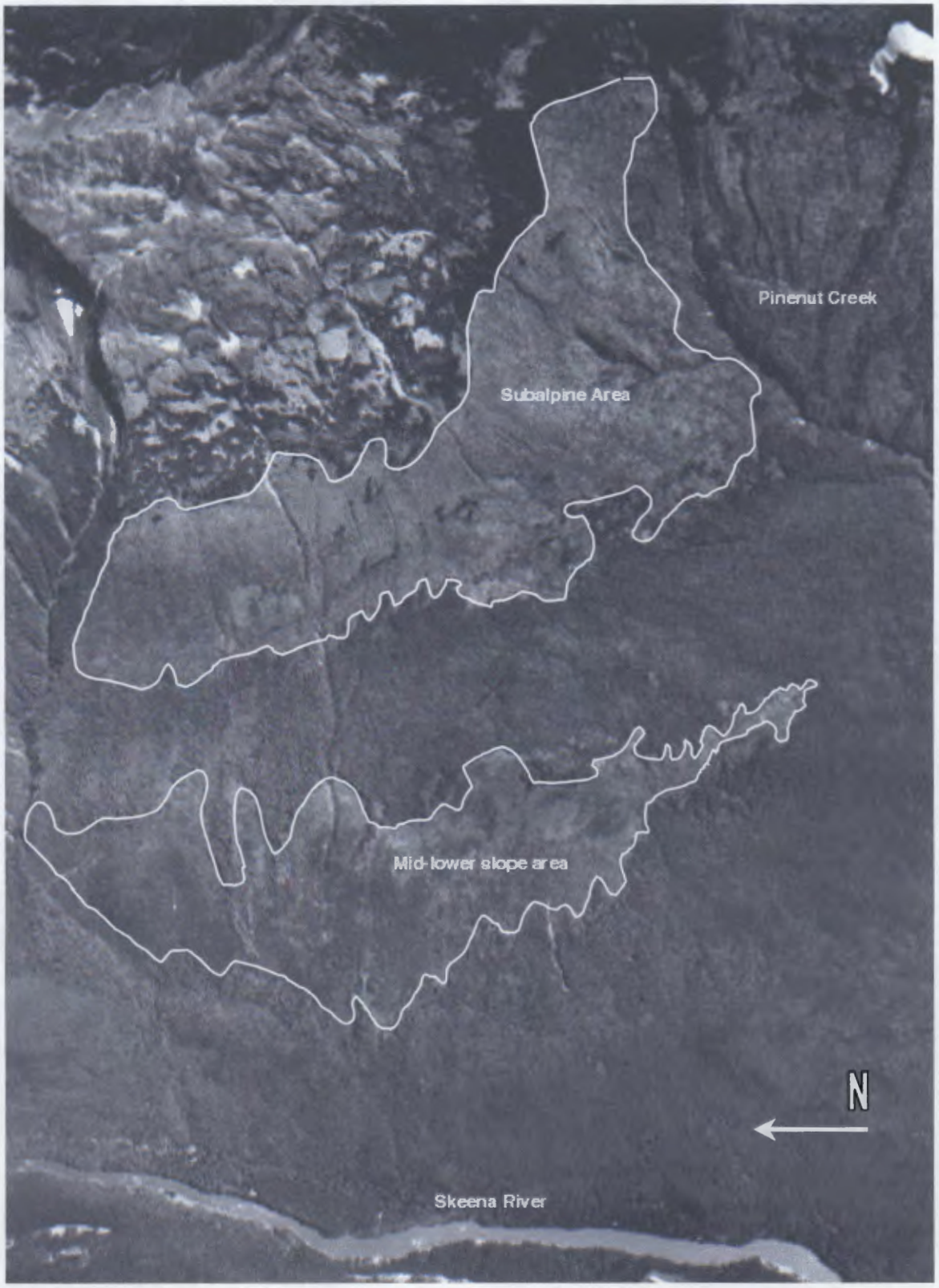

Figure 5. 36 Subalpine and mid-lower slope huckleberry areas on the west flank of Caribou Mountain - 1978 (Airphoto scale is approximately 1: 13,000)

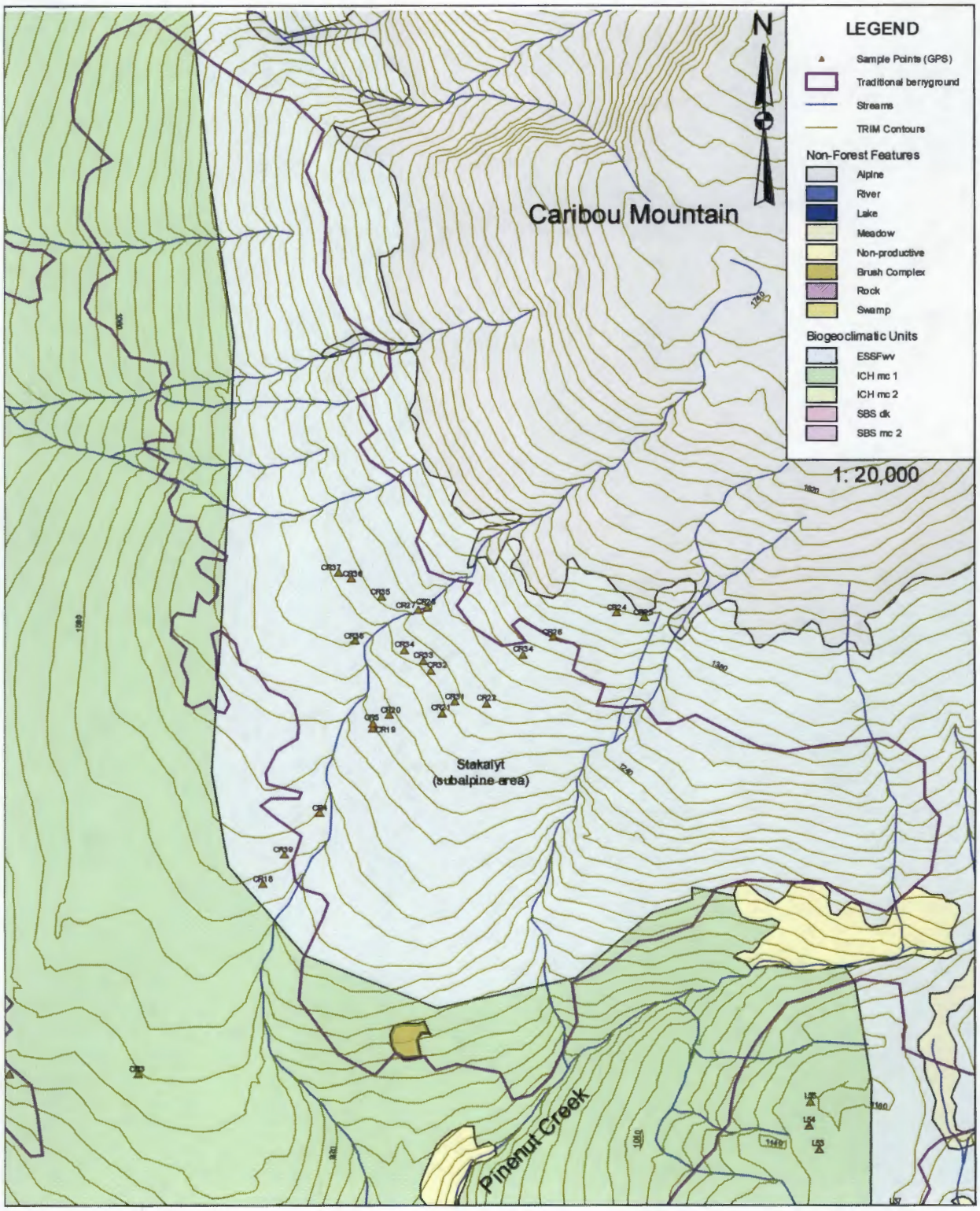

Figure 5. 37 Stakaiyt Huckleberry Area (subalpine area)

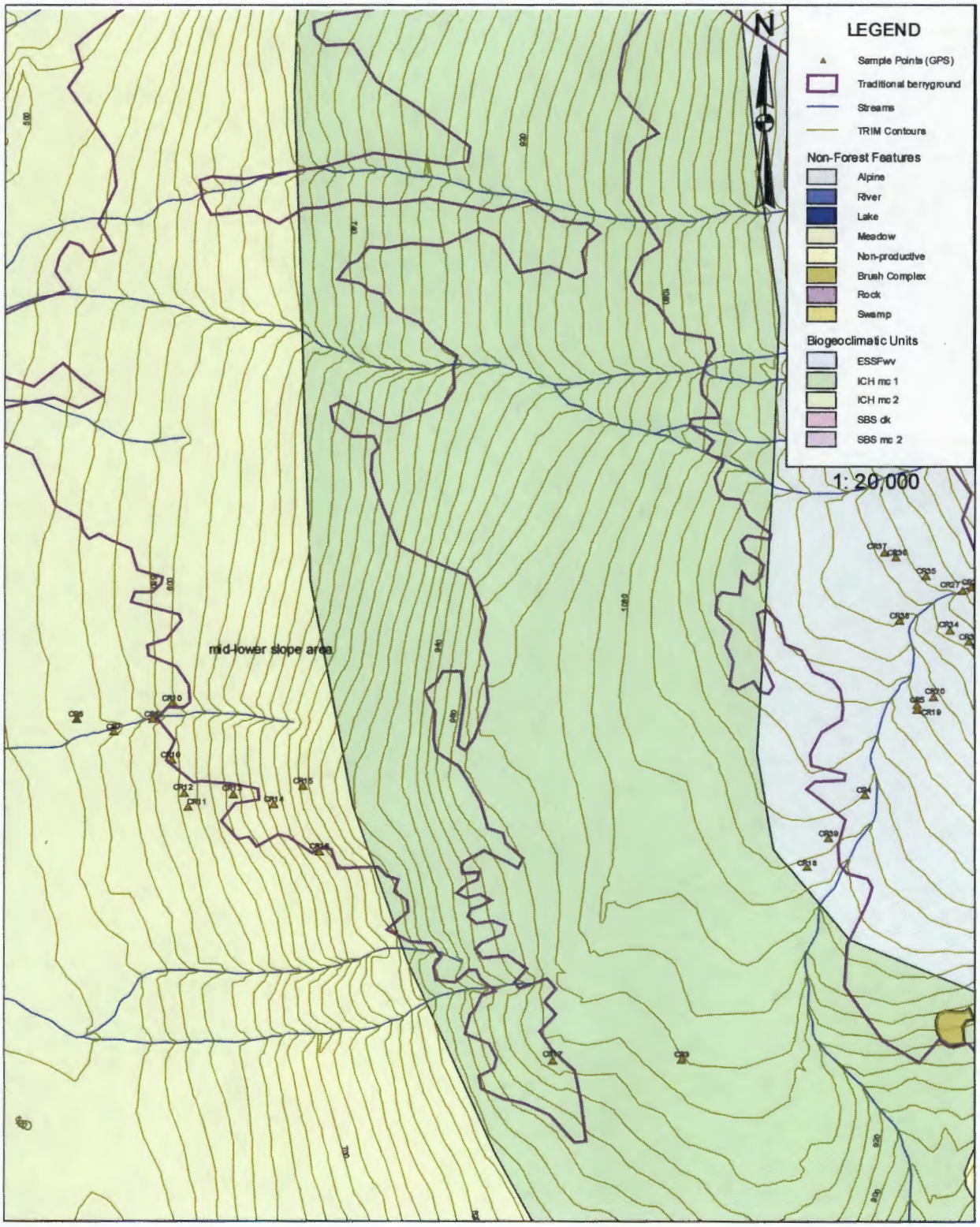

Figure 5. 38 Stakaiyt Huckleberry Area (mid-lower slope area)

5.4.2 Ecological Overview

This ecological overview outlines the ecological characteristics of the two sections of the berry area. The following tables (Table 5.7, Table 5.8) summarize plot data from the Stakaiyt area.

Area	Plot ID	BGC Unit	Site Series	Stand Structure*	Crown Closure	Slope (%)	Aspect (deg.)	Elev. (m.)	Dominant tree	Dominant shrub
Lower subalpine	△CR5	ICHmc1	/01a	YF Ct	20	17	255	1197	Ba	*M. ferruginea*
Upper subalpine	△CR31	ESSFwv	/05	LS	8	36	247	1258	none	*V. membranaceum*
Upper subalpine	△CR37	ESSFwv	/07	LS	7	20	249	1261	Ba	*M. ferruginea*
Low-mid slope	△CR13	ICHmc2	/01a	YF Ct	75	44	260	702	Hw	*T. heterophylla*
Low-mid slope	△CR15	ICHmc1	/01a	YF Ct	80	55	269	801	Hw	none

*YF= young forest, LS= low shrub, C= coniferous, t= two storied

Table 5. 7. Ecological/Site Summary for Stakaiyt.

Area	Plot ID	Drainage	Soil Texture	Humus Form	Coarse Frag. (%)	% V. mem.	Snags & CWD	Charcoal Presence
Lower subalpine	△CR5	moderate	silty loam	mormoder	35	17	some snags & CWD	in F and H layers
Upper subalpine	△CR31	moderate	silty loam	Mormoder	30	50	few snags and CWD	in F layer
Upper subalpine	△CR37	poor	clay loam	mormoder	40	20	some snags & CWD	in humus
Low-mid slope	△CR13	well	loam	hemimor	30	0	few snags and vets	in F and H layers
Low-mid slope	△CR15	well	loam	hemimor	40	0	CWD	in humus

Table 5. 8. Soil/Huckleberry/Fire Summary for Stakaiyt.

5.4.2.1 Subalpine Area

This site ranges in elevation from approximately 1000 metres to 1300 metres and is bordered to the south by Pinenut Creek. The site is primarily located in the Engelmann Spruce Subalpine Fir moist, very cold biogeoclimatic subzone (ESSFwv) with lower sections classified in the Nass variant of the Interior Cedar Hemlock moist cold subzone (ICHmc1) (Figure 5.37). Exposure is warm with aspects varying from west to south, but being predominantly southwest.

The terrain is characterized by gentle to moderate slopes undulating with low ridges and mild depressions which are generally oriented parallel to the slope. Several deeply incised drainage features carry large amounts of meltwater during the summer months and continue to carry smaller amounts of surface water in the fall in seemingly oversized channels. Soils are developed on deep morainal and colluvial blankets and are typically fine textured silt loams. These soils are primarily classified as dystric brunisols and humo-ferric podzols, with some gleysolic soils occurring on subhygric sites.

This area is characterized by an extensive ericaceous shrubfield complex interspersed with coniferous regeneration that becomes increasingly sparse and patchy with increasing elevation. Because of the variability observed within this subalpine area, it has been split into two sections along elevation lines at 1200 metres: lower parkland (1000-1200m) and upper shrubfield (1200-1300m). These two types are described separately in the sections that follow.

5.4.2.1.1 Lower Parkland (1000-1200 metres)

Figure 5. 39 Lower parkland area at △CR5

The bottom boundary of this lower area follows a discontinuous edge of burnt areas and fire-skips with dense clumps of regenerating conifers interspersed with openings dominated by vigorous ericaceous shrub communities (Figure 5.39). Predominant tree species are amabilis fir (*Abies amabilis* [Dougl. ex Loud.] Forbes), subalpine fir, western hemlock, Roche spruce and scattered lodgepole pine. The ecological plot installed in this area was in an area classified as the mesic Western hemlock – step moss site series (ICHmc1 /01a), the predominant site series throughout most of this lower

zone. Amabilis fir was prevalent in several areas, suggesting that these sites could possibly be classified in the amabilis fir phase of the ICHmc1 biogeoclimatic variant. However, the location of this site on warm aspects makes such a designation problematic and contradictory to the defining characteristics of the amabilis fir phase (ICHmc1a), as this phase is typically found on cool, moist northeast aspects (Banner et al., 1993). Amabilis fir and minor components of lodgepole pine and Roche spruce were dominant in the taller, more advanced regeneration layers. Younger western hemlock and subalpine fir were prevalent in lower regeneration layers, and were invading gaps in the shrub complex and expanding the edges of existing coniferous clumps.

The ericaceous shrub complex in these areas was dominated by false azalea, which reached heights of two metres with lesser but significant components of oval-leaved blueberry and black huckleberry. Minor components of Scouler's willow and sitka mountain ash (*Sorbus sitchenchis* Roemer) were scattered individually and in small patches throughout the area.

Black huckleberry was fairly abundant throughout this type with cover of 17% at the plot at △CR5 and estimated covers ranging from ten to twenty percent throughout this type. Black huckleberry was typically found persisting as an understorey shrub, overtopped by false azalea and oval-leaved blueberry. Black huckleberry generally exhibited a diminutive growth form, good vigour and was not observed to bear fruit under these circumstances.

A review of the autecological characteristics of these and other species by Haeussler et al. (1990) indicated that both false azalea and oval-leaved blueberry are fire sensitive species that do not regenerate vigorously following fire events. This shrub complex appears to be mature and stable, and the interspecific dynamics of this ericaceous shrubfield community do not appear to be changing significantly at present. The main dynamic in this type is the increase in coniferous competition characterized by conifer ingress, and the increasing shade caused by

the growth of existing saplings and advanced regeneration. Although this process is relatively slow in this subalpine environment, increased shading will likely cause a significant reduction in the density and vigour of black huckleberry in the future.

5.4.2.1.2 Upper shrubfield

Figure 5. 40 Upper shrubfield at △CR26

An extensive ericaceous shrubfield complex characterized the upper section of the subalpine area with sparse coniferous regeneration exhibiting a markedly clumpy distribution (Figure 5.40). This section was classified in the ESSFwv biogeoclimatic subzone (Figure 5.37). A large number of sites in this area were evidently receiving seepage water from upslope alpine areas and consequently there were large permesic and subhygric areas classified as the Subalpine fir – Oak fern – Heron's bill (ESSFwv /05) site series (plot at △CR31) and the Subalpine fir – Horsetail – Glow moss (ESSFwv/07) site series (plot at △CR37) throughout this area.

Subalpine fir and amabilis fir were the dominant tree species with a minor component of hybrid white spruce, western hemlock and scattered lodgepole pine. Ingress of additional conifers is occurring in gaps in the shrub layer as well as around existing conifer clumps. However, this process appears to be occurring at a slower pace than was observed in the lower section of this subalpine area, and many large shrubfield areas remain open with very little coniferous regeneration.

The shrub complex in this section contains the same key species as at lower elevations; however, black huckleberry has maintained prominence here. False azalea, while still a major

component of the shrub complex, is not dominant. Sitka mountain ash is more common in this upper area, although it does not appear to compete with huckleberry as it is relatively tall with sparse foliage and a small basal area. This species is able to coexist relatively well with the lower growing black huckleberry. Oval–leaved blueberry also occurs in abundance in this area, growing amongst black huckleberry but at relatively low cover levels and not appearing to exert a significant competitive influence.

Figure 5. 41 Pure huckleberry patch at △CR31

Black huckleberry exhibited good vigour and high cover throughout this upper slope section of the subalpine area, occurring on a wide variety of site series and maintaining relatively high cover and good vigour even on the subhygric ESSFwv /07 association. Pure patches of black huckleberry were common throughout this area particularly on permesic and drier ecological associations. These areas, such as the one at plot △CR31 (Figure 5.41) typically had dense cover of black huckleberry: 165 stems >=2mm in diameter (measured 1 cm above ground level) were counted in a 1.26 metre radius plot at this site for an overall density of 33 stems per square metre in addition to many smaller stems. The majority of these huckleberry shrubs were stout, and apparently very old stems, and were often observed to have been extensively browsed many times over a period of years. Studies of winter diets of mountain goats (*Oreamnos americanus*) in southeast Alaska (Fox and Smith, 1988) indicated that goats utilize *Vaccinium* species as winter browse. It is possible that the goat populations on Caribou Mountain have made use of this subalpine berry area and are responsible for the observed grazing activity. Huckleberry response to repeated browsing was variable, ranging from vigorous production of robust, large calibre shoots to much weaker production of thin, frail shoots.

