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Plants, Land and People, A Study of Wet'suwet'en Ethnobotany

By

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ABSTRACT

This thesis is an exploration of the relationship of the Wet'suwet'en people of northwest British Columbia to the plants of their environment. The Wet'suwet'en are an Athabaskan speaking people whose way of life shows many similarities to the peoples of the Northwest Coast, especially to the Gitksan whose territories abut theirs.

Wet'suwet'en resource use and regulation is discussed, with a review of territoriality, conservation ethics and vegetation management. Then traditional Wet'suwet'en plant uses and classification are reviewed, followed by a discussion of the role of plant foods in traditional Wet'suwet'en nutrition.

Because studies of northern hunting and fishing peoples have tended to emphasise the importance of animal foods and products, it is important to document the role of plants in the economies of northern peoples. Plants are used by Wet'suwet'en people for herbal medicines, foods, and material culture. Plant foods were the sole dietary sources of Vitamin C, fibre, and carbohydrate; plant foods played a supplemental role in other aspects of nutrition.

The uses of 59 species of vascular plants and three non-vascular taxa are reported here. Wet'suwet'en plant uses show similarities to the neighbouring Gitksan and Carrier peoples. Wet'suwet'en plant classification shows a utilitarian bias. The majority of the seventy five named taxa so far documented were utilised.

The documentation of ethnobotanical and ecological knowledge of traditional peoples is important at the present time when traditional cultures are rapidly being overwhelmed by "world culture" and the details of cultural knowledge and adaptation are being lost. Not only does this represent an important preservation of heritage for individual traditional cultural groups, but it also represents an invaluable data base of human adaptation to environment and use of the environment. Without the knowledge of traditional peoples, we cannot explore the relationship of peoples to their environments to determine which kinds of adaptations may

be sustainable.

The documentation of ethnobotanical knowledge has other benefits as well: problems of human health can also be approached through an analysis of traditional foods and medicines.

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Chapter 1

Introduction

The Wet'suwet'en are Athapaskan speaking people living in the drainage of the Bulkley River and the northwest headwaters of the Fraser River in Northwestern British Columbia, Canada. Modern Wet'suwet'en live largely in two villages which are on Indian Reserves in the Bulkley Valley, Moricetown and Hagwilget (Fig. I-1). Wet'suwet'en people also live in other communities in the Bulkley Valley and Nechako Plateau. A number of Wet'suwet'en people live in other parts of British Columbia such as Prince George or Vancouver, and may return to the Bulkley Valley at intervals. There are about 1000 Wet'suwet'en living in their traditional territories in northwest British Columbia (Mills n.d.).

The Wet'suwet'en were long classed as Carrier, Northwest Carrier, or Babines (Jenness 1943, Tobey 1981, Kari and Hargus n.d.[1]), though they consider themselves to be a distinct group. Their ethnography was studied by Jenness in the 1920's (Jenness 1943), and more recently by Antonia Mills (n.d.). Their language has been called Northern Carrier (Kari n.d.), Babine (Cook 1990, Story 1984, Krause and Golla 1981, Kari n.d.), or Babine-Wet'suwet'en (Kari and Hargus n.d.) which is sometimes classed as a dialect of Carrier (Duff 1964, Kari and Hargus n.d.), and sometimes as a distinct language (Rigsby and Kari n.d.: 50; Krause and Golla 1981, Kari n.d., Kari and Hargus n.d., Story 1984). The Wet'suwet'en refer to their language as Wet'suwet'en. There is rather limited mutual comprehension of Wet'suwet'en and central Carrier (Morice 1892-3:27), supporting contentions that Babine or Northwest Carrier should be considered a distinct language.

The Wet'suwet'en have interacted and feasted with the neighbouring Gitksan, a Tsimshian speaking group, for an indeterminate but apparently long period of time in the vicinity of Hazelton (Mills n.d.). Many features of their social system resemble the Gitksan, specifically the House and feast systems, the matrilineal inheritance system and the possession of territory. These aspects of Wet'suwet'en life will be reviewed in some detail in Chapter 2. The present Wet'suwet'en village of Hagwilget (Gitksan term

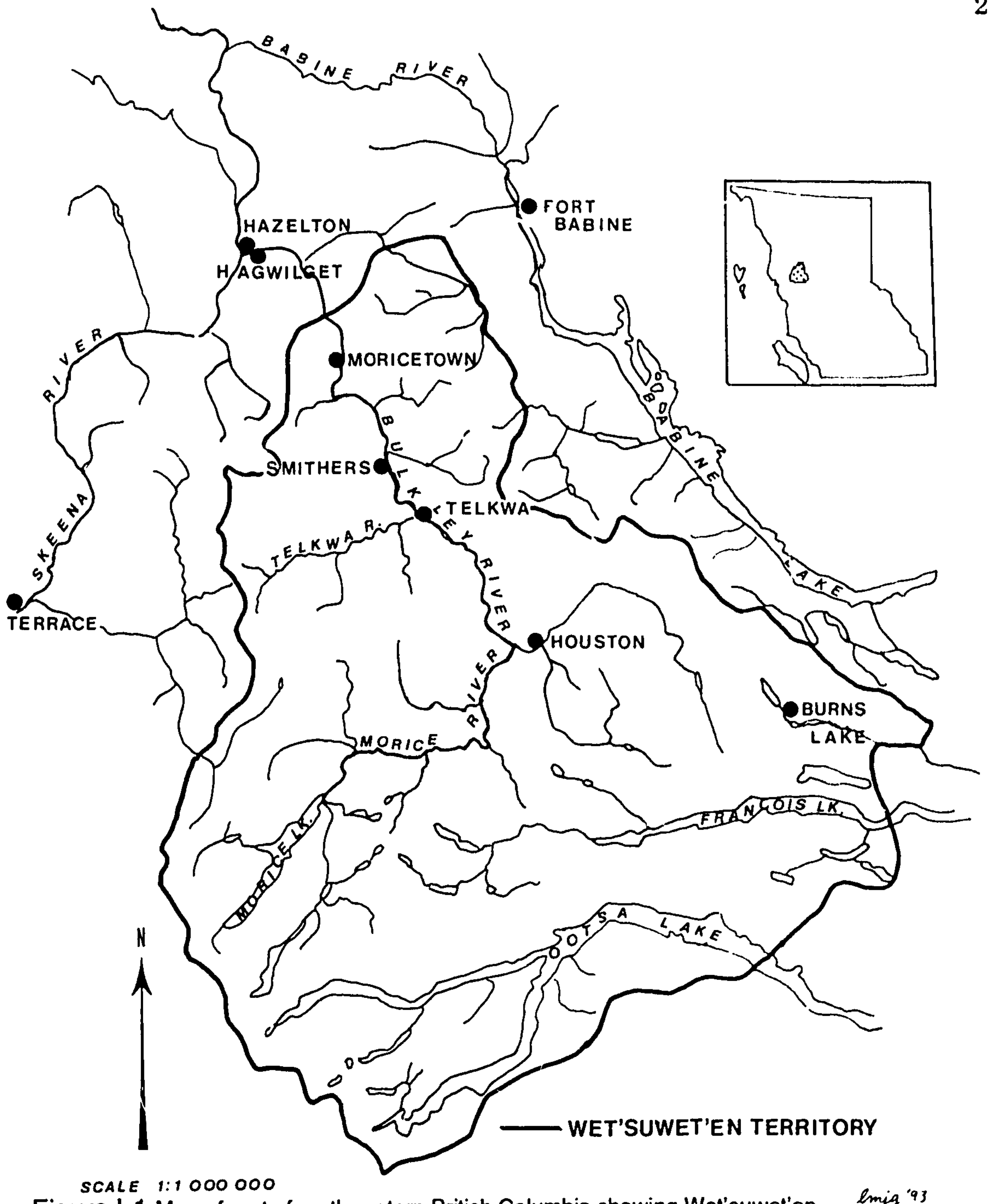

Figure I-1 Map of part of northwestern British Columbia showing Wet'suwet'en territories and villages and other local towns.

meaning 'kind or gentle man') or Tse-Kya (Wet'suwet'en for 'under the rock'), about 7 km upstream from the Gitksan village of Gitanmaaxs, was established in the1820's after a rockslide in Bulkley Canyon blocked ascent of the salmon to the traditional fishing place in Moricetown Canyon (the village of Kya Wiget). Before 1820 relations between the Wet'suwet'en and Gitksan may have been less close, although oral histories of the Wet'suwet'en and Gitksan (*kungax* and *ada'ok*) suggest a long period of interaction beginning at some period in the distant past around the fabled village of Dizkle, located some ten or twelve kilometres upstream from Hagwilget.

History

The period of contact began with the arrival of fur traders on Babine Lake in 1822 (Morice 1978; Cassidy and Cassidy 1980; Cassidy 1987) and gold seekers for the Omineca goldrush travelling through Skeena Forks (Hazelton) in the early 1860's (Cassidy 1987). Direct contact had been preceded by the arrival of European trade goods brought by Tsimshian traders from the Coast beginning about 1812 (Morice 1978; Cassidy 1987). The Collins Overland Telegraph crew arrived in 1866. By 1870, a white outfitter had established himself at Mission Flats near modern South Hazelton, and by 1871 Hazelton had been established by the government as a townsite which contained general stores and several establishments with "spirit licenses" (Cassidy 1987). A pack trail was constructed by the government following the route of the Indian trails up the Bulkley River and to Babine Lake. Employment as packers carrying goods to the Omineca gold fields was now available to the Wet'suwet'en. By the 1880's the Hudson's Bay Company had established a post in Hazelton and was supplying the northern Interior, New Caledonia, from Hazelton, bringing goods up the river by freight canoe to the head of navigation at Hazelton.