Overall, this area appeared to be maintaining its shrubfield characteristics relatively well. Late lying snow and moist ground over much of this area reduce opportunities for seedling establishment and limit tree growth, dramatically slowing successional processes. As a result there are still open shrub patches with high numbers of black huckleberry shrubs. These sites appear to have good potential for restoration to productive berry grounds.

5.4.2.2 Mid-lower Slope Area

This area is a large, fire initiated, age class three (41-60 yrs) stand located on the west face of Caribou Mountain, directly west of (below) the higher elevation berry area discussed previously (Figure 5.36). Ranging from 600 to 1000 metres elevation (Figure 5.38), this site is currently forested with a dense, hemlock dominated, coniferous stand. Overall, this area is primarily mesic and areas observed during field reconnaissance were classified in the ICHmc2 /01 and ICHmc1 /01a site series. Soils are formed on a combination of morainal and colluvial parent materials and were generally coarse textured loams and sandy loams with moderate to high coarse fragment components and classified as dystric brunisols. Slopes were moderate to steep, ranging from 20 to 50 percent.

Figure 5. 42 Dense hemlock stand △ CR10

Extremely dense stands of western hemlock poles and saplings have regenerated on this site following an extensive fire event 55-60 years ago (Figure 5.42). While western hemlock is the dominant tree species in this area, western red cedar (*Thuja plicata* Donn ex D. Donn in Lamb) often forms a significant component of the stand; Roche spruce is generally present but sparsely distributed. A variety of deciduous species, including black cottonwood, trembling aspen, Scouler's willow and paper birch, were scattered as individual stems and in small pockets throughout the stand. Many of these deciduous stems were observed to be declining due to light

competition from the densely stocked, overtopping conifers. Scattered lodgepole pine were observed throughout the area and were generally of larger size than the hemlock and cedar, however, many were in the same age class, originating from the most recent stand-initiating fire event. In addition, several scattered pine veterans were located amongst the young stand. These veterans often exhibited single fire scars.

Most areas of this stand were so densely stocked that very little light reached the forest floor. Crown closure estimates of 75% and 80% were recorded at the two plot installations in this type. As a result of the low light levels there was little or no shrub or herb layer in the understorey throughout most areas. Where light was available, coniferous regeneration of hemlock and cedar often dominated the understorey.

Black huckleberry was virtually non-existent in these stands, although it was observed to persist in the understorey of adjacent older and more open stands. However, even on these more open sites in the mid-lower slope area black huckleberry occurred only at extremely low densities and exhibited low vigour.

5.4.3 Cultural Context and Field Data

The upper areas of the Stakaiyt area were reportedly a traditional berry harvesting ground, as well as being important for goat hunting. This area is within the Gitxsan traditional territory of Gutginuxw (House of the Owl).

Gitxsan elders have reported the use of this area as a berry ground. The following passage from Pete Muldoe's *Delgamuukw* testimony confirms that Stakaiyt was a berry ground and indicates that it was considered part of another huckleberry area south of Pinenut Creek, Lax Ansa Maja (Maatsa):

Q: That's United Church on the Kispiox reserve?
A: Yes. That's the United Church.
Q: And is that Sidina Mountain in the background, Sidina Mountain across the river?
A: Yes. That's also part of that berry picking right in the edge of that snow cap.
Q: Now, if your lordship has Exhibit 498, your lordship will see Sidina Mountain to the east of the Kispiox River and your lordship will then --
A: That's the one they call Lax Ansa Maja right in the slope there.

(Delgamuukw vs the Queen
SCBC transcript volume 101 p. 6463)

In an interview with Neil Sterritt, Abel Brown, Chief Anda Ap related the following description of travelling between these areas, "had to go way down to a creek, then up again for half a day walk from Lax Ansa Maatsa to Stakaiyt".

Additional evidence has been previously collected in interviews with Gitxsan elders. In a 1976 interview with Neil John Sterritt, Perry Sampson stated that, "the last place to be burned for berries is above 'slow down cabins'" (Sterritt, interview notes, 1976). The site referred to as 'slow down cabins' is in the vicinity of a fishing site on the Skeena River, just south of the Sidina Creek confluence. Directly above this site is the lower, densely treed portion of the Stakaiyt berry patch that appears to have burned most recently in about 1950.

There was a great deal of physical cultural heritage evidence documented on and around these sites. The upper, subalpine areas are accessed by a trail that climbs on high ground northwest of Pinenut Creek. This trail is currently maintained by the BC Forest Service as a recreation trail but has abundant evidence of First Nation's use going back to the early parts of the 20th century and before. Several message trees were encountered with names of Gitxsan people; the oldest one that was legible was dated in the 1930s and signed by J. and A. Brown. Other message trees made reference to packing game down the trail as well as to the weather. Messages were recorded in all seasons.

In addition, the trail was heavily blazed with some of the oldest blazes disappearing beneath the bark of the old growth hemlock. A blaze scar on an old hemlock (300+ yrs) that was still clearly visible was aged at 119 years; the tree was therefore blazed in 1881 at the latest (quite likely prior to this).

Two old camp locations were encountered along the trail on either side of the main creek. The remains of an old cook stove and tins from the 1940s or 1950s were located at the first camp at △CR4. A second camp across the creek was situated in the last patch of old growth below the extensive shrubfield area.

Figure 5. 43 Blaze on fire snag △CR5

Blazes were found on fire snags within the berry patch such as the one near △CR19 (Figure 5.43), which pre-dated the most recent fire event by approximately 30 years, dating it in the late 1800s. In addition, several sections of well-defined trailbed were identified in submesic areas within the subalpine shrubfield area. Shallow cache pits measuring approximately 60 cm square and 20 cm deep were found within the upper shrubfield area. One was found in sandy soil on the ridge above the main creek through the upper berry patch area at △CR28. A second possible cache pit was located near △CR37.

In the lower, heavily forested area, a large number of bark stripped cedar trees were located. This was immediately below the burned area, in the vicinity of a recently built road and planned (laid out) cutblock. The scar lobe on one of these bark stripped cedar trees (Figure 5.44) was aged to at least 156 years old indicating a modification date prior to 1845. A retrospective study of berry patch management carried out in Washington (Mack and McClure, 2001) found a strong linkage between bark stripped cedar CMTs and huckleberry patches, with bark harvest dates corresponding very closely with periods of use of berry patch areas.

Cedar bark was apparently used to make temporary folded bark baskets for transporting excess huckleberries back to villages. The authors state that bark stripped cedar trees are, "probably our best tool for determining the age of adjacent berry processing sites used within the last 300 years".

Figure 5. 44 Cedar CMT at △CR7 scar lobe aged at 156 yrs

While there is no available evidence to suggest that the Gitxsan used folded cedar bark baskets, a number of other uses of cedar bark have been noted in relation to berry harvesting and processing activities. The Gitxsan used cedar bark to weave berry picking baskets as well as for roofing material for berry drying houses and shelters which protected drying berries from rain (People of 'Ksan, 1980). It is notable that a very large number of bark stripped cedar are located in an upland location in close proximity to a significant berry harvesting area on Caribou Mountain. It is quite probable that the cedar bark harvesting activity observed could have been associated with berry harvesting and processing on Stakaiyt. However, late summer is not the best time to be harvesting cedar bark due to reduced sap flow, and the timing would have been a departure from traditional patterns of spring cedar bark stripping. The question of timing notwithstanding, the potential relationship between cedar bark stripping and huckleberry harvesting and processing merits more careful examination.

The oral history from Gitxsan elders identifying this area as a berry ground and the extensive physical evidence of human use of this area, much of it distinctive First Nations activity, indicates the importance of this area as a traditional resource gathering area for the Gitxsan. Evidence from field reconnaissance confirms that Gitxsan people have used this area to gather and hunt a variety of resources in all seasons. The proximity of Stakaiyt to Gitxsan villages and reserves, as well as its proximity to ancestral villages further confirms its place within a cultural landscape. The evidence documented reflects a pattern of traditional use, which

not only included riverine environments, but stretched through old, montane hemlock stands to subalpine berry grounds, and continued further upslope to alpine habitats where other upland resources such as goat and marmot could be obtained.

5.4.4 Fire History

There was a great deal of fire history evidence collected from the subalpine and mid-lower slope sample areas on Caribou Mountain. Fire history data from this site includes a number of ages collected with an increment borer as well as several wedge samples of fire scar lobes from cedar veterans in the mid-lower slope area. The two distinct areas (subalpine and mid-lower slope) exhibit distinctly different fire history traits as a result of the differences in species composition (influencing response to fire and preservation of fire evidence) and likely a difference in the fire regime influencing these sites. Therefore, these two areas are examined and analysed separately in the sections which follow, but, it should be noted that fires connected these two areas and their fire histories are inter-related to some extent. Recognizing

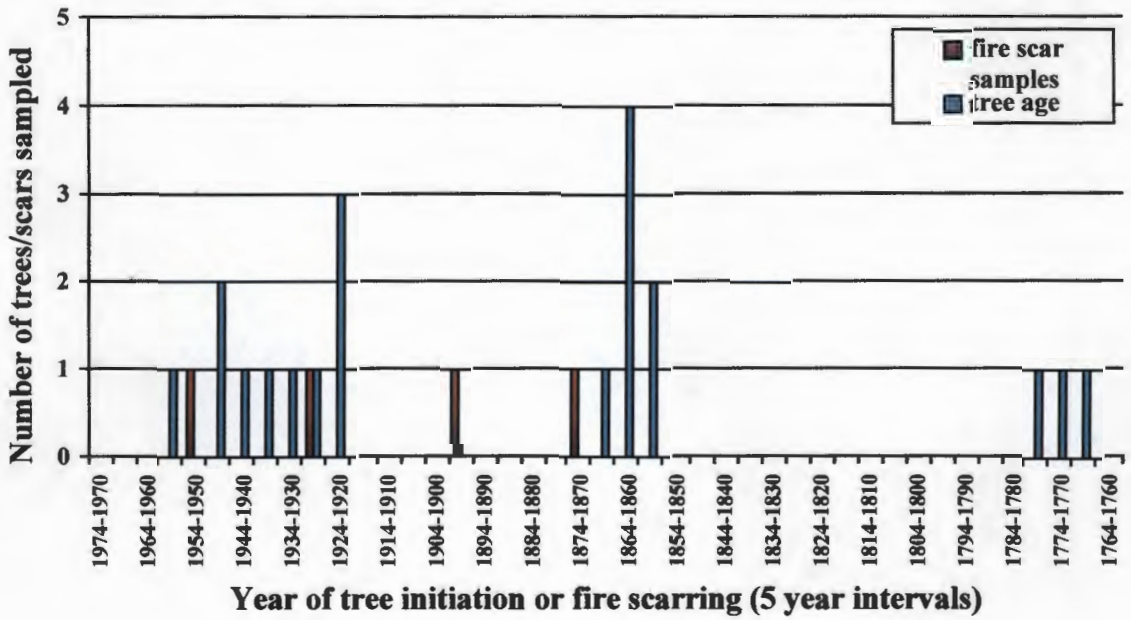

Figure 5. 45 Tree age cohorts from trees sampled at Stakaiyt (combined areas).

this inter-related fire history, the data collected during field reconnaissance for both areas combined is summarized in a composite fire history histogram (Figure 5.45).

5.4.4.1 Subalpine Area

Figure 5. 46 Subalpine area showing open shrubfield, scattered fire snags and lodgepole pine regeneration

The majority of this upper area was characterized by open ericaceous shrubfield (Figure 5.46) with a tree layer dominated by fire sensitive *Abies* species that tend not to survive fire events, and are known to have a low resistance to decay. As a result, there were few veteran trees remaining and no fire scar evidence was available. A number of age samples were taken from the largest trees (mainly from lodgepole pine) in the stand. The fire history data collected for this area (independent of other sample areas) are summarized in the fire history histogram for this area (Figure 5.47).

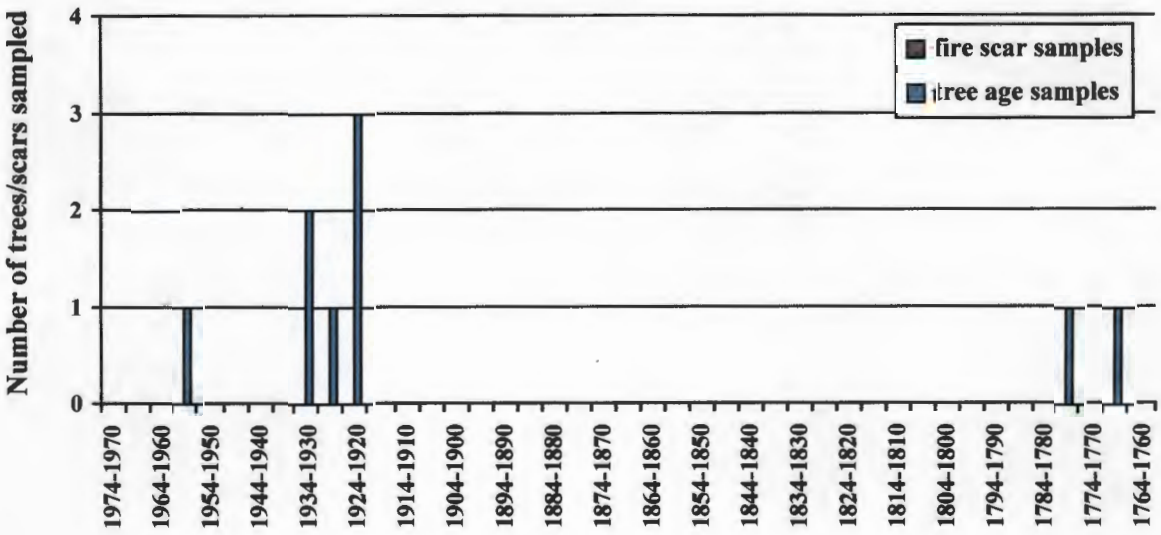

Figure 5. 47 Tree age cohorts from trees sampled at Stalaiyt (subalpine areas).

Several of the age samples collected in this area were bracketed between 67 and 80 years, with ages clustered at 67 and 77-80. One younger age sample (41 years) was collected from a lodgepole pine at the plot at △CR37. This sample was taken within an area classified as age class one (21-40 years) on the forest cover map, suggesting that there may have been another more recent fire event in this area. However, only one sample was collected within this area, and more samples are required to determine the time of stand initiation with a sufficient degree of confidence.

A fringe of older, subalpine fir dominated stands separated the seral shrub complex from the alpine areas above treeline (Figure 5.48). Trees in this old growth strip are classed in age class eight on forest cover maps. An age sample from a large subalpine fir in this area yielded an approximate age of 226 years. The existence of this strip of old, fire sensitive species at the upslope edge of a large burn raises some interesting questions about fire timing and dynamics. The expectation under ordinary summer burning conditions would be that this strip would burn and that the fire would reach the alpine. However, the observed pattern seems to suggest that this fire burned to snowline where it was extinguished, suggesting a spring or possibly a late fall burn.

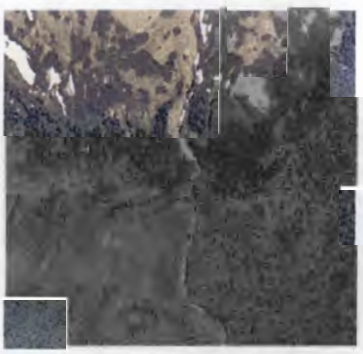

Figure 5. 48 Airphoto of the upper subalpine area with fringe of old subalpine fir at alpine border

The area below this subalpine shrubfield is treed with widely spaced old growth hemlock and ingress of subalpine fir in canopy gaps. A few old lodgepole pine are found scattered widely on submesic sites. A lodgepole pine located just below this subalpine shrubfield area at △CR3 was aged at 220 years. A second lodgepole pine at this site was aged at 329 years which quite probably represents the initiation time of many of the large western hemlock trees in these old growth types, several of which were observed to have fire scars at the base. The existence of fire scars throughout many of these old growth areas as well as the sparse distribution and

limbless boles of the larger trees indicates that fire traveled through these stands on at least one occasion. This suggests that despite the existence of strips of old growth forest between the two areas of relatively recent fire events, the fire history on this slope is inter-related to some extent.

5.4.4.2 Mid-lower Slope

The mid-lower slope area was apparently influenced by a fairly frequent fire regime. The most recent fire event is clearly in evidence as a large even-aged stand initiated by what appears to have been a fairly intense fire event. There were several cedar veterans on the mid-lower slope area that exhibited one or more fire scars. Wedge samples of fire scar lobes were collected from a few of these trees. In addition, age samples of lodgepole pine from fire edges and fire-skips provided additional information that was used to begin reconstructing the fire regime in this area. It is important to note that this area is immediately below the subalpine area, separated by a swath of old growth hemlock (age class eight [141-250 years] and nine [250+ years]), and as noted, there is evidence that fire has passed through these older types. Therefore, fires recorded in this mid-lower slope area may well have initiated, or been initiated by, fire events at higher elevations. This observation parallels the findings of a study of the Hoh fire on the Olympic Peninsula of Washington State, which found that more than half of the subalpine areas (subalpine fir and mountain hemlock) experienced crown fires while only ten percent of the montane forest (western hemlock, Douglas fir) experienced crown fires (Agee and Huff, 1980, cited in Parminter, 1983). Therefore there was a major difference in fire behaviour between these types; a dynamic which may be a factor at the montane/subalpine interface on Stakaiyt. Fire history samples collected from this area are summarised in the following chart (Figure 5.49).

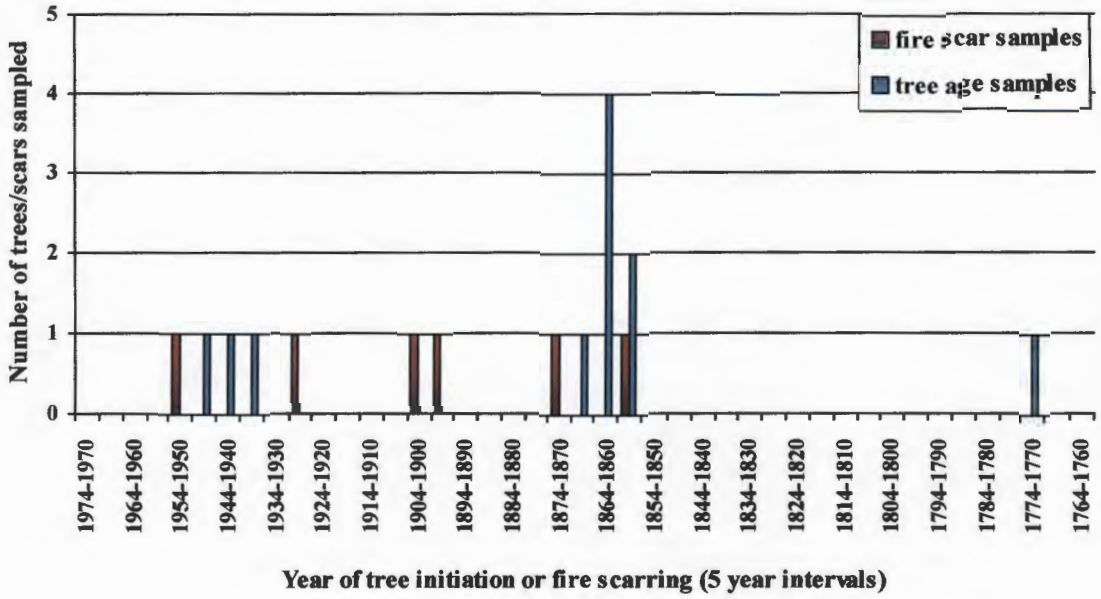

Figure 5. 49 Tree age cohorts from trees sampled at Stakaiyt (mid-lower slope areas).

A wedge sample from a fire scar lobe on a large cedar veteran located at △CR11 revealed three fire scars at 50, 71 and 127 years before present (Figure 5.49). This cedar veteran was located in young, hemlock dominated stand. Scattered lodgepole pine in this young hemlock stand were aged 54-58 years. Age samples taken from older lodgepole pine in fire-skip areas and individual pine vets within this young type were aged 132-145 years.