As contact was impinging on the Wet'suwet'en from surrounding areas, they took part in the prophet movements which characterized many Indian groups, and had their own prophet, Bini. Bini preached aspects of a Christian type of dogma and eschewed some traditional healing practices such as the use of rattles by shamans (Morice 1978; Jenness 1943); he found followers among the Gitksan and Niska'a as well as the Wet'suwet'en. Bini preached for about 15 years prior to his death in 1868. The Oblate fathers had begun missionary efforts in the northern interior by the 1840's, probably contributing to the spread of the prophet cults in surrounding areas. The first missionary reached Hagwilget (Tse-Kya) in 1869, immediately after Bini's death. By 1880 a log church had been constructed at Hagwilget. In 1885 Father Morice was sent to Fort St. James. He established the mission settlement of Moricetown adjacent to the site of Kya Wiget by Moricetown Canyon in the early 1890's. The Church changed aspects of village life, suppressing shamanism, discouraging the feast system, and appointing a Church Chief and Village Chief to effect religious, moral, and political control. Father Morice had a great impact on the lives of the Carrier and Wet'suwet'en (see Mills n.d. for discussion). He translated the scriptures to Carrier, devising a syllabic writing method. He also published a number of scholarly works on the history, material culture and anthropology of the Chilcotin, Carrier, Babine and Wet'suwet'en.

In the early years of the twentieth century, white settlement and land alienation began, dispossessing the Wet'suwet'en of improvements on parts of their territories and traplines which occupied the lower elevations of the Bulkley Valley and Nechako Plateau (Fig. I-2). These events initiated efforts to regain their territory (Cassidy 1987). The Grand Trunk Pacific was completed in 1914, and catalysed change in the area. The town of Smithers was constructed as a divisional point on the railroad, and the railroad stimulated white settlement in the region. At this point, most Wet'suwet'en found themselves confined to the newly surveyed reserves, or travelling in the yet unclaimed 'bush', but hindered from utilizing their territories in the valley bottoms. Shortly after, effective Provincial control in the area was strengthened, and traditional practices such as berry patch burning began to be suppressed by B.C. Forest Service officials (see Chapter 4).

In addition to the pressures of settlement and culture contact, the Wet'suwet'en, like other peoples of North America, were effected by a number of epidemics and by the introduction of non-indigenous diseases. Smallpox and influenza, in particular, caused devastating epidemics in the