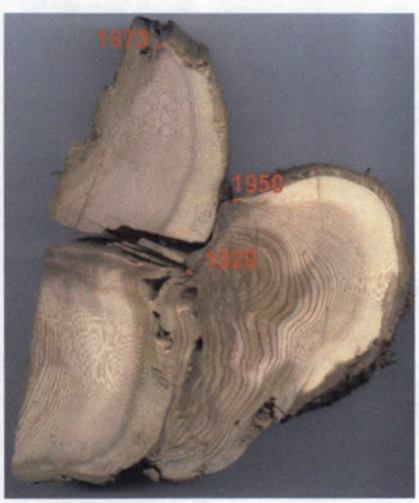

Figure 5. 50 Fire scar wedge sample from cedar veteran at △CR11

Figure 5. 51 Fire scarred cedar (2x) near △CR8

An older stand was located below this youngest hemlock type, and was characterized by widely spaced cedar and hemlock veterans interspersed with younger pine and hemlock. Several of these trees, particularly the cedar, exhibited fire scars (Figure 5.51), one with two scars (with a thin inter-scar lobe) indicating that fire passed through these mature stands lower on the slope as well. An age sample from a younger lodgepole pine at △CR8 revealed an age of 132 years while an old hemlock veteran in the same stand, located below △CR12 was aged 226 years. Finally a wedge sample from a large cedar veteran located several hundred metres south of the youngest stand at △CR29 recorded a fire event 103 years ago.

The fire scar data recorded within and immediately adjacent to the youngest stand indicated three fire events in a 77-year period between 1873 and 1950 (based on the wedge sample from the cedar veteran), for a mean fire return interval of approximately 39 years at △CR11. It is unlikely that this veteran cedar recorded all of the fire events that have occurred on this site and additional fire scar samples need to be collected to more accurately determine past fire frequency for this area.

While the fire scar record indicates dates of several fire events, the cohort ages of trees (mostly pine) within this stand do not necessarily correspond to the timing of these fire events. There are two cohorts of trees with ages greater than the closest fire scar dates. The youngest cohort aged at 54-58 years could not possibly have been initiated by the fire recorded for 1950, but could possibly have been initiated by the fire recorded for 1929. However, in order for this theory to be validated, a 13-17 year period would have been required for the sampled trees to germinate and reach the sampling height of 1.3 metres. This seems highly unlikely given the warm aspect and well-drained soils, both of which are excellent conditions for rapid pine growth. Lodgepole pine is expected to reach 1.3 metres in approximately three years under good growing conditions (as would be expected after a fire) on zonal ICHmc2 sites such as this

(Anonymous, 1997)[27]. This therefore suggests that another fire (unrecorded in the fire scar samples) may have initiated many of the trees in this younger type. However, this would require that these relatively young trees survived the ensuing fire event of 1950 without exhibiting evidence of scarring. This seems a highly improbable sequence of events. One additional possibility is that the fire-scarred cedar has a number of missing rings, possibly as a result of the shock of the fire event and wounding. Similarly, a second cohort ranging from 132-145 could not have been initiated by the fire event recorded 127 years ago based on a sample from the fire-scarred cedar. However, it is likely that an earlier fire event initiated this cohort. Additional fire scar samples are required to clarify this chronology of fire events.

The wedge shaped burn pattern exhibited by this lower-mid slope area (Figures 5.36 and 5.38) suggests the most recent fire was driven across the slope by wind blowing up the Skeena Valley from the south. The thin edge of the wedge is located on the old trail up Pinenut Creek, indicating that this may have been the point of ignition for this fire event.

While it is not feasible to fully reconstruct the fire regime of this lower-mid slope area without additional fire history data, it is apparent that this area has experienced several fire events during the last 150 years. Clearly, the fire regime on this slope had a far shorter return interval than the expected interval of 200 years for the ICHmc2 and ICHmc1, or than the 350 year mean event interval expected for the ESSFwv as identified in the MoF biodiversity guidebook (Anonymous, 1995).

5.4.5 Site Summary

For the most part, the Stakaiyt berry grounds are dominated by moderately sloping, mesic sites on warm aspects. However, increasing seepage and wetter ecological associations are

[27] The # of years to breast height (3 in this case) is calculated from site index for ICHmc2 /01 of 21 metres at 50 years for an average annual growth of .42 metres

encountered adjacent to alpine areas that are influenced by snowmelt runoff throughout most of the growing season.

Dense, uniform, western hemlock dominated stands were observed to occupy lower elevations, and appeared to have established promptly following a fire event occurring in the late 1930s or early 1940s. Conifer regeneration dominated by *Abies* species was sparse and clumpy in the higher elevation subalpine area. Persistent seral shrub communities, comprised primarily of ericaceous species, dominated these sites.

Black huckleberry abundance was observed to be strongly correlated with light availability. Plants varied in vigour and abundance from nonexistent to very low cover and vigour in the dense hemlock stands on mid-lower slopes, to relatively high cover values with good vigour in the open shrubfield complexes encountered in the subalpine area.

Large concentrations of black huckleberry in the subalpine area were observed to have experienced heavy grazing by wildlife over many years. This grazing activity was noted to be most pronounced in the higher elevations areas, where black huckleberry occurred in greatest abundance. Caribou Mountain is well known as important mountain goat habitat and as noted previously it is possible that goats are responsible for the observed grazing patterns.

Several knowledgeable Gitxsan elders indicated that this area is part of a traditional berry ground. The abundant evidence of cultural use confirms this, and suggests the importance of this area for the collection of a number of other plant and animal resources, particularly red cedar bark and mountain goat as well as caribou in the past. The location of two camp areas below the open shrubfield area suggests the importance of this early seral type as an area where resources were gathered on multi-day excursions in the past.

The proximity of this site to the named berry ground across Pinenut Creek at Lax Ansa Maatsa is an indication that both are important berry grounds and were likely interrelated with respect to use and management. Warmer aspects and greater elevational range of this area on Stakaiyt may have provided important site variability to ensure dependable harvests despite variable weather conditions from year to year. As Pete Muldoe indicated in his *Delgamuukw* testimony (cited earlier in this thesis), this site is considered part of Lax Ansa Maja (Maatsa).

Perry Sampson, a Gitxsan elder, has identified the southwest flank of Mount Tomlinson, a few kilometres to the north as another traditional huckleberry area (2000). All three huckleberry areas are situated on higher elevation sites with warm aspects near the major village sites across the river at Kispiox and nearby at Caribou (Utson Creek), a site which Perry Sampson refers to as "the hometown of Gutginuxw" (personal communication, September, 2000). In *Delgamuukw* affidavits this old village site is referred to as Lax Xsin Djihl (also the name of the territory) and is described as a village site on the Skeena river at the mouth of Utson Creek (*Delgamuukw* vs. the Queen, exhibit 609, Abel Brown). In addition, several fishing stations are located along the east side of the Skeena near the base of Caribou Mountain. This indicates that one or more, and quite probably all three of these factors (elevation, aspect and proximity to villages or fishing sites) may have been important in determining which areas would be actively used as huckleberry patches. The consistent aspect and slope across much of the west flank of Caribou Mountain suggests that other areas of highly suitable habitat may exist in close proximity to villages and fishing stations. It is therefore possible that other portions of this slope may have formed part of a more extensive berry ground in the past.

The existence of relatively frequent fire events on this slope, its proximity to major villages, its history as a berry ground and the importance of abundant huckleberry harvests to Gitxsan subsistence trade and culture, all suggest that this area was managed for berry production using landscape burning. While it is difficult to verify this unequivocally, it is also difficult to

formulate an alternative explanation for the combined oral history, fire history, ecological and cultural evidence that has been assembled for this site. It is clear that this area was a landscape that has been actively used by the Gitxsan in the historic period for gathering a variety of resources, a pattern that is almost certainly a continuation of past patterns.

5.46. Lax Ansa Maatsa: Case Study

5.5.1 Introduction

Lax Ansa Maatsa is a named huckleberry ground identified in territorial affidavits as "berry area on a ridge south of upper Pinenut Creek" in the Gutginuxw territory of Lax Xsin Djihl (*Delgamuukw* vs. the Queen, exhibit 609). The extent of this area is illustrated in the following aerial photo (Figure 5.52) This area is an upland plateau between Nine Mile Mountain and Sidina Mountain that has been actively used for berry harvesting as recently as the 1950's.

Figure 5. 52 Lax Ansa Maatsa (1978) Airphoto. Scale is approximately 1: 18,000

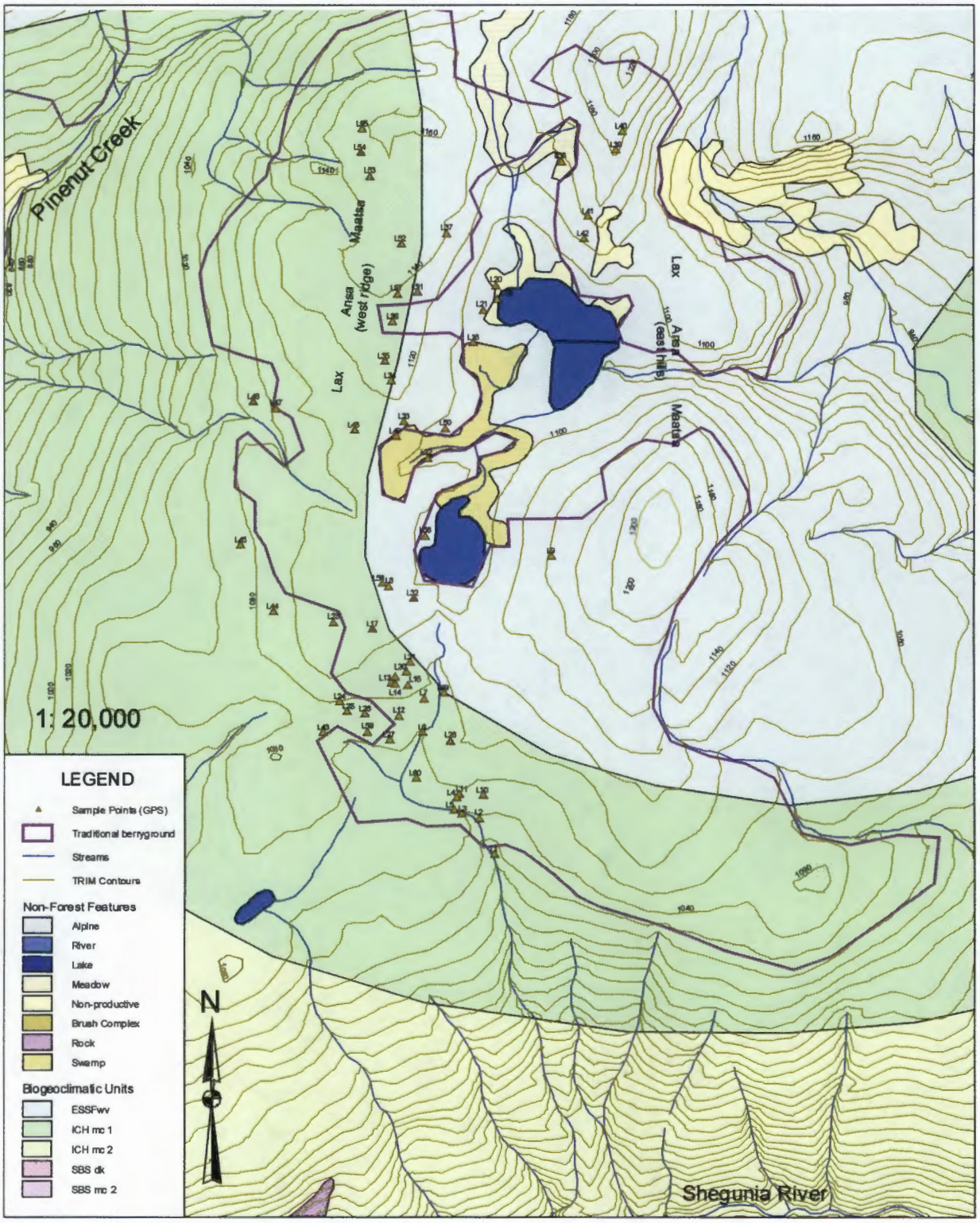

Figure 5.53 Lax Ansa Maatsa Berry Area and Field Sample Points

5.5.2 Ecological Overview

For the purposes of this study, the Lax Ansa Maatsa area is defined by the extent of early seral communities composed primarily of ericaceous shrubs and areas dominated by relatively young (less than 100 year old) coniferous regeneration. To characterize it in broad terms, the area under discussion is an overgrown berry ground that is succeeding to coniferous forest as trees become established at the margins of the open area. The site is characterized by rolling terrain punctuated by two substantial hills at the eastern boundary, creating a large area of warm south and west aspects. Two small lakes are set in a shallow basin located roughly in the centre of this plateau area. These lakes are linked by a wetland complex and drainage into Pinenut Creek to the north. Another small creek has its source on this plateau and drains to the south, eventually emptying into the Shegunia River.

Lax Ansa Maatsa is largely situated at elevations between 1100 and 1200 metres with a small area on the south end reaching as low as 1000 metres (Figure 5.53). Ecologically, this plateau area is transitional between the Nass variant of the Interior Cedar Hemlock moist, cold subzone (ICHmc1) and the wet, very cold subzone of the Engelmann Spruce-Subalpine Fir zone (ESSFwv). The significant numbers of amabilis fir on some areas of this site suggests that these areas could be classified in the amabilis fir phase of the ICHmc1 (ICHmc1a). However, this phase is typically found on cool moist (largely northeast) aspects (Banner et. al. 1993), conditions that are generally not observed in this berry ground. Most sites in the area surveyed were placed in the ESSFwv, with some smaller areas classified as ICHmc1. The latter biogeoclimatic variant occurs primarily on the warmer south and west-facing slopes of the two hills east of the lakes (Figure 5.53).

Aside from the wetland complexes, this area is largely mesic with some submesic and subxeric sites associated with a gentle north–south ridge that occupies the western half of the plateau and the narrower ridge crests of the two hills located east of the lakes. Soils were

primarily fine textured, silty loams formed on morainal parent materials and classified as dystric brunisols and, on some sites, humo-ferric podzols.

The following tables (Table 5.9, Table 5.10) summarize the ecological data collected from a series of plots on this site.

Area	Plot ID	BGC Unit	Site Series	Stand Structure*	Crown Closure	Slope (%)	Asp. (deg.)	Elev. (m)	Dominant tree	Dominant shrub
East hills	△L9	ICHmc1	/01a	PS Cs	30	17	264	1159	Hm	*M. ferruginea*
East hills	△L39	ICHmc1	/01a	YF Ct	25	10	226	1203	Ba	*M. ferruginea*
West ridge	△L17	ESSFwv	/01	LS	15	0	none	1135	Hw	*M. ferruginea*
West ridge	△L34	ESSFwv	/03	LS	15	10	228	1136	Bl	*M. ferruginea*
West ridge	△L55	ESSFwv	/03	LS	12	15	280	1175	Hw	*M. ferruginea*

*PS= pole/sapling, YF= young forest, LS= low shrub, C= coniferous, t= two-storied, s= single-storied

Table 5. 9. Ecological/Site Summary for the Lax Ansa Maatsa area.

Area	Plot ID	Drainage	Soil Texture	Humus Form	Coarse Frag. (%)	% V. mem	Snags & CWD	Charcoal Presence
East hills	△L9	moderate	silty loam	mormoder	40	20	some snags and CWD	no charcoal
East hills	△L39	moderate	silty loam	mormoder	25	8	few snags some CWD	in H layer
West ridge	△L17	moderate	silty loam	hemimor	15	8	few snags	in H layer
West ridge	△L34	moderate	silty loam	mormoder	15	8	several snags and CWD	in H layer
West ridge	△L55	moderate	Loam	mormoder	40	5	CWD various sizes	in F layer

Table 5. 10. Soil/Huckleberry/Fire Summary for the Lax Ansa Maatsa area.

The vegetation on this site is largely characterized by a persistent ericaceous shrubfield complex that is in the process of succeeding to a forest stand dominated by subalpine fir, amabilis fir, mountain hemlock (*Tsuga mertenesia* [Bong.] Carr.) and western hemlock. Tree distribution is generally patchy and is densest close to the edge of adjacent older stands, while

interior areas, particularly on exposed ridges, continue to maintain open shrubfield characteristics.

Figure 5. 54 Old growth hemlock in ICHmc1 /01a

Surrounding forests are typically old growth hemlock stands in age classes eight and nine. These stands are primarily classified in the mesic ICHmc1 /01a site series (Figure 5.54). Mature hemlock veterans in these types appeared to be extremely old and were generally widely spaced, often concentrated in small pockets, with mature and maturing subalpine fir and western hemlock filling in the gaps. There was generally very little understorey in undisturbed areas of these stands, however, false azalea and oval-leaved blueberry grew vigorously in canopy gaps and areas of younger, maturing forest.

Figure 5. 55 Black huckleberry (red foliage – lower centre) persisting below false azalea (light foliage) at △L7

Black huckleberry is present on all sites in the old berry ground, and varies from five to thirty percent cover. It generally persists as an understorey shrub beneath its ericaceous associates: false azalea and oval-leaved blueberry (Figure 5.55). Black huckleberry exhibited good vigour and high cover values on the drier more exposed sites where it occasionally dominates small areas. Black huckleberry was only occasionally observed to fruit in this area and when fruit was observed, only very low numbers of berries had been observed. Oval-leaved blueberry however, generally bore abundant fruit throughout this area. Although black huckleberry was observed to be a diminutive, understorey species throughout this area, it generally exhibited good vigour and did not appear to be senescent or declining markedly.

A more thorough discussion of the ecological characteristics and successional dynamics of this area is facilitated by dividing the area into two distinct areas: 1) the gentle ridge west of the two lakes, and 2) the hillsides east of the lakes (figure 5.53). Characteristics of these two areas are outlined in the following sections.

5.5.2.1 Western Ridge

A broad, gently sloping ridge dominated the area west of the two lakes and stretched more than two kilometres from its northern end above Pinenut Creek to its endpoint several hundred metres southwest of the southernmost, teardrop-shaped lake (Figure 5.53). This area was characterized by large submesic, sparsely treed areas across the broad ridgetop (Figure 5.57) area that were classified as ESSFwv /03 (Figure 5.56). These relatively dry sites graded into mesic associations on the eastern side of the ridge down toward the two lakes and at the lower, southern end of the ridge.

Figure 5. 56 Relatively open ESSFwv /03 shrubfield - west ridge △L48

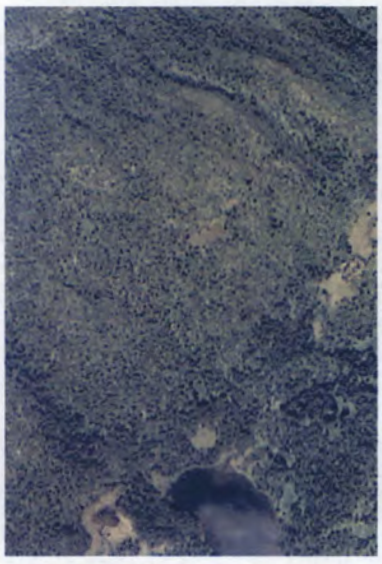

Figure 5. 57 North end of the western ridge containing plot △L55

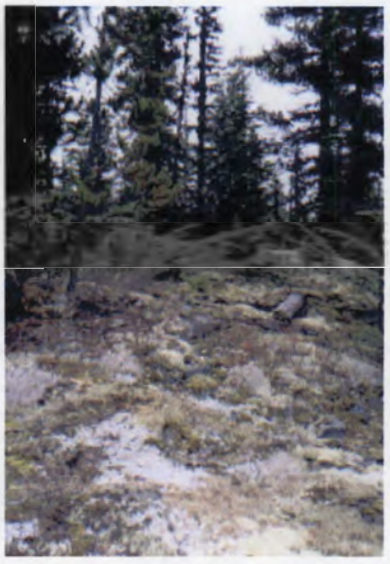

Figure 5. 58 ESSF wv /02 pocket on rocky outcrop near △L48

The higher, northern half of the ridgetop was interspersed with a few small rocky outcrops which supported subxeric vegetation communities dominated by terrestrial lichens and are classified as the Subalpine fir, Lodgepole pine – Cladonia (ESSFwv /02) site series (Figure 5.58). This site series is identified as a rare plant community (blue listed) in the Kispiox Forest District. Haeussler (1998) postulates that the rarity of this fire adapted, pine-lichen site series is attributable to the "wet, snowy climate and infrequent fire" that largely shape the vegetation assemblages in the ESSFwv subzone.

5.5.2.2 Eastern Hills

The two large elliptical hills to the east of the small lakes were both oriented north to south. The areas surveyed were primarily on the warm south and west aspects of these hills, as well as on the ridgetop areas, and were largely mesic with some seepage zones and wet meadows in toe slope areas. These sites were primarily classified as ICHmc1 based on vegetation characteristics, particularly the abundance of amabilis fir. Warm aspects on the west and south aspects of these hills likely account for the predominance of ICHmc1 vegetation assemblages at these uncharacteristically high elevations.

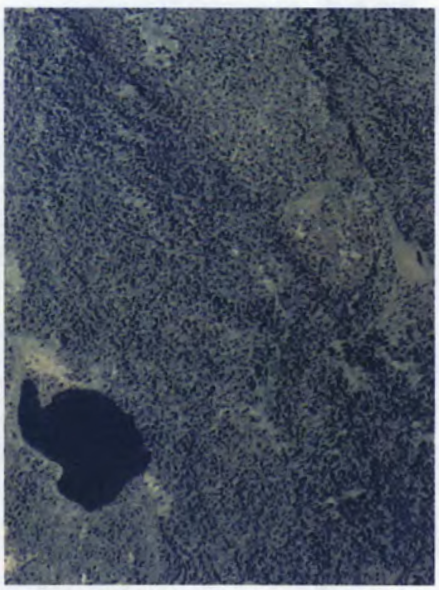

Figure 5. 59 East hills east of smaller lake – contains plot △L9

Figure 5. 60 ICHmc1 /01a heavy azalea and maturing *Abies* at plot △L9

Large portions of this area have succeeded to young coniferous stands (Figure 5.59), which exhibit a closed canopy in a few places. Coniferous seedlings, saplings and poles have established in all areas, although some portions have relatively low densities of coniferous establishment and maintaining open shrubfield characteristics. Heavy growth of false azalea (Figure 5.60) has excluded conifers on some sites, although clumps of tree regeneration within these areas generally provide opportunities for additional coniferous establishment at their margins. It is expected that black huckleberry will maintain a presence on this site even under an increasingly closed canopy, but it will likely decline in vigour and abundance with decreased light availability. It is anticipated that this decline in black huckleberry vigour and abundance may increasingly become an impediment to the successful restoration of this area as a productive huckleberry patch.

5.5.3 Cultural Context and Field Data

Gitxsan advisors Perry Sampson and Walter Wilson report that Lax Ansa Maatsa has been used in the last fifty years as a berry picking ground (2000)[28]. During interviews conducted by Richard Overstall and Neil Sterritt (1986) documenting berry picking and processing near Kispiox in the 1920's, Gitxsan elders Percy Sterritt and the late Gertie Morrison recalled camping at Lax Ansa Maatsa at the start of the huckleberry picking season with their grandmother Sophia Johnson and her sister's family. They described this site as a bench north of the Salmon River where they picked and dried the Sim maiy (black huckleberry) before moving further up the valley to pick mii yehl or lowbush blueberry (*Vaccinium caespitosum*) on lower elevation sites. This area is also well known for its important moose habitat. In addition, this area is part of a goat migration corridor between Caribou Mountain and Nine Mile Mountain (Walter Wilson[29], personal communication, 2001). It is within easy access of the traditional goat and caribou hunting areas on Caribou Mountain. Caribou have been sighted in this area within

[28] Perry Sampson reports guiding Lottie Muldoe and Gertie Morrison up to this area. Walter Wilson reports that Lottie Muldoe picked berries in this area.

the last 30 years and antlers are still found in the headwaters of Pinenut Creek (Walter Wilson, personal communication, 2001).

Gitxsan people have also used this berry ground as a trapping base to access surrounding old growth stands for trapping marten and other furbearers. A trapping cabin was reportedly located between the two lakes and several dozen traps were apparently hung in a spruce tree at this site (Walter Wilson, personal communication, 2001). This berry ground is also close to several fishing stations on the Skeena, as well as an area traditionally used for netting spring salmon on the Shegunia River (Gitxsan and Wet'suwet'en Chiefs, 1987).

Figure 5. 61 Large blaze in old hemlock stand

There was a great deal of physical cultural heritage evidence documented within and at the margins of this berry ground. There are many blazes on trees within the shrubfield and in adjacent wooded areas, with some trees blazed quite high on the bole indicating winter use of this area as well. Particularly high concentrations of blazes were recorded in the old growth hemlock types west of the shrubfield area. Many of these blazes were on old growth hemlock trees (Figure 5.61) and (the blazes) were estimated to be well over 100 years of age. A very large old hemlock was discovered at △L45 blazed on all four sides, likely indicating a trail junction. The blazes on this particular tree were approximately 50 cm in length.

From the blaze patterns recorded on this site, it would appear that a number of trails exit the shrubfield along its western side and coalesce into a trail running north–south inside the old growth hemlock type. It also appeared as if some of these blaze patterns turned to the southwest at the south end of the shrubfield and headed towards the small oval shaped lake

[29] Walter Wilson is a caretaker for the house of Gutginuxw

and then likely down the ridge to the Skeena Valley bottom. This is similar to a route described by Perry Sampson (personal communication, 2000) for accessing this berry ground. He reports that the trail into this area passed by Collins Lake and ascended the ridge to the berry patch area and that he had used this trail many years ago when he had accompanied the late Lottie Muldoe and the late Elsie Morrison to this area on a berry-picking excursion. This route would coincide with some of the blaze patterns observed in the old growth hemlock types on the western margin of the berry patch area.

Trails within the shrubfield area seemed to follow the wetland complexes. A number of blazes were found throughout these areas, and a trail appeared to follow the wetland north of the larger lake towards Pinenut Creek and the berry ground at Stakaiyt (south and west flank of Caribou Mountain). The Pinenut Creek Valley is extremely steep below this area and the best crossing location to access the subalpine and alpine areas on Caribou Mountain would be at the north end of the wetland complex north of the two lakes. In addition to the blaze patterns, several sections of trailbed were located both within (Figure 5.62) and outside (5.63) of the shrubfield area. Some of these were currently being used by wildlife but in many cases they were not used, and were instead obscured in thick brush.

Figure 5. 62 Section of trailbed within shrubfield near △L7

Figure 5. 63 3-4 blazes – Bl - swamp complex △L22

Figure 5. 64 Old raft near camp location at △L19

A campsite was located at the northwest corner of the larger lake. This site was located on a trail which ran from the wetland area (southwest of the lake), and skirted the west side of the lake, turning east and running through the camp and into the wetland complex to the north of the lake. At this point the blaze pattern petered out. The campsite itself had evidence of fire pits, a number of chopped branches and axe marks on trees. In addition, the remains of an old raft were found at the shoreline (Figure 5.64).

To the west of the campsite, in a cool (east-facing), permesic opening at the edge of the open shrubfield area (△L37), a series of three shallow, square depressions were found, arranged in a line and spaced equidistant from one another (Figure 5.65). These depressions measured approximately 50 centimetres square and were approximately 15 centimetres deep. These were similar to the shallow pit depressions found on Stakaiyt (Caribou Mountain), and at other berry patch sites in the area.

Figure 5. 65 Shallow, square depressions in permesic forest edge area at △L37

The purpose of these depressions is uncertain. However, it is possible that these sites were used to cache harvested berries, keeping them cool while the pickers continued their work. It seems plausible that the depressions were used to steady the large bentwood boxes that were traditionally used by berry pickers, keeping them upright and avoiding spillage. The cedar bentwood berry box recently discovered at an old berry camp in the lower Harold Price drainage measured 43cmx42cm at the base (Rabnett, 1999), which would fit in the depressions located in the berry patches. The location of these pits at the edge of an open shrubfield area and above a known camp location supports this hypothesis. In

theory, berry pickers could fill one of the large bentwood boxes with berries and cache it securely in a cool spot that they would pass enroute back to the berry camp at the end of the day.

In summary, this is a named berry patch area that is still commonly known and referred to by its Gitxsan name of "Lax Ansa Maatsa" by a number of Gitxsan elders. It is also known as an important hunting ground, particularly for moose in the fall. The site is within easy access of the alpine goat (and formerly caribou) hunting areas on Caribou Mountain. The location of a camp at the two lakes, and the reported existence of a cabin between these two lakes and another cabin[30] in older timber along the western boundary of this area, all indicate intensive use of this area for multi-day hunting, trapping and gathering excursions. It is clear that this high elevation plateau was an important habitat traditionally used to gather a number of upland resources. It is also interesting to note, that despite the importance of these other resources, the name for this site is most often referred to in reference to its importance as a huckleberry gathering area.

5.5.4 Fire History

Figure 5. 66 Multi-aged pine growing together near △L58

Documenting fire history in subalpine forests is often challenging due to the lack of fire scar evidence and the intermittent nature of regeneration of coniferous tree species at high elevations. One option that is available to determine fire history in these areas is the use of tree (age) cohorts of species that are known fire followers such as lodgepole pine. James Agee (1993) has indicated that lodgepole pine is a suitable marker tree for fire events in subalpine areas. However, in areas where lodgepole pine bear non-serotinous cones and suitable microsites exist, lodgepole pine may regenerate long after the last fire event, making it more difficult to identify

[30] *Delgamuukw* maps indicate a cabin at the headwaters of a small creek draining west from the berry ground plateau into Pinenut Creek (west of the southernmost of the two small lakes)

distinct fire-initiated cohorts of pine with certainty. This may be the case within several of the areas surveyed in this area (Figure 5.66). As a result, only the oldest, most abundant pine age class is used as a marker of a past fire event. Fortunately, there was a great deal of additional fire history evidence documented on this site which provides additional context that contributes to our understanding of the nature of past fire events.

More than two dozen age samples were collected from mature trees (primarily lodgepole pine) throughout the open shrubfield area, as well as in fire-skips and older forests at the margins of this berry ground. Most of the samples used to date relatively recent fire events were collected from lodgepole pine that were deemed to be the largest (and assumed to be the oldest) in the area. This yielded a range of ages from 76 to 92 that did not appear to be grouped in any particular manner, but instead formed a continuum, with no gaps greater than two years between ages. Tande (1977) found that lodgepole pine establish from 1-20 years post-fire with the average establishment at four years in forests near Jasper, Alberta. This drawn out pattern of lodgepole pine establishment could account for the pattern of lodgepole pine ages observed here. Samples from older stands yielded ages of 101, 184, 228 and 359, while younger trees were aged 70 (two samples), 52, 46, 38.

There was relatively little fire scar evidence available on or around this site. Most of the tree species which dominate this high elevation area (*Abies* and *Tsuga* species) are typically fire avoiders (Agee, 1993), and tend to either burn readily in fire events or succumb quickly to rot or decay once damaged. The fire scar evidence that was collected indicates a fire event approximately 90 years ago based primarily on an increment borer sample of a subalpine fir veteran in a fire-skip area at △L36. This fire scar lobe had 75 countable rings and was geometrically corrected, adding 15 years for a total age of 90 years. A second increment borer sample from fire scar lobe on a

Figure 5. 67 Fire scarred Hw at △L1 (scar=74+ yrs)

large hemlock veteran at △L1 (Figure 5.67) yielded 74 countable rings and likely recorded a fire in the same time period, although this sample was not corrected. The majority of the lodgepole pine sampled likely originated from a fire in the period around 1910. The regeneration "pulse" in age classes between 76 and 90 years, as seen in Figure 5.68, supports this hypothesis and suggests that the fire event recorded at △L36 quite likely affected a large portion of this area as trees in this age category were widely dispersed across the site.

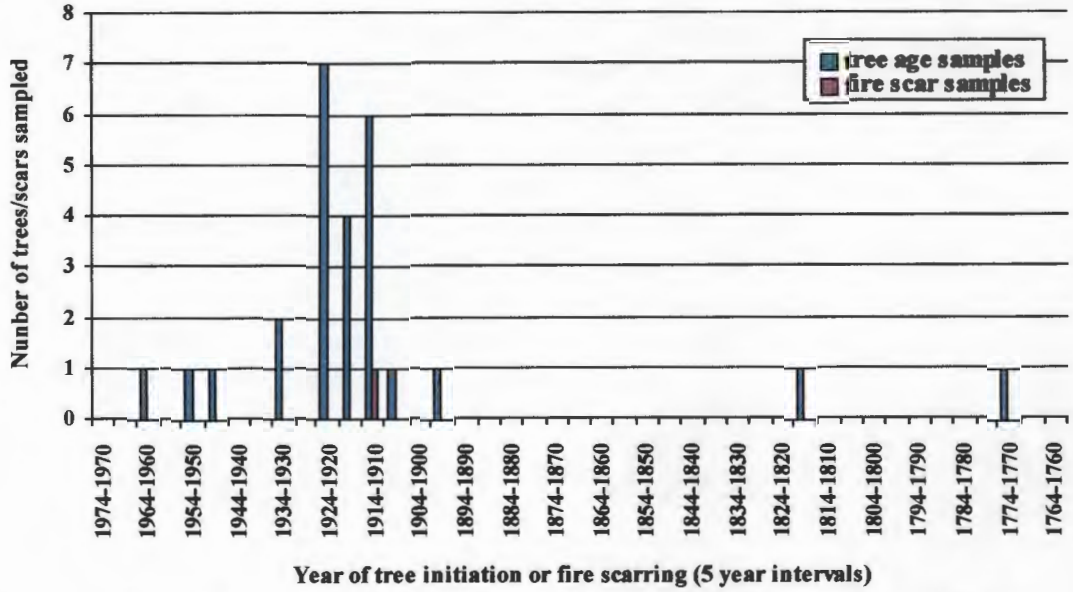

Figure 5. 68 Tree age cohorts from trees sampled within Lax Ansa Maatsa.

Additional characteristics of the past fire regime can be inferred from the variation in stand characteristics within this area. Initial air photo analysis revealed that the extensive north–south ridge that lies west of the two little lakes (west ridge) is sparsely treed with smaller stems relative to more densely treed areas to the south and east of the small lakes. This observation was confirmed during field reconnaissance and sampling, and could not be immediately associated with topographical or other site features. While the ridge was generally drier overall than other areas surveyed, there were many large, ecologically equivalent areas in terms of aspect, elevation, moisture and nutrient status on the more densely treed east hills. Despite the similarities between site types, these areas were very different with respect to stand density and

age structure (based on observation). The more open stand on the west ridge generally appeared to have a wider variety of regeneration age classes, whereas the more densely treed sites on the east hills appeared to be more even-aged with the majority of the stems in the older age class (76-90 years).

It is interesting to note that the oldest pines on both sites did not appear to differ appreciably in age[31]. Therefore, it is inferred that the young stands on both sites were likely initiated by the same fire event, and that sites with similar ecological potential on these two site types are following distinctly different successional pathways. This suggests that some other factor is influencing stand development on these sites. It appears likely that this other factor is related to the fire regime and could possibly be the intensity or frequency of past fire events. Differences in one or both of these factors may have limited tree regeneration opportunities over the past decades on the more sparsely treed west ridge.

It is postulated that the sparsely treed ridge west of the little lakes has experienced more frequent fire disturbance than the area to the east and south of the lakes. As a result of this more frequent or intense disturbance, available seed sources would be markedly reduced on the west ridge and recolonization of this site would be increasingly dependent on the establishment of seedlings from wind-dispersed seed. At the same time, shrub species which sprout from surviving rhizomes following a fire would have an advantage, establishing ground cover that would further limit opportunities for coniferous establishment. The stand characteristics of this ridge appeared to reflect the influences of this type of disturbance and regeneration pattern.

Additional information about the fire history of this site can be inferred from the distribution, size and variability of woody debris that remains on the site in the form of downed logs and

standing snags. Generally speaking, snags and coarse woody debris were sparsely distributed on this site, increasing in abundance in moister, depressional areas and on cool aspects. Again, there were distinct differences between the ridge west of the lakes, and other young stands on this site. Areas on the west ridge generally had a variety of size classes of snags and a relatively low amount of coarse woody debris overall, relative to other young stands on the east hills and areas south of the lakes.

Table 5.11 summarizes the snags and coarse woody debris present in a 0.01 hectare plot established at △L55. This total stump/snag count indicates a stand density of 600 stems/hectare for this site prior to the last fire, assuming that all trees were living at that time. From the varying states of decay it appears as if the standing (solid) fire snags in the 25 centimetre (at 1.3 metres) size class were likely alive much more recently than the stumps with trunks on the ground which were in advanced stages of decay (decay classes 4 and 5 [Anonymous, 1998]). Therefore, the pre-fire stand density estimate is likely conservative and pre-fire stand density was likely closer to 200 stems per hectare.

Stem Diameter (cm)	Standing Solid	Stump & CWD
15		1
25	2	
50		3

Table 5. 11. Summary of Previous Stand Characteristics at △L55.

In general, there was a sparse and patchy distribution of downed and standing fire snags on this site. These snags varied in size (Figure 5.70), with the largest likely being several hundred years old at the time of death. A moderate sized subalpine fir fire snag (31.5 cm dbh) at △L15 was aged at 188 years. In some cases, snags exhibited evidence of scarring from two fire events (Figure 5.69 and Figure 5.71). It appears as if, prior to the last fire, large scattered living

[31] Additional age samples are required in order to confirm age class distributions on this site.

trees, including some fire veterans were sparsely distributed throughout many areas of this site. This type of stand structure is indicative of a moderate intensity fire regime characterized by "substantial numbers of residual trees in the larger age classes" and which will "often develop a multiple-age structure" (Agee, 1998).

Further evidence that this area has experienced a moderate intensity fire regime in the past can be inferred from the abundance of fire refugia and "skips" that are distributed in several areas at the centre of the plateau. Topographic and site characteristics (i.e., moister site series) have allowed these areas to avoid fire for longer periods than surrounding areas. However, fire scars observed within these types indicate that fire did pass through some of them, but apparently did not ladder into the crowns. This suggests that these stands must have had a structure that was relatively fire resistant at the time of the last fire. The stand appears to have been relatively open with few fine fuels accumulated, and relatively few low-reaching limbs on trees. The large subalpine fir at △L36 was aged 359 years, and was immediately adjacent to the subalpine fir vet with the fire scar that dated a fire event at approximately 1910. This open, fire-adapted stand structure was characteristic of many of the old growth hemlock stands that surrounded this site. More recent in-fill of canopy gaps has created a much more densely stocked and fire-prone stand structure than appears to have existed in the past.

Higher elevation forests such as this one, dominated by fire sensitive species, generally experience high-intensity fire regimes with long return intervals, generally leaving a stand with few residual stems and very large patch sizes (Agee, 1993; Agee, 1998). Therefore, this site (particularly the west ridge) exhibits evidence that a moderate intensity fire regime influenced stand characteristics prior to the last fire. Based on observations of the current stand and snag characteristics, the most recent fire appears to have been of relatively high intensity, removing most residual trees from the site outside of a few remnant refugia, largely concentrated in moist areas.

Figure 5. 69 Scar pattern on snag indicates 2 fires

Figure 5. 70 Multiple size structure of snags

Figure 5. 71 Char pattern - burning of previous scar

The fire history evidence from Lax Ansa Maatsa indicated that this berry ground has likely experienced relatively frequent fires compared to surrounding high elevation forests. Current open stand characteristics, particularly on the western ridge, are most readily accounted for by the previous moderate intensity fire regime, and possibly the impact of the most recent (higher intensity) fire event. One or both of these factors have had the effect of reducing coniferous seedbanks in organic layers and favoring the early establishment of sprouting, rhizomatous shrub species. Ingress of coniferous species appears to have occurred relatively slowly, and interior areas remain relatively open. The fire scar evidence and the characteristics of snags and coarse woody debris in this area further suggests the previous influence of a moderate intensity fire regime. However, the best indication of the fire history of this site lies in the successional dynamics that are now well underway and are reducing the cover and fruit production of black huckleberry throughout. Lax Ansa Maatsa cannot remain a productive berry patch without the intervention of fire at relatively short intervals to maintain the berry ground in an early successional stage.