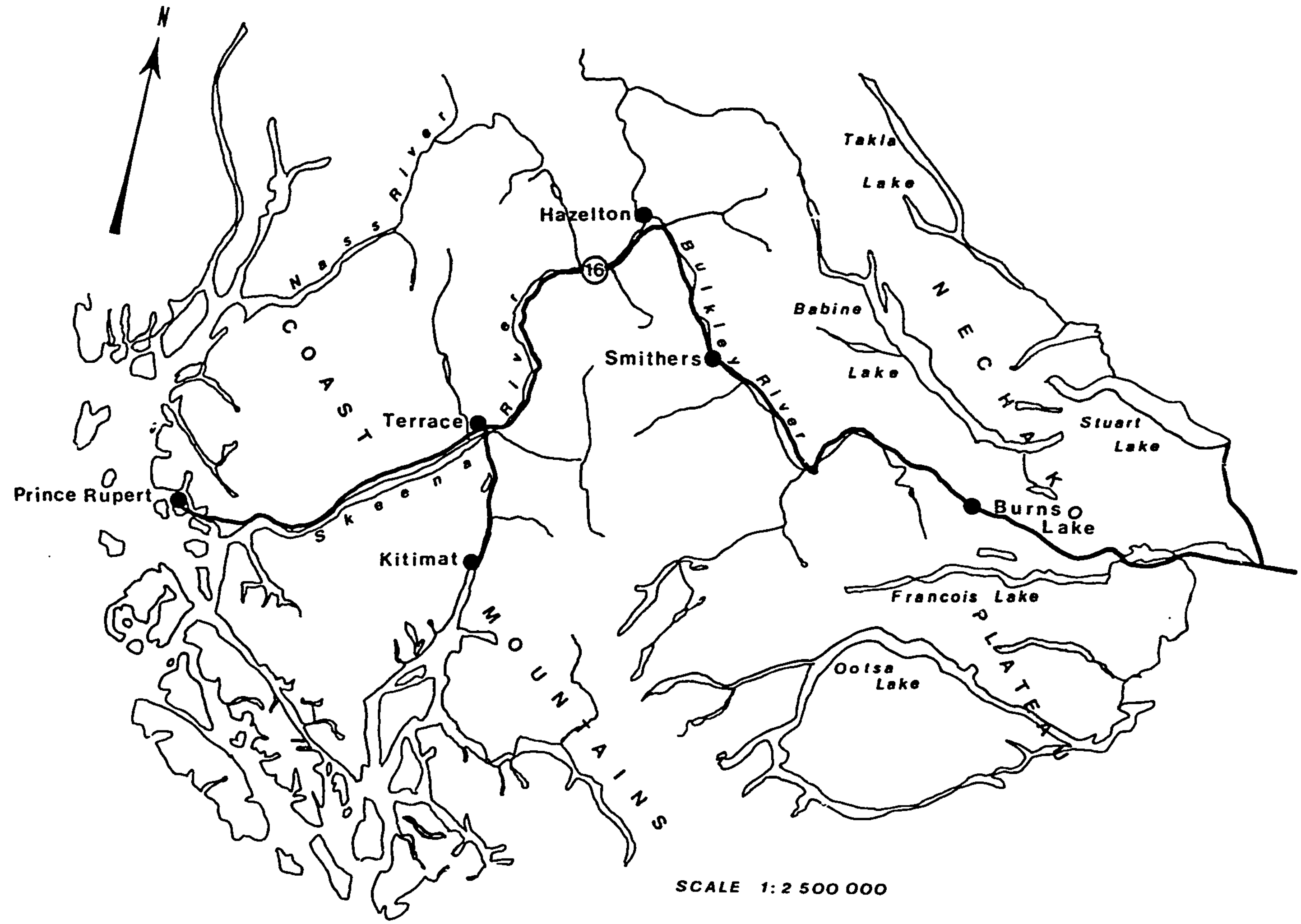

Figure I-2 Regional Map of Northwest British Columbia latter part of the nineteenth century and the early twentieth century. Aboriginal population at Kya Wiget was estimated to be around 1100 people by Mills (n.d.) based on the description of the village by Peter Skene Ogden in the 1820's (Ogden 1853, cited in Mills:88). Wet'suwet'en population in 1862 had plummeted to about 100 people following an outbreak of smallpox. Tuberculosis and venereal disease were more insidious, but nonetheless important factors in Wet'suwet'en life after contact.

The Wet'suwet'en worked as packers and trappers after white contact, and once the railroad had been completed in 1914, as tie cutters and cedar pole cutters. A shortage of available land made it difficult for Wet'suwet'en to succeed at mixed farming, though many evidently desired to do so (Cassidy 1987). Many Wet'suwet'en joined the large numbers of native peoples who became involved in the commercial fishery in the twenties and subsequent decades, mostly working out of Prince Rupert canneries, which were accessible by railroad.

In 1910 a school was established at Tse-Kya. Under Father Morice, literacy in Carrier had been taught, but no English language schooling had been supplied. Hagwilget was considered as the location for a residential school, but in 1917 the Nescolie residential school was established at the Mission in Fort St. James (Cassidy 1987), ushering in the era of separation of Wet'suwet'en children from their families and home villages, and the removal of Wet'suwet'en children from effective traditional education. In 1922 the Catholic school at Lejac on Fraser Lake was established. Many Wet'suwet'en children were sent to this establishment until its closure. Strong criticisms of this school have been levied, charging exploitation of students for labour, lack of sensitivity to native culture and beliefs, and failure to provide adequate education (Moran 1988:42-44).

In later decades, Indian day schools were built on the reserves, and school attendance at provincial schools in Hazelton, Smithers or other communities also occurred. Some Wet'suwet'en continued to live off reserve, a number becoming enfranchised to enhance their civil rights, but losing thereby the privilege of remaining on reserve, or even of being buried there.

Modern Wet'suwet'en in northwest B.C. work primarily in extractive resource industries such as logging or commercial fishing, or in government funded jobs such as band manager or teacher. Many are underemployed as job opportunities for those who chose to remain on their reserves are limited. Relatively high rates of transfer payments provide income on the reserve, especially for the many older people and for those of low job skills, as in many northern native communities. Traditional occupations such as trapping do continue, but do not account for most of the economic base of the community. Efforts to create a commercial inland fishery have met with mixed success, due to political obstacles and the lack of already established infrastructure in the communities for such an enterprise (Morrell 1989). A modest subsistence economy persists alongside the newer cash economy, emphasising salmon fishing and moose hunting, with supplemental berry picking. Some traditional foods are produced now primarily for distribution in the feasthall.

The struggle to regain control of the land has continued down the years. In the early 1970's a joint Tribal Council was formed with the Gitksan and a comprehensive land claim initiated in 1977. In 1987 the Tribal Council sued the Province of British Columbia for ownership and jurisdiction of the traditional territories of the Gitksan and Wet'suwet'en. In 1991, Justice McEachern handed down a negative decision (McEachern 1991), stating that unextinguished aboriginal rights did not exist. This decision is being appealed by the hereditary chiefs.

The Environment

The Wet'suwet'en territories occupy the transition between the northwest coast and the boreal interior in northwest British Columbia (Fig. I-2). The western portion is rugged and mountainous, with high precipitation and large areas of montane and alpine landscape scored with deep valleys and penetrated by several large lakes. The Bulkley Valley divides the Hazelton Mountains from the Babines, another relatively rugged but drier range separating the Bulkley Valley and the territory of the Wet'suwet'en from Babine Lake, and the Babines, with whom they have traded and intermarried. The southern portion of Wet'suwet'en territory, locally known as the "lakes district", includes the inner edge of the Coast

Mountains (Tahtsa Ranges) and the adjacent Nechako Plateau, a rolling upland at about 2500' elevation with hills and broad valleys. This area includes the drainage divide between the Skeena River system and the Fraser, and the northwestern portion of the Fraser drainage (tributaries of François and Tahtsa Lakes).