5.5.5 Site Summary

Lax Ansa Maatsa is a named Gitxsan berry ground that is in the process of succeeding to a subalpine fir dominated forest. Based on field reconnaissance, ecological sampling and fire history analysis, it appears that the last major fire event on this site occurred at about 1910. Since that time this site has been used by Gitxsan people as a huckleberry gathering area as well as for hunting and trapping. In the post fire decades, coniferous regeneration and fire sensitive shrub species have begun to dominate this site, relegating black huckleberry to understorey status. In 2000 black huckleberry was not observed to bear fruit in any significant quantity anywhere on this site. This formerly important traditional gathering area has been rendered unproductive by the lack of fire disturbance over the past 50 years.

Long term traditional use of this area by Gitxsan people is documented in the oral tradition and is confirmed by cultural heritage evidence available on and around this site. It is clear that this upland berry ground was the centre of activities for gathering a variety of important resources. It is also clear that the Gitxsan would have had to actively manage this area using landscape burning in order to keep it productive as a huckleberry patch. Lax Ansa Maatsa is a fascinating example of an upland cultural landscape that exemplifies the critical connection between the people and the land

CHAPTER 6: FRUIT LEATHER AND FIRE SNAGS: CASE STUDY ANALYSIS

6.1 Introduction

This summary chapter will revisit the four research questions which inspired and directed this project. These questions are intended to provide insights into the systems of environmental management employed by the Gitxsan and Wet'suwet'en. The primary goal is to understand what types of sites were being managed for black huckleberry production, why these sites were tended so carefully over long time periods and how they were managed. The research questions are:

1. Is there a set of ecological and or topographical characteristics that is commonly associated with traditional huckleberry sites?
2. Based on the ecological and fire history evidence collected, are there commonalties in fire regime characteristics among the huckleberry sites studied?
3. Have individual traditional huckleberry patches followed similar successional pathways after the cessation of anthropogenic burning?
4. Based on the analysis of field data from the case studies, what can be inferred about stewardship strategies and techniques used by the Gitxsan and Wet'suwet'en to manage the huckleberry resource?

6.2 Study Site Stratification

Generally speaking, the five traditional black huckleberry patches surveyed as part of this research initiative, when assessed as a group, exhibit a great deal of variability with respect to ecological and physiographic characteristics. At first glance, this finding seemed to run contrary to the initial hypothesis that there should be a set of ecological and physiographic characteristics which would define an ideal site type to which the Gitxsan and Wet'suwet'en would direct their management efforts in order to maximize huckleberry production. While there was no single site type that emerged as the "typical" or "ideal" black huckleberry patch, the

study sites did display a relatively consistent profile with respect to soil moisture and nutrient regime, being predominantly mesic to submesic with nutrient regimes tending to be poor to medium. Despite the overall variability in physiographic and biogeoclimatic attributes, some patterns did emerge, with more consistent trends in biophysical characteristics observed for huckleberry patches grouped within particular biogeoclimatic units.

The patterns inherent in the data for these five sites are most apparent when categorized by elevation. The elevation ranges (in brackets) are used to divide the sites into "high" (>1000m), "medium" (700 – 1000m) and "low" (<700m) elevation categories. These categories are based in a very general way on the natural breaks between the sites and are defined only for the purposes of discussion and comparison. The Stakaiyt area includes two ecologically distinct berry patch areas at different elevations separated by a swath of old growth hemlock forest which have been analysed separately. Biophysical site characteristics for the case study areas are summarised in the following table (Table 6.1).

Elevation Category	Site Name	Biogeoclimatic Unit(s)	Elevation Range (m.)	Aspect (average)	SNMR* (dominant)	Stand Structure	First Nation
Low	Beket Degii Ts'ooyiin	ICHmc2	440-635	NE	3-4 B-C	Decid./Conif.	Wet'suwet'en
Low	Lower Harold Price	ICHmc2/mc1	495-1000	NE	3-4 B-C	Conif.	Wet'suwet'en
Mid	Sool Nii	SBSmc2/SBSdk	600-1100	SW	3-4 B-C	Decid./Conif.	Wet'suwet'en
Mid	Stakaiyt (mid-lower)	ICHmc2/mc1	600-1000	SW	3-4 C	Conif.	Gitxsan
High	Stakaiyt (upper area)	ESSFwv/ICHmc1	1000-1300	SW	3-5 B-C	Shrub/parkland	Gitxsan
High	Lax Ansa Maatsa	ESSFwv/ICHmc1	1000-1200	SW	3-4 B-C	Shrub/parkland	Gitxsan

*Soil Nutrient/Moisture Regime (see edatopic grid - appendix #3)

Table 6. 1. Study Sites and Elevation Categories

The following sections address the four research questions using these three elevation classes as a basis for analysis.

6.3 Ecological Profile

- *Research Question #1: Is there a set of ecological and or topographical characteristics that is commonly associated with traditional huckleberry sites?*

6.3.1 Valley Bottom (low elevation) Sites

Two of the case study sites (Beket Degii Ts'ooyiin and lower Harold Price) were classified as "low" elevation. While the Harold Price site certainly extends to higher elevations, the vast majority of the sampling here was undertaken at elevations below 700 metres, as this is where evidence of berry processing activities was discovered. It is assumed that this lower area of the Harold Price site was also central to the huckleberry harvesting and management activities. Both of these low elevation sites are located in Wet'suwet'en territory. In addition to these sites, there are two other named, low elevation huckleberry sites in Wet'suwet'en territory near Beket Degii Ts'ooyiin, they are Ooniin'aay and Decen Det'ekw (Figure 5.2). There were no low elevation sites surveyed or identified within Gitxsan territory, although some that have been reported include a site on the first bench above the Skeena River, just south of the Fiddler Creek confluence (approximately 350 metres elevation), and an area on the south side of the Skeena River near the Gitxsan village of Kitwanga (approximately 600 metres elevation) (Allen Gottesfeld[32], personal communication, 2001).

These low elevation sites (two case studies, and the other two sites – identified by Wet'suwet'en elders) were all characterized by predominantly cool aspects (northeast to east), moderate slopes and initial successional stages dominated by deciduous species. Comparing the characteristics of these low elevation huckleberry patches to the black huckleberry habitat suitability model (Burton et al., 2000) these sites would be defined as having low potential based

[32] Head Scientist: Gitxsan Watershed Authority

on five out of the seven predictive characteristics; elevation, aspect, leading species and biogeoclimatic unit. The seeming incongruity of several traditionally managed huckleberry patches on sites predicted to have low suitability for this species deserves further investigation.

Possible explanations for this seeming incongruity likely relate to the pursuit of gathering and management efficiencies and convenience, as well as the ecological characteristics of these sites. However, it is assumed that First Nations, in this case the Wet'suwet'en, would not actively manage for huckleberry production in areas that were not potentially productive. From an ecological perspective this site has soil moisture and nutrient status characteristics suitable for productive black huckleberry growth. The influence of the cool aspects may in fact create suitable climatic conditions for black huckleberry growth at low elevations by reducing the occurrence and extent of limiting summer drought conditions. As these sites are now largely treed, and have relatively low coverage of low vigour black huckleberry at present, it is difficult to determine areas or levels of past huckleberry productivity. However, the abundant huckleberry growth in the hydro cut of Beket Degii Ts'ooyiin (Figure 5.10), and in gaps on Decen Det'ekw as well as in submesic gaps on the lower Harold Price site are all indications of the potential productivity of these areas. Consideration of these black huckleberry patches within the context of seasonal round activities, proximity to other resource gathering areas, travel corridors, village sites and the suitability for berry processing will likely yield additional insights into their use and maintenance.

6.3.2 Montane (mid-elevation) Sites

The two mid-elevation huckleberry patches were Sool Nii (Reiseter Ridge) and the lower portion of Stakaiyt. Another mid-elevation traditional Wet'suwet'en berry ground, "Wetil Xoos", was identified on the east side of the Bulkley River near Moricetown. Some of these sites extend to higher elevations (i.e. Sool Nii), however, the classification as "mid-elevation", is

based on the area in which intensive sampling was conducted, which was at middle elevations (between 700-1000 metres).

All of these sites are located on warm, primarily southwest aspects. The two mid-elevation case study sites are located on moderate to steep slopes. The lower area of Stakaiyt is now densely forested with coniferous, hemlock dominated stands, while the Reiseter ridge site is forested with a combination of deciduous, aspen dominated complexes in lower areas, and relatively open young coniferous lodgepole pine dominated stands in upper areas.

Based on a comparison with the habitat suitability model for black huckleberry (Burton et al., 2000), these sites (the two case study areas) would be considered transitional with respect to habitat suitability. The location of these sites on warm aspects between 700-1000 metres and varying between ICHmc2 and ICHmc1, means that lower elevation sections would be considered low suitability while higher elevation areas would be considered moderate suitability or in the case of a south aspect, possibly high suitability. The traditional use and management of these types of sites as huckleberry gathering areas is inferred from oral history accounts and field examinations of two berry ground areas. The presence of significant areas of moderate suitability huckleberry habitat, based on the predictive model, is currently the best available evidence that huckleberry can even grow on lower Stakaiyt, as it was not in evidence under the dense hemlock canopy. For other sites such as Sool Nii, this rating confirms observations of vigorous huckleberry growth in upper areas of this site.

6.3.3 Subalpine Sites

The two subalpine sites surveyed during fieldwork (Stakaiyt [upper] and Lax Ansa Maatsa) were classified in the high elevation category. Several other high elevation sites have been identified (i.e. Fiddler Creek and Grouse Mountain) and these will be used to provide additional context.

The case study sites are located on high elevation subalpine plateau or bench sites, characterized by gentle to moderate slopes, rolling topography and warm aspects. Similar site characteristics have been observed on high elevation huckleberry patch sites at Fiddler Creek, below Kitwanga in the lower Skeena River drainage, and at Grouse Mountain, near Quick (between Smithers and Houston, BC). Despite similar topographic characteristics, these two additional sites vary greatly with respect to continentality, being almost coastal (Fiddler Creek) and strongly sub-boreal (Grouse Mountain) with respect to climate.

The physiographic profile of subalpine berry harvesting sites surveyed mirrors results of studies in the Washington Cascades for Sahaptin and Chinookan speaking peoples of the lower Columbia River. A study in that area found that traditional subalpine huckleberry sites were, "generally flat to moderately sloping, including upland benches and areas adjacent to small lakes, ponds or wet meadows" (Mack and McClure, in review). Similarly, for the Sto:lo of the Fraser Valley, higher elevation huckleberry areas were described as parkland sites characterized by rolling terrain, wet meadows, lakes and small ponds and accessible huckleberry patches, "any of which may have been maintained by cultural burning" (Lepofsky et al., in press).

The vegetation of the two subalpine study sites was characterized by a persistent seral shrub complex, dominated by a variety of ericaceous species with significant conifer ingress, particularly in lower elevation areas. Similar observations were documented during fieldwork for the Fiddler Creek site and observed during a reconnaissance trip to the Grouse Mountain site.

From an examination of the two subalpine case study areas, it is evident that: a) these areas were both formerly productive for black huckleberry and b) there are no longer any harvestable quantities of huckleberries being produced. Both sites straddle the ICHmc1 and

ESSFwv transition at their lower extremes and extend into the ESSFwv to varying degrees. Both sites are largely mesic with some wetter areas at higher elevations on Stakaiyt and wetland complexes in depressional areas on Lax Ansa Maatsa. In general, both sites are now largely occupied by ericaceous shrub complex with the fire sensitive false azalea being the dominant shrub species in most areas. Coniferous ingress, largely *Abies* and *Tsuga* species, is rapidly reducing the extent of open shrubfield area on both sites and is reducing the vigour and productivity of black huckleberry.

Both of these high elevation huckleberry patches still contain significant components of relatively open shrub complex where black huckleberry exhibits good vigour and substantial cover. These sites fit within the profile of sites predicted to be moderate huckleberry habitat (Burton et al., 2000). The location of these early seral vegetation types largely corresponds with the only two higher elevation bench/plateau areas on the warm aspects of Caribou Mountain, other areas of the mountain are much more steeply sloping and are mostly forested with mature and old growth, *Tsuga* dominated stands.

6.3.4 Summary

Based on analysis of ecological data collected from the five case study sites (Stakaiyt divided into two sections and analysed separately), and contextual information from seven additional traditional huckleberry patch sites, it is apparent that these black huckleberry patches, taken as a group, do not fit a single ecological or physiographic profile. However, looking at particular aspects of these huckleberry patches reveals some commonalties between sites.

All sites surveyed were similar with respect to soil nutrient regime (poor – medium sites). Most sites surveyed were predominantly mesic to submesic, a characteristic which was most pronounced in the lower and mid-elevation sites. Higher elevation sites began to show wider variability with respect to environmental variables and a broader ecological niche for black

huckleberry with strong growth being observed across a relatively broad moisture gradient. However, on the whole, sites observed to support relatively abundant and vigorous huckleberry growth did fit the profile of mesic to submesic moisture status and poor to medium nutrient status.

Overall, the aspect of the black huckleberry patches studied was clustered around two ranges; southwest and northeast. Initially this appeared to indicate that there was no pattern or influence of aspect on site selection for traditional huckleberry harvest and management. However, after further consideration it became apparent that the low elevation huckleberry sites were predominantly on cool aspects ranging from north to east. In total there were four low elevation sites observed, all on cool aspects. This finding may be related to the environmental requirement of black huckleberry to grow in areas that do not experience summer moisture deficits (Haeussler et al., 1990).

Middle elevation sites, Sool Nii and the lower area of Stakaiyt are both on predominantly southwest aspects. No other middle elevation sites were identified although it is expected that many more exist. Some sites, which cover large elevation ranges such as the lower Harold Price site, include areas that would be considered middle elevation as well, although these higher areas of this site were not surveyed in this research initiative. Middle elevation sites were generally heavily treed, often in coniferous species, a factor which makes recognition of these huckleberry patches difficult without the aid of additional anecdotal information and confirmatory cultural heritage and fire history evidence.

The two subalpine case study sites had aspects that ranged from south to west, with the predominant aspect being southwest. In addition, the subalpine Grouse Mountain site is a plateau with southwest aspect, and Fiddler Creek site is an upland plateau with aspects ranging from southeast to southwest. The topography of these subalpine huckleberry sites exhibits a

clear trend toward upland plateau areas with warm aspects as was observed on Stakaiyt and Lax Ansa Maatsa.

The traditional huckleberry sites studied also varied from a topographical perspective but fit a profile within the three elevation categories. Middle and lower elevation sites were primarily situated on moderate to steeply sloping sites with relatively even topography while higher elevation sites were typically found on rolling upland plateaus which are often associated with wetlands, ponds and small lakes.

6.4 Overall Fire History

- *Research Question #2: Based on the ecological and fire history evidence collected, are there commonalties in fire regime characteristics among the huckleberry sites studied?*

All traditional huckleberry grounds exhibited evidence of relatively frequent fire activity in the past 150-200 years relative to benchmark values estimated for natural fire regimes in the study area. Most fire activity on these sites pre-dated systematic fire recording in the region. Therefore, the opportunity to date fire events was largely dependent on the availability and preservation of fire scar evidence, and identification of cohort ages of fire-following tree species. A variety of additional features provided further indications of the characteristics of fire regimes, which have influenced these sites in the past.

6.4.1 Valley Bottom (low elevation) Sites

Both the Bek'et Degii Ts'ooyiin a lower Harold Price berry patches had mean fire return intervals of approximately 50 years. The lower Harold Price site had one particularly short inter-fire interval of just thirteen years. It is likely that the fire scar record did not capture all of the fire activity on either site and that as identified in other research, fuel conditions and fire behaviour were key determinants of the degree to which the fire scar record reflected actual fire occurrence (McBride and Lewis, 1984).

For this study, the individual fire return interval of thirteen years documented for the lower Harold Price site is expected to be more representative of the type of return interval required to promote black huckleberry productivity than other estimated return intervals (several in the fifty year range) for these low elevation huckleberry patches. Otherwise, rapid succession by a number of deciduous and coniferous species, as observed on these sites now, would have rendered them unproductive in the past by outcompeting black huckleberry.

6.4.2 Montane (mid elevation) Sites

The lower area of Stakaiyt experienced a mean fire return interval of thirty nine years based on fire scar evidence from one small group of remnant cedar veterans. The other middle elevation site at Sool Nii, did not yield a great deal of remnant fire scar evidence prior to the most recent fire event. However, based on cohort ages it appears that this site has experienced three fire events in a period of 150 years for an estimated mean return interval of seventy five years for this site. It should be noted that field reconnaissance effort on these two mid-elevation sites was light relative to the higher and lower elevation berry ground areas. As a result, it is very likely that additional fire scar evidence exists on these sites but was not recorded during field sampling. Again, as for the lower elevation sites, the mean fire return interval estimates based on fire scar and cohort age evidence appear to be too long to maintain productive black huckleberry harvesting opportunities on these sites. Again, it is probable that additional fires occurred in interceding years and did not result in persistent scar evidence or that this evidence was not encountered during the course of the fieldwork.

6.4.3 Subalpine Sites

The fire history for these areas indicates that both study sites have experienced fairly high intensity fire events in the last eighty to ninety years. This is indicated by domination of a single age class on both sites, with a few older veterans left from previous fires. It appears that a fire

passed over much of Lax Ansa Maatsa around 1910, and that a fire passed over a large part of the southwest flank of Caribou Mountain around 1920. There is a possibility that the fire history for these areas is related because while these two areas are separated by Pinenut Creek, which provides some topographic separation, the most recent fires in both areas burned close to this creek. Additional fire history data (including accurate fire scar samples) are needed to further investigate this hypothesis.

Some oral history evidence about traditional burning of huckleberry patches suggests that rotational burning of huckleberry patches may have been practiced in some berry patches or larger berry gathering areas. If used, this technique would have ensured that some portion of each berry ground was maintained in a constant state of productivity. In addition, this approach would have likely assisted with fire control by creating additional firebreaks. This type of a pattern would create substantial difficulties for the reconstruction of fire history for these sites as a whole. It is possible that some degree of rotational burning was practiced on one or both of the subalpine berry grounds studied here. Many additional age samples, and most importantly fire scar samples, would be needed in order to describe fire history at this fine scale.

An area within the upper portion of the Stakaiyt berry ground appeared to have burned relatively recently (around 1959), although no record of a fire in this location is recorded in fire records kept by the Prince Rupert Forest Region[33]. If a fire had occurred here, it is expected that it would have been documented, as this hillside is readily visible from well-traveled valley bottom areas north of Hazelton. However, the paucity of early records of fire events in the area suggests that early fire records were not comprehensive. Additional sampling would required in this particular area to develop a more definitive disturbance history.

[33] Fire records for the Prince Rupert Forest Region begin in 1950

Lower elevation stands (below the Stakaiyt berry ground) have experienced frequent fire events. Fire scar evidence indicated that fire traveled between upper and lower elevation stands through older, fire resistant timber types. Substantial fire-skip areas remain within Lax Ansa Maatsa. These fire-skips exhibited evidence that fire passed through some areas, suggesting that these stands likely had characteristics which protected the normally fire sensitive species (i.e. subalpine fir) from burning. Snag characteristics from both sites suggested that prior to the most recent fire, there were a variety of age and size classes of remnant trees in a very open stand configuration. Some of these snags exhibited evidence of two fire scars. These snag characteristics suggested the past influence of a moderate intensity fire regime characterized by relatively frequent fire events, compared to the natural fire regime in subalpine forests which are often characterized by stand replacing events (Agee, 1993).

When trying to unravel the fire history of upland ericaceous shrubfield complexes, it is important to consider the patterns of wildfire in these vegetation communities. Firstly, ericaceous species are known to be somewhat fire resistant and difficult to burn under all but the most extreme fire weather (Minore, 1997; Agee, 1993; Miller, 1977). In addition, *Abies* species, such as those that dominate this site, are known to be highly flammable due to their thin, resinous bark and their habit of retaining lower combustible limbs that reach to the ground (Arno, 1977; Smith and Fischer, 1997). Fires have been known to jump from one clump of subalpine fir to another (Agee, 1993), and this species may therefore be a major vector of fire spread in these subalpine shrubfield communities. The fire resistance of the ericaceous shrub complex means that to ignite and carry a fire in these vegetation complexes it is likely necessary to have high fire hazard (low fuel moisture), and some amount of coniferous ingress of flammable species such as subalpine fire.