Forest types include (Fig. I-3) a fringe of Interior Cedar Hemlock (ICHmc)[2] in the Bulkley Valley and lower slopes between Hazelton and Moricetown, Sub-Boreal Spruce (SBS) in the rest of the Bulkley Valley and most of the Nechako Plateau area, and mostly Engelmann Spruce-Subalpine Fir (ESSF) in the subalpine, surmounted by grassy alpine tundra (AT) (Ministry of Forests 1988). The coastal mountains have extremely high snowpacks, and narrow fringes of Coastal Western Hemlock (CWH) and Mountain Hemlock (MH) subalpine forest below the heather dominated Alpine Tundra (AT) occur in this area (Ministry of Forests 1988).

The landscape is heavily forested below the alpine with the exception of grassy south facing slopes and swamp areas in the valleys, and avalanche areas in the mountains, which may be dominated by scrub or herbaceous vegetation depending on avalanche frequency. In the Interior-Cedar Hemlock Zone species with a more coastal distribution such as western red-cedar and western hemlock occur. The village sites of Hagwilget and Moricetown occur in this zone. The Bulkley Valley and Nechako Plateau are more boreal in aspect. The landscape here consists of a mosaic of spruce, pine and aspen forest, punctuated with grassy slopes, willow swamps and black spruce muskeg.

Nature of the Study

My purpose is to document traditional uses and knowledge of plants by the Wet'suwet'en. I chose to work largely with the information from living consultants for several reasons. Firstly, no systematic work on Wet'suwet'en ethnobotany has been carried out. Secondly, available documentation of Wet'suwet'en plant uses suffers from inadequate information on ethnographic context. Father Morice's work (1893) in particular does not differentiate the Wet'suwet'en from generalized Carrier or even Chilcotin consistently, and there are significant differences in

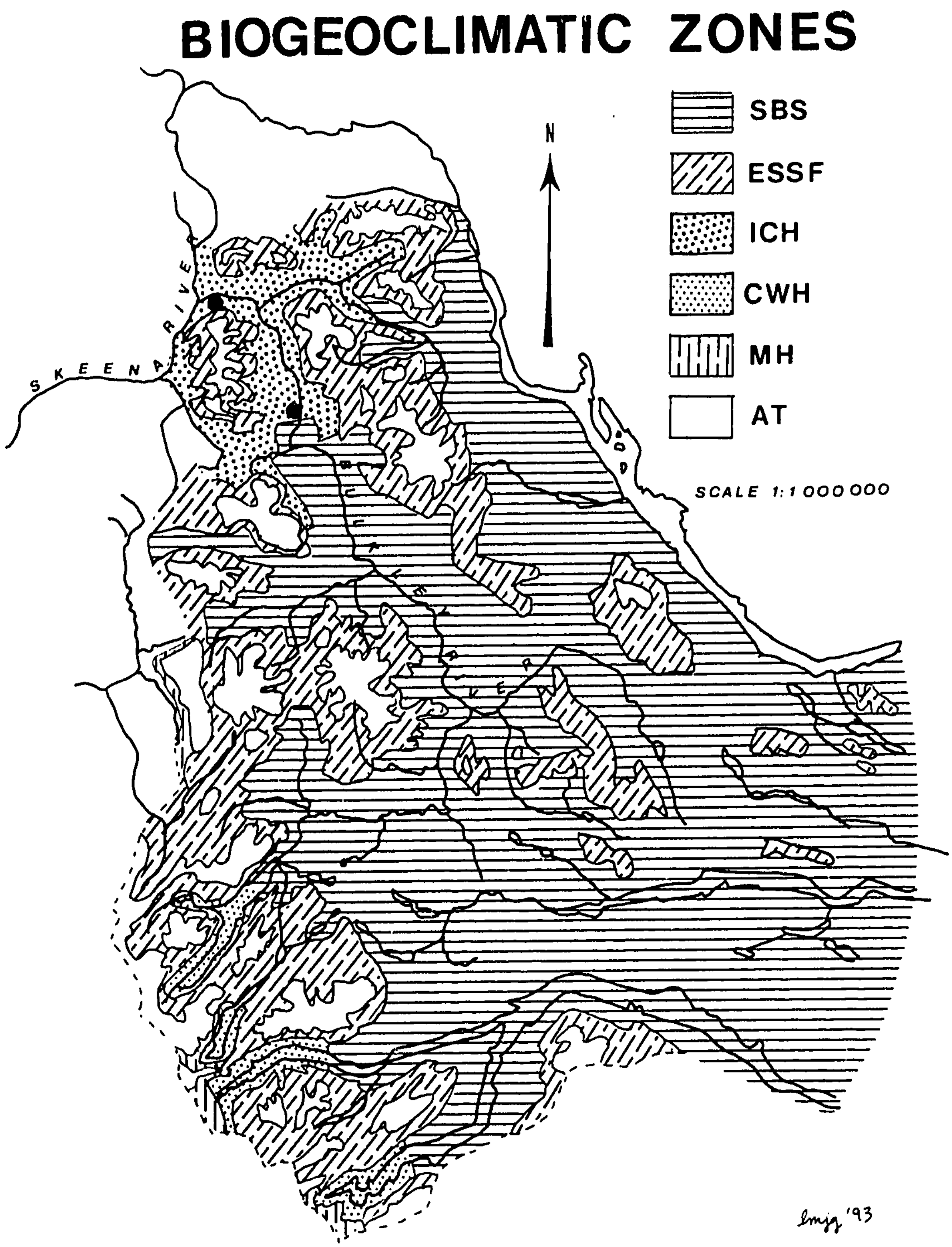

Figure I-3 Map Units: SBS= Sub-Boreal Spruce; ESSF= Engelmann Spruce-Subalpine Fir; ICH= Interior Cedar-Hemlock; CWH= Coastal Western Hemlock; MH= Mountain Hemlock; AT= Alpine Tundra; Hagwilget and Moricetown indicated by dark circles. (after Biogeoclimatic and Ecoregion Units of the Prince Rupert Forest District, 1988, map prepared by the British Columbia Forest Service) culture and environment across the area such that greater specificity is needed to place reported plant uses in context. Thirdly, for most plant use records, the botanical determinations are not reliable. This is especially true of some local unpublished oral history material (Murdoch n.d.) and also of the material Harlan Smith derived from the notes of Jenness (Smith 1928).

Since a number of Wet'suwet'en elders retain knowledge of contact-traditional plant uses and the Wet'suwet'en names of ecologically and economically salient plants, it seemed worthwhile to document this knowledge while it was still possible to do so. Given the dramatic changes in way of life over the past ninety years, this knowledge base is perishable, and many of the younger people have very incomplete knowledge of traditional plant uses.

I gathered information on the uses of plants for food, medicine and technology, and their Wet'suwet'en names. The use of Wet'suwet'en names was in part prompted by methodological considerations, since one cannot assume a one to one correspondence between scientific botanical taxa and indigenous plant taxa, and partly because the English language botanical knowledge of most of my consultants was too poor to allow specific determination of plant identity for all but the most widely known and recognized plants. Use of Wet'suwet'en plant names avoided any ambiguity in which plants were being referred to. Documentation of the names of plants is also the first step toward dealing with indigenous classification of plants.

I gathered additional information about ecological data such as the annual round, aboriginal burning, hunting and fishing practices and beliefs, about plant classification, and about other aspects of spiritual beliefs and healing.

Methods

I conducted informal interviews with thirty three Wet'suwet'en people over the period from October 1987-August 1992, and received information from two other people interviewed by Beverley Anderson (personal communication). Thirteen of the consultants were men and twenty one were women. Twenty four of the consultants were elders, eleven men and thirteen women. All of the elders except one were fluent in Wet'suwet'en, and all but three spoke enough English to carry on a conversation about plant uses predominantly in English. Of the middle aged and younger men and women, most had moderate to good skills in Wet'suwet'en; two consultants did not speak Wet'suwet'en. All of the middle aged and younger people were fluent in English, though botanical vocabulary in English might be limited. Most of the elders had little formal schooling and had experienced traditional upbringing and bush living. Some had been to residential school. The younger consultants had all attended school, and had varying backgrounds in traditional skills. My sample size and flexible interview techniques did not permit systematic evaluation of variation in information between consultants of different genders, ages or cultural experience, or rigorous corroboration of data among the consultants.

Interviews were conducted in English or in Wet'suwet'en, depending on the language skills of the consultant and on the availability of a translator. My interview procedure was informal and open ended. I asked some direct questions and sometimes elicited responses to photographs of plants or artifacts, or to specimens of plants or artifacts. The open interview style maximised the consultant's comfort and control of the interview process and content. Most interviews took place in people's homes or smokehouses. Some interviews or conversations took place in public gatherings or at the Moricetown school. Two field trips to gather medicinal plants were taken with one elder, her daughter, and the Wet'suwet'en language and culture instructor from the Moricetown school.

Notes were taken of interviews and some interviews were tape recorded with permission of the consultant. Copies of the tapes and interview notes were made for the Kyah Wiget Education Society in Moricetown and for the Gitksan-Wet'suwet'en government library in Hazelton. Use of an oral translator made possible interviews with functionally monolingual elders, who had a rich knowledge of traditional plant uses.

Voucher specimens of plants were collected, and are deposited in the Herbarium of the Royal British Columbia Museum (VIC) in Victoria, B.C. Vouchers of plants collected during BAR grant funding will be deposited at the University of Alberta Herbarium (ALTA). Photographs of plants or plant parts were also taken, and served as interview tools in the later part of the study. Copies of photographs have also been given to the Kyah Wiget Education Society in Moricetown.