The fire history evidence for these two subalpine berry patches is insufficient to draw strong conclusions about the fire regime prior to the most recent fire event. However, the

assembled evidence suggests that the fire regime was both more frequent and less intense than would be expected under natural conditions for these forests. This evidence is consistent with oral history evidence, which indicates that black huckleberry patches such as these, were managed through a regime of regular landscape burns.

6.5 The Nature of Successional Pathways

- *Research Question #3: Have individual traditional huckleberry patches followed similar successional pathways after the cessation of anthropogenic burning?*

6.5.1 Low elevation sites

The low elevation berry patch study areas are variable with respect to current vegetation assemblages, the Beket Degii Ts'ooyiin site is predominantly a deciduous complex at present, whereas the lower Harold Price berry patch area is presently characterized by a largely coniferous (hemlock dominated) stand. However, deciduous remnants visible in the lower Harold Price indicate that this site had an initial stand composition that included a larger component of fire-following, deciduous species. Of particular interest in this context, is what current vegetation assemblages can tell us about past fire regimes on these sites. As has been noted previously, a lack of coniferous regeneration in hardwood dominated stands in the Skeena and Bulkley valleys is likely due to the influence of frequent fire in the past (Williams et al., 2000). Based on field reconnaissance and observation it would appear that the predominantly deciduous litter on these sites contributes to the development of deep, relatively rich moder humus forms, which are not conducive to seedling establishment by species such as lodgepole pine which prefer a mineral seedbed for germination and early growth (Anonymous, 1990a). Also, annual leaf litter appears to be a barrier to seedling establishment for other coniferous species, restricting germinant establishment and survival even for species adapted to rich organic substrates, and low light conditions. In addition, this deciduous organic layer is not ideal for a species such as black huckleberry which grows best on a slightly acidic substrate (Minore and Dubraisch, 1978; Smith, 1974) and prefers a mor humus form (Haeussler et al.,

1990). Therefore, it would appear that deciduous complexes create conditions, which are not only resistant to conifer invasion but are generally unsuitable for black huckleberry establishment and growth. This theory is validated to some extent by the results of field sampling, which found low levels of black huckleberry cover in these deciduous complexes. In contrast, lodgepole pine dominated stands, with similar light levels but more acidic soils, and shallower, poorer mor humus forms, generally had at least moderate levels of black huckleberry cover.

In the lower Harold Price drainage, the existence of a dense coniferous stand (hemlock dominated), in a former traditional berry ground, which has evidently experienced relatively frequent fire, is incongruous. The contrast between successional pathways on the two low elevation huckleberry patches is particularly apparent when one considers the similarities between the Harold Price patch and the Bek'et Degii Ts'ooyiin site with respect to aspect, biogeoclimatic classification, slope and soil nutrient and moisture status. The only apparent biophysical difference between the two sites is the abundant hemlock seed source available in the vicinity of the lower Harold Price site. As noted earlier this seed source and the cool north aspect may have provided conditions suitable for dense hemlock establishment, despite initial deciduous stand components.

Of note, is a successional similarity among the two low elevation huckleberry patches. On both sites, drier, poorer areas such as those with coarse textured soils, areas of shallow soils and ridge crest areas tended to lodgepole pine regeneration. In addition, both areas had scattered pine throughout western hemlock-leading coniferous stands and the deciduous complexes.

6.5.2 Middle elevation sites

Similar to the lower elevation huckleberry patches, the middle elevation berry patch areas on Stakaiyt and Sool Nii exhibited variable successional development and markedly different current stand characteristics.

In a pattern similar to that observed on Beket Degii Ts'ooyiin, the site at Sool Nii was characterized by dense deciduous (aspen dominated) complexes, particularly in lower areas, giving way to lodgepole pine dominated stands on upper, drier, poorer sites with coarse textured soils. The deciduous complexes here typically had little or no coniferous ingress, even seventy five years after the most recent fire event. The negative influence of deciduous litter and associated deep rich humus on conifer seedling establishment was observed. The mid-elevation huckleberry patch area at Stakaiyt is densely treed with hemlock to the exclusion of any understorey including black huckleberry. A few persistent deciduous remnants attest to the potential for this site to have developed as a deciduous complex. Evidently, an abundant hemlock seed source was available from mature hemlock stands, which are adjacent to this site in the upper areas, with the lower margin of this berry patch bordering on a mature mixed cedar-hemlock stand.

Once again the dense western hemlock stand seems to have established despite very strong evidence for multiple fire events at relatively short intervals, in this case a 39 year mean return interval. The compelling indications from oral history indicating that this site was traditionally managed for black huckleberry, raises the likelihood that fire here was more frequent than these data indicate. However, this site is on a warmer west aspect and does not reflect ideal conditions for hemlock establishment according to silvical definitions (Anonymous, 1990a). It therefore appears that hemlock seed source may be a major determinant of post-disturbance stand characteristics in these ICH forest types even with frequent fire events and some initial establishment of early seral deciduous species.

Perhaps the only successional trend we can identify for these mid-elevation berry patch sites is that they are variable with respect to successional development following the cessation of a relatively frequent fire regime. This may be due to variation in the characteristics of the former fire regime, factors like the intensity of the last burn and the post-fire conditions for seedling establishment or the available seed source. It is most likely a combination of these and other factors that determines the successional pathway.

6.5.3 High elevation sites

A persistent seral shrub complex comprising primarily ericaceous species dominated both of the high elevation berry patches surveyed. Several of these species, chiefly false azalea and oval-leaved blueberry are noted to be fire sensitive (Haeussler et al., 1990), which is a further indication of the need for fire maintenance on these traditional huckleberry grounds and the extended fire free period which they have experienced. These persistent shrubfield communities reflect the harsh subalpine environment, characterized by a short growing season, cold temperatures and late lying snow. These factors all mitigate against conifer establishment, allowing rhizomatous shrub species to dominate the site following disturbance. The relatively frequent fire regime which influenced these sites in the past has likely had a very significant impact on coniferous growth, through destruction of soil seedbanks, killing juvenile trees and seedlings prior to seed production, all of which limit opportunities for succession to coniferous stands. It is important to note that surrounding areas of Caribou Mountain support dense coniferous stands, even on the rocky alpine scree slopes, which indicates that these huckleberry patches would also be forested in the absence of relatively frequent disturbance.

While ericaceous shrub complex was the dominant vegetation community on these sites, conifer ingress was also well advanced, and had reached crown closure in a few areas. Crown closure was particularly evident near the lower elevation margins of these sites and on the

steeper warm aspects at lower elevations such as the eastern hills at Lax Ansa Maatsa. Other research has indicated the influence of a warming climate which can accelerate conifer ingress into subalpine meadows (Agee, 1993), and this may be a factor influencing the rate of conifer establishment and growth into these traditional subalpine berry grounds as well.

Black huckleberry continues to form a significant component of the shrub complex on these subalpine sites, exhibiting broader ecological amplitude here than was observed in lower elevation areas. The most pronounced aspect of this increased ecological amplitude is that black huckleberry increasingly occurs across a wider moisture gradient which includes subhygric sites in the ESSFwv areas of Stakaiyt. As noted earlier, this observation reflects the high degree of adaptation of this species to the harsh subalpine environment.

A key factor in these high elevation sites is the potential interaction between topography and successional processes. On Lax Ansa Maatsa it was observed that two areas on either side of the two lakes contrast. They are situated at similar elevations, but had markedly different stand characteristics. The broad western ridge was relatively sparsely treed with a variety of age classes, and the steeper eastern hills with warmer aspects had a much denser, more uniform cover of coniferous species. It was also observed that these areas varied with respect to biogeoclimatic classification, the eastern hills being classified as ICHmc1 and the broad ridge classified as ESSFwv based on plant indicator species. The broad ridge has vegetation assemblages reflective of harsher environmental influences, likely including cooler temperatures and later lying snow than the east hills.

While I have postulated that differences in coniferous establishment and past and present stand characteristics may be due to more frequent fire on the west ridge, and the higher prevalence of submesic site types, it appears likely that topography has also had an influence. The harsher environmental conditions on the ridge are factors that act to discourage coniferous

ingress and establishment, favouring the persistence of a seral, ericaceous shrub complex in this area. From the perspective of a First Nations group trying to maintain a huckleberry patch, this would present a much more favourable opportunity for maintaining productivity, theoretically requiring less frequent management.

6.6 Traditional Berry Patch Management Strategies

➢ *Research Question #4: Based on the analysis of field data from the case studies what can be inferred about stewardship strategies and techniques used by the Gitxsan and Wet'suwet'en to manage the huckleberry resource*

In order to improve our understanding of traditional huckleberry management by the Gitxsan and Wet'suwet'en, and the ecological and fire history characteristics of the berry patches themselves, it is instructive to consider the resource stewardship strategies and techniques, which are reported to have been used, or appear to have been employed.

6.6.1 Stewardship Strategies

6.6.1.1 Reasons for Burning

First Nations have identified a number of reasons for active management of black huckleberry (and other *Vaccinium* species) through the application of prescribed fire:

- Greater berry patch productivity (number of berries).
- Increased berry sweetness.
- Larger berry size.
- Reduction of pests which infest huckleberry patches.

These reasons must have been compelling incentives for active management for a people reliant on the huckleberry resource as a key component of their subsistence diet and as a valued trade good, particularly when one considers the difficulties reported from prescribed burning trials in ericaceous shrub communities.

As noted earlier, black huckleberry was highly prized as a dietary staple and trade good by First Nations groups throughout its geographical range, many of whom managed this species using landscape burning. As we know that managing this ericaceous vegetation community with fire is a difficult undertaking (Minore, 1997; Miller, 1977). the vast scale of this traditional management is a strong indication of the great importance of the black huckleberry crop and the apparent effectiveness of First Nations landscape burning activities for promoting abundant yields of fruit. Elsewhere in British Columbia prescribed burning of *Vaccinium* shrubfields was practiced on individual sites for well over one thousand years (Lepofsky et al., in press). The long-term use of established black huckleberry patches further underlines the importance of this system of environmental management.

6.6.1.2 Rotational Burning

As noted previously, some descriptions of berry management suggest that rotational burning may have been practiced in order to maintain berry patches or particular berry areas in a state of more or less constant production. There would have been a strong incentive to do this, particularly in cases of productive, reliable, or conveniently located berry patches, which were important for use on an annual basis. The following excerpt from the late Martha Brown's (former Chief Xhliimlaxha) commission evidence, used earlier in this thesis, is repeated again here, and suggests that the rotational burning strategy may have been used in some areas.

> Q: Did you burn part of your territory so that the berries would grow there?
> A: That's what they used to do in the old days. Whenever there's not a good crop of berries on one side of the river grandfather used to burn and it's the same on the other side of the river. If there's a poor crop they will burn and just move over, to and fro.
>
> *Delgamuukw et al vs. the Queen*
> *Commission Evidence of Martha Brown*
> *Volume 1, Text 2*

This pattern would help to explain an apparent contradiction between reported management practices and the ecological characteristics of *Vaccinium membranaceum.* Some

oral history accounts indicate that the Gitxsan burned black huckleberry patches at intervals of approximately four years (Gottesfeld, 1994), and several references in *Delgamuukw* testimony indicates that inter-burn intervals varied, with reports ranging from two to seven years between burn treatments. Ecological research indicates that huckleberry does not recover to full productivity until seven or more years post-burn (Minore, 1997), the actual time interval likely being a function of environmental variables and burn intensity. At higher elevations, and particularly in subalpine parkland areas, the burn frequency required to maintain huckleberry productivity may have been relatively long as late-lying snow and short growing seasons maintain seral shrubfields for relatively long periods in these areas. Therefore, the burning interval reported in several oral history accounts appears too short to promote maximum productivity of individual black huckleberry patches. However, if only a portion of a patch or an area is burned at any one time, this frequent burning regime makes imminent sense. In fact, it provides a great deal more management flexibility allowing for prolonged periods where conditions are not suitable to burn off huckleberry patches and to take advantage of suitable burning conditions when they occur.

The example of burn rotations (figure 6.1) illustrates the advantages of using the rotational burning strategy to maintain constant production within a huckleberry patch. The advantages of employing a strategy of more frequent maintenance burns is evident when one contrasts high elevation patch "A" where 50% of the area is maintained in productive status and high elevation patch "B" where 67% of the area is maintained in productive status as a result of a more frequent burning regime.

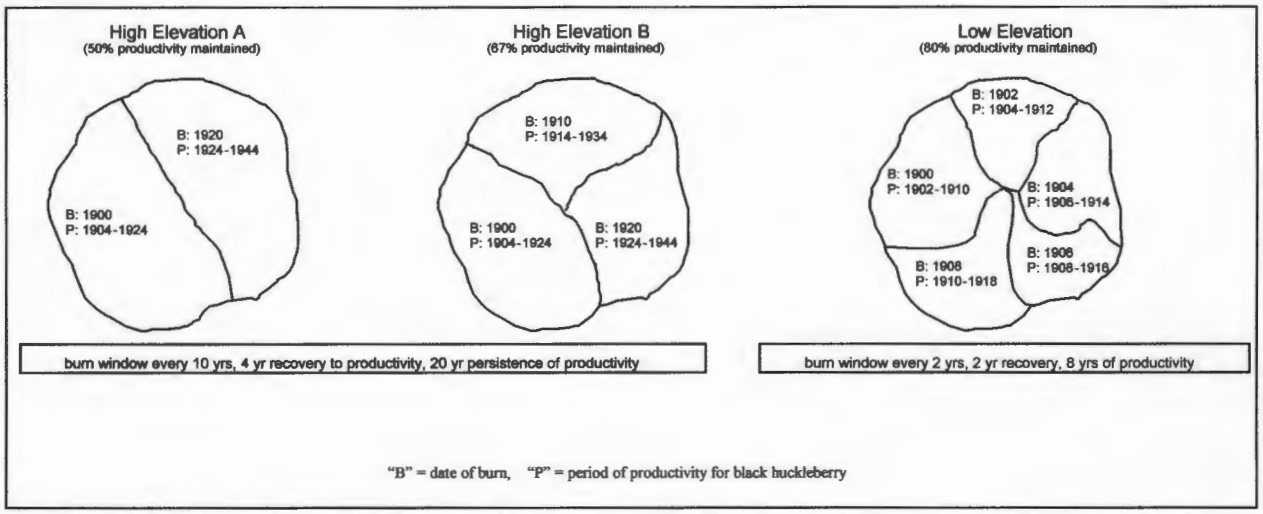

Figure 6.1 Rotational burning schematic

The greater flexibility (more burning opportunities) afforded in low elevation sites is illustrated in the low elevation rotational burning example, however, frequent burning was likely a necessity in these low elevation patches to counteract relatively rapid succession by herbaceous and woody competitors. The influence of burn intensity on the recovery time for black huckleberry productivity is an important factor which may have favoured the use of more frequent burning. Higher frequency would theoretically have resulted in lower intensity burns (due to lower fuel loading) and correspondingly, a relatively rapid recovery to black huckleberry productivity.

An additional factor influencing disturbance pattern on these sites is that burns in the ericaceous shrub complex are often spotty and even in cases where entire patches were burned, only certain areas (likely the ones with greatest fuel accumulations) would burn at any one time. This would create a mosaic of productive and unproductive huckleberry areas throughout a patch. This factor may also have encouraged additional burning activity within a given patch at relatively short intervals in order to bring "fire skip" areas within the patch into production.

Therefore, while there is little conclusive evidence that rotational burning was practiced, it is a strategy that is consistent with burning intervals reported by Gitxsan and Wet'suwet'en advisors and the ecological characteristics and burn response of black huckleberry.

6.6.1.3 Variable Site Types

It is evident from the elevational and topographic variability in traditional huckleberry sites included in this research that a huckleberry management strategy used by the Gitxsan and Wet'suwet'en involved managing a wide range of site types varying in elevation and aspect. This strategy would mitigate against the influence of unfavorable weather events and potential variability in pollination success. As Haeussler (1987) notes, " Stochastic weather events such as late frosts or hail have a huge impact on year to year productivity (of black huckleberry) because they can destroy reproductive buds, flowers or fruit".

Another advantage of managing a range of sites with variable biophysical attributes and climatic influences, is the potential to extend the huckleberry harvest over a longer time period, and increase the total potential harvest. In addition, for the Wet'suwet'en and Gitxsan, managing low elevation huckleberry patches would provide opportunities to harvest huckleberries in close proximity to summer fishing sites without disrupting the salmon harvest.

Management of low and middle elevation huckleberry sites has not, to my knowledge, been reported elsewhere in the literature for other First Nations groups. This could be a function of a wider range of habitat suitability for black huckleberry in cooler, northern ecosystems. A plant indicator guide for southeastern Washington and western Oregon lists *Vaccinium membranaceum* as a species of "cool sites at middle to high elevations" (Halverson, 1986) whereas in northern BC its distribution is described as, "valley bottoms to high elevations" (MacKinnon et al., 1992). Therefore the wider range of site types traditionally managed for black huckleberry in northwestern BC could well be a function of a broader elevation range suitable

for huckleberry growth in this region. Managing multi-elevation sites would obviously be quite advantageous extending the harvest season and mitigating against stochastic events which could cause crop failure in some patches.

6.6.2 Techniques

While the motivation for traditional burning of black huckleberry patches is clear and the necessity of such management is amply supported by ecological research, the techniques employed are more difficult to discern. Of interest are the aspects of burning activities such as frequency of burn, stand condition, time of year, weather, ignition points and burn patterns.

6.6.2.1 Frequency

First Nations advisors have provided a great deal of information regarding frequency of burning, however, the frequencies reported vary considerably. As noted previously, burn frequencies of anywhere from two to seven years have been reported by Gitxsan and Wet'suwet'en elders. The following quote form Art Mathews Jr. indicates the importance of fruit quality indicators as determinants of huckleberry patch burning regimes:

> These were the women that do the actual job and they know the very taste they want and the texture, and as soon as they begin to lose the taste, they would then tell the men that it is time to re-burn the area.
>
> *Art Mathews Jr.*
> *Delgamuukw et al. vs. the Queen*
> *Transcript volume 73 p. p.4719*

Several factors would have contributed to the determination of burn frequency, these include:

1. Availability of good burning weather.
2. Berry taste (sweetness).
3. Berry texture
4. Berry size.
5. Berry productivity.

6. Availability of other productive areas.
7. Fuel accumulations and moisture content.

There were surely other factors that contributed to decisions about burning, and each site had different characteristics so that burn opportunities would vary across aspect and elevation depending on weather patterns. Managing a wide range of site types would provide increased opportunities for meeting the specific requirements needed for successful prescribed burning of one or more huckleberry patches in any given year.

With respect to burn frequency it is likely that different sites operated on different burn rotations due to variable successional trends and the resultant impact on black huckleberry productivity (i.e. lower elevation huckleberry patches would likely require more frequent burning and would likely afford more frequent burning opportunities than higher elevation huckleberry patches). In addition, year-to-year weather would restrict burning opportunities on some sites to those years with suitable weather. The reference in the 1934 forest service report that "late falls" were associated with fires in the vicinity of Indian berry pickers attests to the importance of weather as a determinant of fire frequency. It is likely that, the seeming contradictions in reports of burn frequency for management of the huckleberry resource actually represent an acceptable range for management of a variety of habitat types with different successional trends and burn opportunities, as well as the influence of environmental management strategies such as rotational burning.

6.6.2.2 Timing

The historical excerpt cited previously describing the occurrence of fires in areas frequented by Indian berry pickers, on a hot windy day in the late summer of 1934, is of particular interest when considering the timing of burn treatments. This detail draws a strong connection between upland berry picking activities by Native people in the area, a dry fall and

numerous fires located in close proximity to the Indian berry pickers. Operating under the assumption that these were berry patch burns, the weather report for the day the fires were observed (August 24th) provides an interesting suggestion of the conditions that may have been necessary to ignite, and successfully burn upland black huckleberry patches. This excerpt also corresponds with oral history accounts of Gitxsan elders that berry patch burning was generally conducted in late August or early September (Gottesfeld, 1994a).