Plants were identified by bringing fresh specimens to elders, or by verifying plant identifications in the field. Sometimes "case" specimens of known identity (Bye 1986) were used to elicit information, such as cleaned rootstocks of the fern *Dryopteris expansa* (K.B. Presl) Fraser-Jenkins & Jermy or a piece of dried rootstock of *Veratrum viride* Ait.. Initial identification was often by reference to local English common name in the case of well known and common plants such as spruce or devil's club. Sometimes verbal description was supplemented with drawings or reference to photographs as initial identification. Knowledge of the local flora proved invaluable in hypothesising what plants were being described by consultants, and then obtaining specimens to verify the identification.

Plants were identified by use of regional floristic treatments (Hultén 1968; Hitchcock and Cronquist 1973, Hitchcock *et al.* 1955, 1959, 1961, 1964, 1969; Taylor 1973a, 1973b, 1983; and Brayshaw 1976). In problematic cases such as the fern rhizome and the cinder conk, botanical experts at the Royal B.C. Museum or the Botany Department of the University of Alberta were consulted to verify the identification and assist with correct nomenclature.

Wet'suwet'en language transcriptions were kindly provided by Dr. Sharon Hargus of the Linguistics Department of the University of Washington, who checked my provisional orthography and definitions with several Wet'suwet'en consultants she was working with, primarily Dora Wilson-Kenni and Alfred Joseph. Supplemental assistance with Wet'suwet'en orthography and linguistic analysis was provided by Dr. Gillian Story of the Summer Institute of Linguistics. The practical orthography employed in this work is the modified Hildebrandt system devised by Dr. Hargus for a Wet'suwet'en literacy project she assisted with for the Hagwilget Band. This was the preferred orthography of the Wet'suwet'en language and culture teacher at the Moricetown School as well.

Discussion

Role of Plants in Northern Hunting and Fishing Cultures

The role of plants in subsistence and material culture of northern and northwestern North American hunting and fishing cultures is significant and needs to be better documented. Much of the research to date on northern and northwestern North American cultures has emphasized hunting and fishing and its importance in aboriginal economies (e.g. Tanner 1979, Wenzel 1981, Kew n.d.) Despite a general stereotype that plant use is unimportant in the subsistence or economies of such cultures (c.f. Porsild 1953, McKennan 1959, VanStone 1974, Tanner 1979, Hunn 1981, Wenzel 1981), there are indications that plants are critical for provision of certain nutrients (c.f. Porsild 1953, Nickerson *et al.* 1973), are widely utilized for medicine, and, recalling that wood is derived from plants, fundamental to aspects of aboriginal technology in virtually all human cultures. Studies which have been carried out on the ethnobotany of these northern groups lends support to the diversity of plant uses and traditional knowledge (e.g. Nickerson *et al.* 1973; Jones 1983; Hunn 1981, 1990, 1991; Clément 1990; Turner *et al.* 1990) in northern cultures.

Women's Knowledge

Much of the existing ethnographic literature reflects the biases of (usually male) ethnographers and often informants (c.f. Borré 1990:192-199). Male food procurement, often hunting or fishing, is dramatic and salient, and it is easier for a male anthropologist to work with male informants. In many cultures social norms may make it difficult for a male ethnographer to work directly with women. Female work in traditional cultures frequently emphasizes use of plants, especially for foods, medicines, basketry and textiles. Male work with plants may be largely confined to technology (e.g. house construction, canoe making, manufacture of implements, monumental art, items such as looms or snowshoes), while male participation in plant food gathering and processing or medicine making may range from subordinate to negligible in foraging cultures. Even where it is not negligible, gender role differentiation may cause men and women in a culture to have different knowledge regarding plants (Kainer and Duryea 1992). Therefore, if a study emphasizes males as "type" culture bearers, it may overlook the importance of plant use and knowledge, or may document only part of the botanical knowledge of a culture. There is a growing awareness of the importance of documenting women's knowledge to provide a more complete and accurate picture of indigenous cultures around the world (c.f. Danna Leaman, Virginia Nazarea-Sandoval, 1993 Ethnobiology Conference presentations). This knowledge is more accessible to me because I am a woman (c.f.Borré 1990; Danna Leaman, personal communication).

Ecological knowledge

The "natural" vegetation (and animal populations) of a region are products of long interaction between human populations and other components of environment (cf. Alcorn 1981); human populations, other biota and the physical environment are components of one integrated system. (This is often not perceived by either natural scientists or social scientists.) There is a need to address traditional cultural perception, ideology and management of the environment (traditional ecological knowledge, or TEK). This traditional knowledge forms part of the total subsistence/economic adaptation of a culture.