The following quote is from the late Pat Namox, the former Chief Wah'tah'kwets (Wintergreen Consultants, 1998):

> Hear good weather and bad weather through a whistle in the ear (one ear is good weather, the other is bad weather). They would hear the bad weather coming and while it was very hot, they would send the boys out to set fire for 1 or 2 days. Then the rains would come and put the fire out. They did not want to burn all the land, just some for berry production (huckleberries) and for the wildlife.

Research on huckleberry management by the Sto:lo indicates that fall burning was practiced in high elevation huckleberry patches in the central and upper Fraser Valley as well and burns were initiated, "when the leaves were on the ground", as these were cited as an important fuel source for carrying the fire (Lepofsky et al., in press).

In contrast, research conducted amongst the Spokan of eastern Washington (Ross, 1999) indicates that spring burning was the preferred method for huckleberry management as it minimized damage to underground rhizomes, but that, often due to late springs in montane and subalpine areas this was not possible and fall burning was generally more common.

6.6.2.3 Intensity

The fire weather reported in the 1934 forest service excerpt would facilitate high intensity burns in most fuel types. Sto:lo reports for black huckleberry management indicate that, "you pretty well had to burn all the trees down, it's got to be a very hot fire", however, elders also report that bushes can be harvested soon after a burn suggesting that the roots of blueberry

bushes are not burned and that aboveground vegetation is able to resprout quickly and regain productive status (Lepofsky et al., in press). As these variable reports indicate, it is difficult to determine the intensity of traditional burning for huckleberry management from oral history alone. However, from the accumulated knowledge about the fire-resistant nature of *Vaccinium* shrubfields and references to hot fires from elders it appears that these burns may have been fairly intense. However, as a Sto:lo elder has indicated too much heat would "burn the patch out" and timing the burn just prior to rain was critical (Lepofsky et al., in press), a comment echoed by Pat Namox, a Wet'suwet'en elder (quotation cited earlier in this thesis). One point of interest is that burning of larger fuels has been cited as a factor resulting in significant below ground heating that can kill buried *Vaccinium* rhizomes (Miller, 1977). The maintained huckleberry patches I surveyed, exhibited very little evidence that large woody fuels were present in the past. The scarcity of large fuels may limit soil heating and associated rhizome damage, even in more severe fire weather, and even under the influence of a hot surface fire.

6.7 Research Summary

Black huckleberry was the most important plant resource within the subsistence, trade and cultural lives of the Gitxsan and Wet'suwet'en. It's ecological niche as an early to mid-seral species with specific environmental requirements makes it the quintessential patchy resource. Gitxsan and Wet'suwet'en dependence on black huckleberry necessitated environmental management to ensure reliable harvests of in predictable locations that were coincident with other critical floral and faunal resources harvested in the late summer and early fall portions of the seasonal subsistence round. The Gitxsan and Wet'suwet'en actively manipulated a number of important resources using a variety of environmental management strategies and techniques. The example of landscape burning to promote the growth and productivity of black huckleberry is one of the most accessible opportunities to understand the scope and influence of this

environmental management and the nature of the ecological knowledge which informed these practices.

Consideration of the ecological, cultural and fire history characteristics of these five traditional black huckleberry patches within the context of historical references and ethnographic research, reveals a pattern of traditional use by Gitxsan and Wet'suwet'en people of valley bottom, montane and subalpine, early seral habitats in the late summer and early fall. Huckleberry harvesting was a central activity within this seasonal pattern, but was incorporated with the gathering and hunting of a variety of other resources whose temporal and spatial patterns of availability overlapped with that of black huckleberry.

It is apparent from the currently unproductive status of all five of the former berry patches surveyed during this project that in order to maintain these areas in a productive early seral state there is a requirement for active management using landscape burning. While the stand structure and fire history analyses does not unequivocally illustrate a pattern of anthropogenic management, the evidence that has been presented strongly suggests that the fire events on these sites have been much more frequent than would be expected under natural conditions with only natural ignition sources. The ecological, cultural heritage and fire history field data collected reflects and reinforces the traditional ecological knowledge about landscape burning of huckleberry patches that has been documented for the Gitxsan and Wet'suwet'en over many years.

Managment of the huckleberry resource was certainly a challenge given the large number of variables involved, and the fire resistant nature of huckleberry shrubfields. However, the incentive for an active human stewardship role was clear: huckleberries were a staple of diet, trade and the culture. So for the Gitxsan and Wet'suwet'en, the words of the late Martha Brown (Gitxsan Chief Xhliimlaxha) must have once rung true amongst those who carried the

responsibility for management of the berry patches, "when you can't see your footsteps amongst the berries", it was time to burn.

6.8 Research Applications

There is a great deal of additional research required to develop a more comprehensive understanding of past landscape burning of these black huckleberry patches, and the management of many other berry gathering areas once used by Gitxsan and Wet'suwet'en people. This project and related research initiatives will contribute to new opportunities to integrate traditional ecological knowledge into contemporary resource management approaches and an increased recognition of the sophisticated environmental management regimes developed and employed by First Nations people. Specific contributions and applications include:

1. Redefinition of the concept of natural disturbance regimes to include past anthropogenic burning.
2. Increased recognition of berry patch areas as cultural landscapes with associated archaeological resources.
3. Improved understanding of the scope and practice of landscape burning as an environmental management tool employed by the Gitxsan and Wet'suwet'en.
4. Contributions to huckleberry suitability modeling and a framework for managing black huckleberries as a non-timber forest product.
5. New multidisciplinary techniques for fire history research which acknowledge and investigate the potential anthropogenic contributions to past fire activity.

From a methodological standpoint, it is hoped that other researchers or First Nations groups will be able to use the approach developed in this study to facilitate reconstruction of landscape burning regimes and investigations of the associated ecological legacies. Projects such as this will bridge the gap between traditional ecological knowledge and contemporary resource management practices.

6.8.2 Anthropogenic Burning and "Natural Disturbance" Regimes

Resource managers are increasingly utilizing the characteristics of natural disturbance regimes as models upon which to structure current resource management strategies at the landscape and stand levels (Delong, 1998; DeLong and Kessler, 2000; Anonymous, 1995; Camp et al., 1997; Cissel et al., 1999). Unfortunately past anthropogenic disturbance is rarely recognized as a component of natural disturbance processe and pattern and is therefore not incorporated into management approaches. Despite the importance of these anthropogenic disturbance regimes for the maintenance of adaptive plant communities, there is relatively little information detailing the spatial characteristics of the anthropogenic burning patterns or the impacts of these landscape burning regimes on vegetation characteristics or soil properties. This relative lack of information belies the ecological importance of anthropogenic fire regimes which have had a significant impact on the flora and fauna of many ecosystems throughout North America and elsewhere (Stewart, 1954; Lewis, 1983; Lewis and Ferguson, 1988).

This research will be a useful tool for landscape ecologists, helping them to better understand the impacts of this traditional anthropogenic disturbance regime on ecological characteristics, forest succession and disturbance history in the coast-interior transition zone of British Columbia. Given the scope and time depth of these activities, it is clearly important that the impacts of aboriginal landscape burning activities on the characteristics of past "natural" fire regimes be given due consideration in the development of benchmarks and associated resource management strategies.

Understanding the role of anthropogenic disturbance regime in shaping ecosystems such as berry patches will be critically important for future management, particularly where it is deemed desirable to maintain or restore these ecosystems and to conserve their unique attributes and functional role in the landscape. In the future, a more comprehensive and detailed methodology for investigating natural disturbance patterns, one that more fully includes and

accounts for the influence of past environmental management by aboriginal groups, will provide a much stronger, and more reliable framework upon which to manage and conserve ecosystems.

6.8.3 Huckleberry Patches as Cultural Landscapes

These traditional berry patch areas require recognition as cultural landscapes shaped by an elaborate and effective system of aborignal environmental management. Wet'suwet'en and Gitxsan traditional berry grounds contain, and are surrounded by, a great deal of remnant physical evidence of traditional use, and are associated with significant archaeological resources. In the case of black huckleberry management it has been demonstrated that in some areas these activities are of considerable time depth (Lepofsky et al., in press). The cultural heritage features associated with huckleberry harvesting and related activities are best identified and protected through the recognition of the cultural landscapes with which they are associated.

Interpretive tools based on ecosystem attributes such as predominance of early seral or fire dependent vegetation communities may be used to broaden the scope and improve the effectiveness of predictive archaeological models (e.g. Goodchild, 2000). In addition, identifying the physiographic and ecological characteristics of traditional harvesting sites, and their relation to other cultural and traditional use features (this thesis), is critical to recognizing and protecting the anthropogenic landscapes and archaeological features associated with past environmental management of black huckleberry and other plant species.

6.8.4 Gitxsan and Wet'suwet'en Environmental Management

Validation of past environmental management activities will both support and reinforce Gitxsan and Wet'suwet'en cultures. This will provide new opportunities for traditional

environmental management to be used in a contemporary context to reestablish traditional activities and to address contemporary resource management challenges.

It is apparent from this research, that the environmental management strategies and techniques used by the Gitxsan and Wet'suwet'en cannot be separated from the subsistence objectives or the underlying cultural and spiritual belief systems which guided these activities. Therefore, in order to understand landscape burning, it is important to think in this broader context. Taken together, the techniques, the overall subsistence strategy, and the underlying cultural and spiritual belief systems comprise traditional ecological knowledge, which informs environmental management. The management of the black huckleberry resource by the Gitxsan and Wet'suwet'en exemplifies this holistic approach.

6.8.5 Contemporary Huckleberry Management

This research is also important from an integrated resource management perspective, as black huckleberry and other berry species are increasingly being recognized as economically important forest botanicals. One of the major challenges for resource managers is to integrate the production of economically important plant species into forest management planning and operations. In order to achieve this goal, effective strategies and techniques need to be developed to promote sustainable productivity of these non-timber forest products. At present, the integration of these species is difficult to achieve due to the lack of proven management models for promoting abundant and sustainable populations which are economically viable. Much is to be learned from the Gitxsan and Wet'suwet'en and other First Nations groups throughout BC and elsewhere who practiced effective long-term environmental management to promote sustainable, abundant harvests of black huckleberry and many other species with economic potential.

There are several opportunities for exploration and integration of First Nations environmental management strategies and techniques into the management of forest non-

timber forest products. Management of black huckleberry resource through the application of landscape burning treatments of suitable sites is a real opportunity to integrate traditional knowledge with contemporary resource management. In First Nations communities, this type of initiative could assist with validation and preservation of traditional knowledge while also providing opportunities for economic development and cultural renewal.

6.8.6 Multidisciplinary Fire History Research Methods

The key to successfully designing a research framework which will allow researchers to make inferences about the role that anthropogenic burning may have played in defining the characteristics of a fire regime is to have an understanding of the cultural underpinnings of traditional use of fire by groups in the area. In particular, it is critical to describe the subsistence strategies and if possible the techniques which were employed. This requires knowledge of the autecology and disturbance responses of the target species or plant community. In addition it is important to consider the settlement and land use patterns of the First Nations group in question, including factors such as the degree of sedentarism, seasonal round, migration patterns and population levels. Information about past environmental conditions and dynamics such as shifts in regional climate patterns may provide additional insights into utilization of fire to both shape and maintain economically productive vegetation communities.

One of the most significant challenges faced by researchers investigating the characteristics of anthropogenic burning regimes is recognition and documentation of evidence of the low and moderate severity burns that often characterized these activities. The environmental management strategies being pursued were often intended to increase the frequency and decrease the intensity of fire disturbance in selected habitats to maintain various early and sometimes mid-seral vegetation communities and associated fauna. The techniques used were intended to maximize productivity by limiting burn intensity to a level that would

stimulate new growth of selected species, discourage competing species and allow the target plant species or community to regain productive status as quickly as possible.

As a result, the challenge for fire history researchers looking at aboriginal landscape burning is to identify and characterize a fire regime, which operated at much finer scales both temporally and spatially than many fire regimes which originate only from non-anthropogenic ignition sources. The fire history evidence associated with these fire regimes is much more difficult to detect and interpret than evidence associated with larger, coarser grained stand-initiating fire events.

After review and consideration of the literature, the general conclusion reached is that studies across a wide range of disciplines that incorporate or focus on fire history must evaluate the influence of both anthropogenic and natural ignition sources. To the extent possible, these studies should characterize the relative contributions of both of these influences to the observed fire regime, and consider the dynamic between anthropogenic and natural fire disturbance in the ecological region(s) of interest.

6.9 Conclusion

The broad nature of investigations into First Nations landscape burning invokes linkages to many disciplines including ethnobotany, plant physiology, fire ecology, and successional dynamics. The multi-disciplinary nature of this subject area is necessitated by the inability of any single discipline to decipher the influences of past human-environment interactions on ecosystems. Pieces of these puzzles come from a variety of seemingly disparate sources which once carefully assembled may provide a detailed knowledge of past landscape burning regimes and the associated impacts on plant communities.

The traditional knowledge evident in the environmental management of black huckleberry by the Gitxsan and Wet'suwet'en is interlaced within the cultural matrix which directed their interactions with the land. This concept is embodied in the Wet'suwet'en concept of "Yintah" meaning "all things connected to the land" including the people themselves. The broad encompassing nature of this approach to resource stewardship is perhaps its greatest strength and a positive keynote for the development of future approaches to environmental management.

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Appendix 1: Huckleberry Patch Reconnaissance Data

Map ID	GPS ID	Ecological Information	Cultural Heritage Information	Fire History Information
		Bek'et Degii T'sooyiin		
RR2	RR29C1	ICHmc2 /01-/03 some deciduous patches	PI CMTs in the area	fire scarred PI, fire lobe is **121** yrs
RR3	RR29CM	ICHmc2 /01-/03 some deciduous patches	large concentreation of CMTs over 1 ha	
RR1	RR29E1	ICHmc2 /02, exposed edge of ridge	campsite area nearby	some scarring of PI on ridge crest
RR4	RR29C2	ICHmc2 /01b clearcut area on ridge	approximate location of trail	scarred PI stump, **145** yrs, scar at **22yrs**
RR5	RR29E2	ICHmc2 /Epdm, leading birch, colluvium		charcoal in humus layer
RR6	RR29C3	ICHmc2 /01 mature PI, abundant V. mem		PI **118**, **123** yrs, some fire snags
RR7	RRAGE1			PI - largest in stand (**66** yrs) - no core
RR8	RRSMP1	ICHmc2 /Atcv, NE aspect, AT/Ep/Ct	Pine CMT (61 year old tree)	charring on old CWD
RR9	RRSMP2	ICHmc2 /55 (Oplo horr.) rich humus		fine char in humus, spruce **74+** yrs
RR10	RRKNL1	rocky knoll on /55 slope		
RR11	RRSNG1			fire scarred (2X) snag
RR12	RRT1	mesic, rich slope (/Atpw)	well defined trailbed on contour	charred branches only on CWD
RR13	RRT2	/55, old Hw patch	well defined trailbed on contour	old fire scar at base of Hw vet
RR14	RRT3		well defined trailbed on contour	
RR15	CMTRR1	ICHmc2 /01b - /02 - rocky ridgetop	trailbed, old CMTs and blazes	
RR16	RRTRL1	ICHmc2 /01b	well defined trailbed	
RR17	RRTR2	Bl poles under PI - lots of V. mem	blazed trail and CMTs	age class 5-6
RR18	RRTR3	lots of V. mem - submesic (/01b)	blazed trail interrupted by powerline	younger type than RRTR2
RR19	RRTR4	permesic site	unblazed trail below powerline	
RR20	RRTR5	young coniferous type mesic +	picked up well def. trailbed - no blazes	
RR21	RRTR6	ICH mc2 /53 - rich site some Op. hor.	lost defined trailbed	appears to be age class 4-5
RR22	RRTR7	broad ridgetop (ICH mc2 /51) PI & At	blazed trail, CMTs	
RR23	RRTR8	ridgetop, /51	blazed trail	
RR24	RRTR9	vigorous V. mem in cut with birch sapl.	blazed trail runs into hydro cut	

RR25	RRPLT1	ICHmc2 /Atpw - birch leading	CMTs nearby	little fire evidence
RR26	RR28C1	ICH mc2 /02 ridgetop		Pl **136** yrs
No GPS	RR28CR1	ICH mc2 /01b-/02, rocky ridgetop		no fire scars, Pl **130** yrs
RR27	RR28C2	ICHmc2 /02, exposed edge of ridge		very tight rings Pl **137** yrs
RR28	RR28C3	ICH mc2 /02 - /01b, ridgetop		Pl **129** yrs
RR29	RR28C4	ICH mc2 /02 - /01b, ridgetop	CMT	Pl **130** yrs, smaller Pl nearby is **126** yrs
No GPS	RR28C5	ICH mc2 /01b		100m N of C4, Pl **146** yrs
No GPS	RR28C6	ICH mc2 /01b, Pine/moss		large Pl, **139** yrs, 47cm dbh
RR30	RR28C8	type change to ICH mc2 /52-/01a		large Hw **106** yrs, large Sx **109** yrs
RR31	RR28C9	ICH mc2 /52-/01a, abundant Acer gla.		large Pl - no age available
RR32	RR05C1	type change to /Atpw-/01a (pocket)		large Pl, **136** yrs
RR33	RR05C2	ICH mc2 /o1a Hw/Pl		large Pl, **107** yrs
RR34	RR05E1	timber type change /01a to /Atpw	some CMTs in area (in /01a)	clear edge, Hw-low br. some f. scars
RR35	RR05C3	ICH mc2 /Atpw, little V. mem		avg. Pl, **71** yrs
RR36	RR05E2	ICH mc2 /Atpw		fire (2X) snag (<100 snags/ha)
RR37	RR05E3	timber type edge to young Hw/Cw stand		few snags in Hw/Cw type
No GPS	RR05C4	/01a-/03 - fairly rich some Op. hor.		Pl, **72** yrs
RR38	RR05P1	ICHmc2 /Atpw - birch leading		no snags, few stumps
RR39	RR05C5	ICHmc2 /Atpw - birch leading		Pl, **75** yrs
RR40	RR05C7	ICH mc2 /Atpw - large Hw in hollow		Hw (core RR05C6), **101** yrs
RR41	RR05E5	type change from conif - decid.		
RR42	RR05C8	transition /Atpw - /01a (close to ridge)	CMTs and kindling trees (Pl)	f. scar Pl vet, age **107** yrs lobe **58** yrs
RR43	RR10C1	ICH mc2 /53, Hw/Bl/Sx (458m)	CMTs just upslope 20m	large Sx **165** yrs
RR44	RR10C2	/52, (53 20m S - /01a 15 m N)	CMT stripped 60 yrs ago nearby	large Pl, **203** yrs
RR45	RR10C3	ICH mc2 /01a - /03 mature Hw/Sx/Pl	CMT - aged, old enamel teapot - camp?	large Pl, **191** yrs, CMT strip about 1846
RR47	RR10C4	/01a-/03 - trans. Old Hw to younger Pl	20-40yr old hunting stand	large Pl (32cm) **138** yrs
RR48	RR10C5	type change /01a to /03		large Pl, **139** yrs - little fire evidence
RR49	RR10C6	ICH mc2 /01a near type change (555m)		large Sx, **216** yrs (open Hw/Sx)

RR50	RR10C7	ICH mc2 /01a out of dense Cw.Hw type		Pl, **121** yrs, char in humus (no GPS ID)
RR52	RR10C8	ICH mc2 /53, At/Pl, little regen		Pl, **137** yrs, very sparse conif regen
RR51	RR10E1	change from /01a (Hw/Pl) - /53(At/Ep)	7-8 old Pl CMTs in /01a	type (fire?) bdry low branches on Hw
RR53	RR10E2	edge of old /01a(Hw) and old /54 type		edge of old burn
RR54	RR10C9	ICH mc2 /53-/54 (At/Pl)		large Pl, **71** yrs, few snags or regen
RR55	RR10E4	edge of type /53 to /01a(dense Hw/Cw)		HW/Cw appear quite young on edge
RR56	R10C10	/01a-/03 - dense Hw/Cw (no GPS ID)		largest Pl (28cm), **65** yrs, f. scar in std.
RR57	RR10E5	edge of type /01a(Hw) to /53(Ep/At)		no Pl, looks youger than last /53 type
RR59	R10C11	trans b/n /53(lower) and /52(uphill)		Pl, **73** yrs
RR60	RR10E6	trans from /53 to /01b(rocky and steep)		Pl and lots of V. mem. Some Jun. com.
RR61	R10C12	ICH mc2 /01b Pl on ridgetop (537m)	faint trail running along ridgetop	Pl, **71** yrs
RR46	RR10P1	ICH mc2 /01a-/03 (482m)	CMT's and tea pot, possible campsite	Pl, **211** yrs
RR58	RR10P2	ICHmc2 /53-/54 (523m)		Ep (birch), **68** yrs
		Lower Harold Price		
HP1	HPJNE1	ICHmc2 /01-/01b Hw/moss	mining trails and prospectors cabin nearby	dense small diameter Hw no old stumps
HP2	HP8C1	ICH mc2 /03-/04		large Sx **107** yrs, fire scarred Cw
HP3	HP8C2	ICHmc2 /01 trans to /03 toe of slope		scarred Cw - scar lobe is **104** yrs (approx)
HP4	HP8C3	ICHmc2 /01 shallow draw near toe		double scarred Cw (12-13 year return interval)
HP5	HP8C4	ICHmc2 /01b Hw/moss		Hw **106** years
HP6	HP8C5	ICHmc2 /01b Hw/moss		Hw **107** years
HP7	HP8C6	ICHmc2 /01b Hw/moss		Pl **110** yrs
HP8	HP8C7	ICHmc2 /03-/04 old Hw bdry with /01		Hw **323+** yrs
HP9	HP8E1	ICHmc2 /03		no evidence of fire
HP10	HPC1	ICH mc2 /05, fluvial terrace near HP Ck.		f. scar to grnd, 3 scars 15-50yrs apart
HP11	HPTR1	ICHmc2 /01a (Hw/Cw moss)	trailbed connects to HPC, Cw CMT	f. scar on large Cw (1X)
No GPS	HPC2	ICH mc2 /01a *no GPS (50m S of HPP1)	fully barked Cw pole (12m) axe marks	Sx, **129** yrs - sparse old stumps
HP13	HPC3	ICH mc2 /01a, 2nd terrace		Sx, **131+**, f. scar chip

HP14	HPC4	ICH mc2 /03, 1st terrace	old and newer blazes across draw	Sx, **128** yrs, 3 old Hw at edge of draw
HP15	HPB1	ICH mc2 /01 old Hw age class 9	double sided blaze (south and west)	Hw blaze is **85** yrs old (1915)
HP16	HPC5	ICHmc2 /01old Hw age class 9 no GPS	HW food trees and possible cache pit	Hw cambium strip lobe (**89+** yrs)
HP17	HPC6	ICHmc2 /01 old Hw age class 9	large Hw food trees	Hw cambium strip (**98** years ago)
HP18	HPC7	ICHmc2 /01 young, dense Hw		Sx **118** yrs, old Cw fire snags
HP19	HPC8	ICH mc2 /01b, dry pine/moss type		Pl **100** yrs, very few old stumps/snags
HP20	HPP2	ICH mc2 /01(dry/poor /01) Pl		Pl **94** yrs, very few old stumps/CWD
HP21	HPBR1	ICHmc2 /01	berry camp - racks and boxes (at ck.)	some old stumps and CWD near creek
HP22	HPBR2	ICHmc2 /01	second berry camp with racks and box	Pl nearby is **90** yrs
HP24	HPP3	ICH mc2 /01 Sx/Hw	trailbed NW of berry camps	Sx **118** yrs - rapid early growth
HP12	HPP1	ICH mc2 /01 high CF, no Vac. Mem.	several Cw poles, fully barked	few fire scarred Cw vets right to river
HP25	HPT1	ICH mc2 /01b, dry pine/moss type	well defined trailbed	no old stumps, little large CWD
No GPS	HPT2	ICH mc2 /01 Sx/Hw	trailbed NW of berry camps	no old stumps, little large CWD
HP26	HPCBT1	recent clearcut patch - mesic - submesic		good spot for controlled burn trial
HP27	HPC10	ICHmc2 /01 Hw/Cw/Pl		Cw snag **171** yrs, scar lobe **12** yrs
HP28	HPCMT1	ICHmc2 /01	large Hw food tree	large Hw (age cl. 9) little fire sign
HP29	HPCMT2	ICHmc2 /01 old Hw/moss	large Hw food tree	large Hw (age cl. 9) little fire sign
HP30	HPCMT3	ICHmc2 /05 Cw/Hw	Large Cw bark stripped	little evidence of fire
HP31	HPBZ1	old Hw/Cw type	old blaze 2 more 100m north	
No GPS	HPCMT4	old Hw/Cw type	Hw food tree, trailbed runs N-S	
HP32	HPCMT5	old Hw/Cw type	double blaze 2nd blaze 30m a 320deg	
HP33	HPAGE1	moist rich Sx/Hw/Cw type		large Sx **107** yrs
HP34	HPAGE2	ICHmc2 /05 Cw/Hw	*ages are approx - poor cores	fire skip Hw **153** yrs, Sx **138** yrs, Bl scar
HP35	HPAGE6	ICHmc2 /01b Pl, lots of small Vac. mem.		Pl, **101** yrs
HP36	HPT1	ICHmc2 /01	trailbed running across slope on cntr	
HP37	HPAGE7	ICHmc2 /05		Pl, **109** yrs

HP38	HPAGE8	ICHmc2 /01 (moist/rich) Pl, little V. mem.		Pl **112** yrs
HP39	HPAGE9	ICHmc2 /01 dense Hw/Sx (younger)		Pl, **85+** yrs
HP40	HPAG10	ICHmc2 /01open Pl with Pl regen		Pl, **96** yrs
HP41	HPCMT6	ICHmc2 /01 Pl/Hw stand with Hw under	Pl CMT harvested 50 years ago	Pl **70** yrs
		Sool Nii		
RE1	RE30C1	SBSdk /Atcv - /Atpw open At/Salix		fire scarred Pl
RE2	RE30C2	SBSdk /Atpw		aspen **82** years
RE3	RE30C3	SBSdk /Atpw		Pl snag - **46** years
RE4	RE30E1	SBSdk /Atcv, large Ct - very rich		cottonwood are fire scarred
RE5	RE30C4	SBSmc2 /03, Pl pocket		fire snag **89** yrs, living Pl **84** yrs
RE6	RE30E2	SBSmc2 /05, open Bl		
RE7	RCOR1	SBS dk /03 hillside - common juniper		open Pl
RE9	RPLOT1	SBS dk /05, dense, young Pl		Pl **64** yrs approx
RE10	RCOR3	SBS dk /01 (749m)		Pl **64** yrs approx
RE11	RSAMP1	SBS dk /Atki, P. pen., sask, juniper open		fire dependent vegetation
RE12	RCOR4	SBSdk /Atki		J. scopularum **36** yrs
RE13	RCOR5	SBS dk /Atss At, S. albus, R. par, R. aci		Aspen **65** yrs approx
RE14	RSAMP2	SBS dk /Atss , J. comm, V. mem		open At no conifer regen
RE15	RSAMP3	road splits At permesic & Pl submesic type		Pl above road approx **60** yrs
RE16	RCOR6	SBS dk /01 (736m) old Pl		fire skip Pl **200** yrs
RE17	RSAMP4	SBS mc2 /01 logged area Pl V.mem		braodcast burn - lots of V. mem
RE18	RCOR7	SBS mc2 /05 Pl/Bl, dense Bl pole/sapling		edge of younger Pl type Pl **181** yrs
RE19	RSAMP5	SBS mc2 /01 young Pl/Bl stand		
RE20	RE15B1	SBS mc2 /01 young Pl/Bl stand	2 blazed Bl on ridge - SW-NE	young Pl, some old fire snags and CWD
RE22	RE15P1	SBS mc2 /01c Pl/Hw		Pl **59** yrs approx
RE21	RE15B2	SBS mc2 /01	blaze on Pl (30 yrs old approx)	
RE23	RE15E1	SBS mc2 /01c Pl/Hw same as RE15P1		strong V. mem in open
RE24	RE15E2	SBS mc2 /01Pl/Bl V. mem. Persists		Pl **187** yrs fire scarred Bl 50 m east
RE25	RE15P2	sbs /Atss - /Atcv leading At		

RE26	RE15 C1	SBSdk /Atpw - open At/Pl no GPS		large Pl vet **212** yrs grown over f. scar
CR1	SIDCT1	ICHmc1 /01, dense Hw/moss	well blazed trail	Hw (21.4cm dbh) **134** yrs
CR1	SIDCT1	ICHmc1 /01, open large Hw/moss	well blazed trail	cored large Hw - **283** yrs
CR2	SIDCT2	ICHmc1, old Hw to age class 6/7, V. mem	blaze is 70+yrs, 2 message trees nearby	timber type edge
CR3	SECO1	ICHmc1 /01, azalea shows and V. mem		Pl **329** yrs, Pl **220** yrs
CR4	SCMP1	ICHmc1 /01old Bl	old campsite - stove, tins, message tree	fire skip area b/n younger types
CR5	SPLT1	ICHmc1a /01a, Ba leading	old blazes on trail	Pl **72** yrs
CR39	SCOR6	ICHmci /01		first recent burn - open shrubfield - Pl **62** yrs
CR7	S2COR1	ICHmc2 /01 dense Cw/moss	bark stripped Cw - stripped in 1844	fire scarred Cw vets in area (draw)
CR8	S2COR2	ICHmc2 /01 dense Cw/moss		Pl **129** yrs, no vets on ridge
CR9	S2COR3a	ICHmc2 /01Pl/Hw - dense, young type		small Pl **51** yrs
CR10	S2COR3b	small gully, fire skip 100m S of S2COR3		Pl (35cm dbh) **134** yrs, Pl **139** yrs
CR11	S2CK1b	ICHmc2 /01 Cw vets 24m @183deg from S2CK1		wedge - fires in 1873, 1929, 1950
CR12	S2CK1	ICHmc2 /01 old Hw/moss type		old Hw **223** yrs
CR12	S2CK1	ICHmc2 /01 near S2CK1		Cw fire lobe core **97** yrs (estimate)
CR13	S2PL1	ICHmc2 /01		dense Hw, charcoal in humus layer
CR14	S2COR9	ICHmc2 /01 dense Hw stand		Pl **142** yrs (with scar), Pl **55** yrs
CR15	S2COR10	ICHmc1 /01dense Hw stand		Pl **52** yrs
CR16	S2COR11	ICHmc1 /01, open Pl type		Pl **136** yrs
CR17	SD3BZ1	ICHmc1 /01 old Hw along trail	old blaze on trail 119yrs, 1881	age class 9 Hw
CR18	SD3AC1	ICHmc1 /01 type change into 1st "burn"	blazes and name tree nearby	Open shrubfield scattered fire snags
CR19	SIDPL1	ICHmc1a /01a, Ba leading	Fire snag with blaze (30 yrs prior to fire)	Old Bl snag **291** yrs
CR20	SD3AC2	type change to younger Ba/Bl		more open stand, less regen
CR21	SDECO1	more V. mem, dense and vigorous in many areas		
CR22	SD3CR1	ICHmc1 /0, V. mem. 25-40%		Pl (35cm dbh) **75** yrs
CR23	SD3EC2	permesic seepage slope, dense Epil ang.		few fire snags in this area
CR24	SD3CK1	small creek		
CR25	SD3CR3	permesic,major creek, base of scree slope		Bl in older strip at top of slope **226** yrs

CR26	SD3CR4	ESSFwv /01 dense Bl		Bl in other upper slope type **67** yrs
CR27	SD3CR5	ESSFwv /01, dense azalea		Pl **62** yrs
CR28	SD3 CH1	ESSFwv /02-/03 strip along "J" Creek	possible cache pit 3ftX2.5ftX9in deep	
CR29	SD4CR1	ICHmc2 /01 Hw/Cw moss		large Cw vet with fire scar (scar=**103** yrs)
CR30	SD4CR2	ICHmc2 /01 old Hw/moss type		fire skip small Hw on both sides - Hw **135** yrs
CR31	SD4PL1	ESSF wv /05 - dense V. mem		open shrubfield - few snags/CWD
CR32	SD4EC1	ESSFwv /01 dense azalea		
CR33	SD4CR3	type change to dense Ba, some /05		large Pl **72** yrs
CR34	SD4EC2	type change to drier type coarse soils		
CR35	SD4EC3	type boundary to wetter /05-/07 complex		
CR36	SD4EC4	abundant small streams, leatherleaf sax.		
CR37	SD4PL2	ESSFwv /05-/07	possible cache pit site - square, shallow	Pl **36** yrs
CR38	SD4TR1	ESSFwv /01	well defined trailbed approaching ck.	
		Lax Ansa Maatsa		
L1	SCN1	ICHmc1 /01 old Hw (age cl.9)	* 30 N of SCN1	Hw vet **74+**years (age of f. scar lobe)
L2	CBLZ1	ICHmc1 /01 open Bl and shrubfield	blaze onl Bl (dead)	
L4	CBLAZ2		blaze on small Bl	
L5	CBLZ3	ICH mc1 /01	blaze on Bl (68 yrs) 1932, trailbed	edge of old Hw type
L6	CECO1	ICH mc1 /01	west facing blazes N. side of creek	edge of old Hw type, little fire sign
L7	CECO2	ICHmc1 /01 open shrubfield & Bl poles		several charred snags lots of V. mem
L8	CCR2	ICH mc2 /01		Pl **87+** yrs
L9	CPLOT1	ICHmc		
L10	C2ECO1	ICHmc1 /01 Hw/moss - young Bl/azalea		edge of type b/n age class 6 and 4 (map)
L11	C2ECO2	ESSF wv /01 oldHw/azalea		
L12	C2COR1	ESSF wv /01 Bl/azalea		Bl (largest in stand) **179** yrs
L13	C2COR2	ESSF wv /01 - dense azalea, V. mem		Pl (38cm dbh) **82** yrs
L14	C2COR3	ESSF wv /01		Pl (35cm dbh) **81** yrs
L15	C2COR4	ESSF wv /01		Pl (24.5 cm dbh) **74** yrs
L15	C2COR4	ESSF wv /01		Pl (30.5cm dbh) **84** yrs

L15	C2COR4	ESSF wv /01		fire snag (Bl 31.5 cm dbh) **183** yrs
L15	C2COR4	ESSF wv /01		Hw (36cm dbh) **73** yrs
L16	C2COR8	ESSF wv /01, S. facing knoll		Pl **41** yrs and Pl **33** yrs
L17	C2PLT1	ESSF wv /01	kindling tree on fire snag	Pl 27.5 cm **96** yrs, Pl 25.5 cm **76** yrs
L58	CLUNCH			Pl (40cm) **77** years
L18	C2BLZ1	open sedge meadow complex	blaze on Bl snag (several in draw)	
L19	C2RFCM	ESSF wv /01	old campsite on trail and raft at lake	
L20	C2BLZ	edge of sedge meadow	double blaze on old Bl	
L21	C2BZ3	ESSF wv /01	blaze on ld Bl snag (blazed 3X)	
L22	C2BLZ4	sedge meadow	old blazes in meadow complex	
L57	C2COR10	Open shrub complex		Pl **71** yrs, Pl **76** yrs
L23	CBZ5	ICH mc1a /01 (b/n BZ6 and BZ9)	old blaze	age class 8 (on map), Hw and Bl
L24	C2BZ6	ICH mc1a /01, old Hw type	old blaze on Bl snag heading 15 deg	little fire sign
L25	C2BZ7	ICH mc1a /01	blaze in old Hw type	
L26	C2WTR1	ICH mc1a /01, old Hw type	well defined trailbed	
L27	CBZ10	ICHmc1a /01, old Hw	large single blaze on old Hw	
L28	LK30C1	ESSFwv /01 azalea/V. mem.		Pl (37.5cm dbh) **71** yrs
L29	SWAMP1	bog phototie, old Bl		fire scarred Bl vets and snags in stand
L30	LK30C2			Pl (39cm dbh) **81** yrs
L31	LK30C3	ESSFwv /05, moist depressional pocket	old trail and scattered blazes nearby	old Bl (46.5cm dbh) **223** yrs
L32	LK30C4	ESSFwv /01 dense Bl pole sapling layer		Pl (32cm dbh) **73** yrs
L33	LK30C6	ESSFwv /01		Pl (largest, several smaller ones), **82** yrs
L34	LK30P1	ESSFwv /03, azalea, V. mem, patchy regen		Pl **75** yrs, some CWD, several fire snags
L35	LK30E1	ESSFwv /02 on rocky outcrop - complex		
L36	LK30C7	ESSFwv /01	blaze on small Bl (70yrs approx)	old Bl in fire skip finger **354** yrs
L36	LK30C7	ESSFwv /01	blaze on small Bl (70yrs approx)	fire scar lobe on large Bl vet **90** yrs (scar)
L56	LK30C8	ESSF wv /03-/01, /01 belo, open shrub complex		snags in diff. size classes, Pl **76** yrs
L37	LK30CP	ESSFwv /05 pocket above alder swale	3 small, shallow, square cache pits	edge of open shrubfield/dense trees

L38	LK30E2	ESSFwv /07and /08 types along creek		old Bl and Ba in creek draw
L39	LK30P2	ICHmc1a /01a		Sx 78 yrs
L40	LK30C9	ICHmc1a /01a		Pl 83 yrs
L41	LK30E3	ICHmc1a /01a, dense Bl poles		same age class as plot 2
L42	LK30C10	ICHmc1a /01a		Pl (35cm dbh) 71 yrs
L43	2LCTRL1	NW end of series of phototie bogs	blaze on old Bl nearby	old growth Hw
L44	2LBLZ1	ICH mc1 /o1 Hw/moss lots of younger Bl	several old blazes in area 100+ yrs	
L45	2LBLZ2	ICHmc1 /01, old Hw in age class 9 patch	large 4 way blaze (blazes over 100yrs)	
L46	2LEC1	ICHmc1/01 on slope few permesic draws		timber type change open shrub-old Hw
L47	2LCOR1	ICHmc1a /01a, lots of Ba in stand		largest Pl (26.5cm dbh) 65 yrs
L48	2LCOR2	phototie bog small submesic "island"		Pl (35.5cm dbh) 47yrs
L49	2lCOR3	ICHmc1a /01a Ba/Bl		Pl (27cm dbh) 65 yrs
L50	2LCOR4			Pl (40cm dbh) sig. Older than COR3
L51	2LEC2	ICHmc1a /01a Ba leading		large&small snags in area (2x scar snag)
L52	2LEC3	ESSFwv /03, azalea, V. mem, patchy regen		scattered snags in 25-30 cm dbh range
L53	2LEC4	ESSFwv /03 heavy azalea, strong V. mem.		some large Pl, mostlysmaller Hw, Bl, Ba
L54	2LEC5	ESSFwv /03-/02 change to drier type		
L55	2LPLT1	ESSFwv /03 - open young stand (Eco plot 5)		some fire snags and CWD
L56	C2COR1	ICHmc1a /01a - edge of young type		Large Bl (43cm) 179 yrs
L57	LK30C8			Pl 76yrs
L58	CLUNCH	ICHmc1 /01a open shrubfield		Large Pl (40cm) 77yrs
L59	CBZ11	ICHmc1 /01a old Hw	old single blaze on hemlock	
L60	CBZ12	ICHmc1 /01a old Hw	very old blaze on Hw - others nearby	

Appendix 2: Tree Species Codes

Tree Species Codes

Species Code	Latin Name	Common Name
Act	*Populus balsamifera ssp. trichocarpa*	black cottonwood
At	*Populus tremuloides*	trembling aspen
Ba	*Abies amabilis*	amabilis fir
Bl	*Abies lasiocarpa*	subalpine fir
Cw	*Thuja plicata*	western redcedar
Ep	*Betula papyrifera*	paper birch
Hm	*Tsuga mertensiana*	mountain hemlock
Hw	*Tsuga heterophylla*	western hemlock
Pl	*Pinus contorta var. latifolia*	lodgepole pine
Sx	*Picea glauca x engelmannii*	hybrid white spruce

Appendix 3: Edatopic Grid

Soil Nutrient Regime