The relationship to land is fundamental to many institutions as Steward (1955) correctly realised, although the approach I will espouse here is not the classic cultural ecology of Steward. I will adopt a human ecology based on appreciation of both biological and cultural aspects of ecology, emphasising the subsistence adaptation and the relationship to land rather than elaborating the articulation of this relationship to other aspects of Wet'suwet'en culture.

Steward's cultural ecology paradigm is useful but tends to force thinking into a culture/nature dichotomy, dealing with environment as an independent variable rather than viewing human interaction with the environment from a total system perspective. Other authors, such as Clarke (1977) and Wenzel (1981) envision a system perspective. This approach recognises the inclusion of humans (and their behaviour and culture) as components of ecosystems. It is recognized that subsistence and land relationships do have a fundamental role in human cultures, but a simple deterministic model is entirely inadequate to describe the complexity of this relationship.

Adaptation

Adaptation is a term frequently employed in ecological anthropology/ human ecology and ethnobiology, usually without qualification or definition. It is useful to review what is meant by adaptation in anthropology and to discuss in what sense it is employed in human ecology and ethnobiology. Adaptation is conceived as a process of accommodation between an organism and its environment (Pianka 1983). In the biological sciences, its meaning in ecology and evolutionary biology includes genetic adjustment affecting phenotypic potential to express characteristics which permit survival or competitive success in an environment (Richerson 1977; Pianka 1983). This is conceived as occurring by natural selection on the phenotypes of organisms in that environment, entailing differential reproduction of the underlying genotypes and therefore selection of genotypes which can manifest successful phenotypes (Richerson 1977). Some social scientists and especially sociobiologists (e.g. Tiger and Fox 1966 and 1971, and others cited in Durham 1976) have used adaptation in this sense of genotypic Darwinian fitness to attempt to explain human cultural behaviours which appear to effect a functional human/environment system. Others (Durham 1976, 1978; Alland 1975; Rindos 1985) have dismissed this view as an unhelpful distortion of biological selection and the basis of human cultural behaviour, instead contending that cultural systems also undergo evolution and are subject to selection of adaptive traits in an analogous but non-genetically based manner.

Durham (1978) contends, however, that the capacity for culture is under genetic control and that total cultural expression must have enhanced fitness and have been biologically adaptive to have been selected for in hominid evolution. He believes that cultures are still in general biologically adaptive, although specific culture content is not under genetic control nor subject to natural selection. Rindos (1985, 1986) also discusses the genetic basis of culture capacity and contrasts this with Darwinian selection of cultural phenotypes. Rindos maintains that the social environment, rather than the biotic environment, drives much of cultural selection. Some authors have invoked adaptation to explain various cultural features in ecological terms without specifying what selective mechanisms might have brought about these adaptations. Ross (1978) has suggested that aspects of symbolic systems such as species hunting taboos may be expected to be conditioned by ecological factors such as potential sustainability or energetic efficiency of exploitation of particular species in Amazonia. Durham argues for a "cultural selection" analogous to natural selection which would operate on cultural traits which had strong adaptive consequences (1976).

Examination of cultural patterns of land use, perception and resource use in terms of possible adaptive funcuions is a useful exercise, particularly as interest in traditional ecological knowledge, subsistence systems and resource management is increasing as we search globally for "sustainable" development. Ethnobiologists and others have maintained that various traditional small scale societies can provide models of sustainable adaptations and have urged investigation of their characteristics before these societies are totally overwhelmed in the global economy and culture (c.f. Clarke 1977). This presupposes that traditional small scale societies do in fact have sustainable economies, that they do have cultural features which represent stable adaptations to an environment, or stable human ecosystems.

Some recent authors have contended that disequilibrium models (Moylan 1973; Salisbury 1975; Foin and Davis 1987) may better describe the actual situation even in societies which have been touted as classic exemplars of homeostatic (stable) systems (Rappaport 1971). One of the difficulties is the variety of ways the concept "stability" has been used in ecology (e.g. Dunbar 1973); some are in fact mutually contradictory. Debates have raged in ecology as to whether, for example, rain forests, buffered by many complex pathways and interactions, should be considered stable or not (Foin and Davis 1987; Dunbar 1973). They may persist with little change for long periods of time (one sense of stability) but recover their original state after a severe disturbance only after a prolonged period (a lack of stability in the sense of time to return to the pre-disturbance state, or a lack of resilience) (Foin and Davis 1987).

It has been legitimately argued in ecology and human ecology both that secular change, that is, features like climatic change, or disturbances of stochastic nature (randomly occuring events such as landslides, hurricanes, or European cultural contact) may preclude equilibrium seeking systems from ever reaching an equilibrium. For example, the concept of a climax forest may be meaningless if the period of development from pioneer to postulated climax is longer than shifts in climate. That would mean, necessarily, that the forest is never in equilibrium with the present climate, but is always in some sense a relict of prior conditions, that is, a product of its history.

Foin and Davis (1987) argue that the same situation may apply to the Maring populations studied by Rappaport, who may demonstrate a tendency toward equilibrium, which, however, they never reach because the period of time necessary to reach it is longer than the interval between major disturbances, both biotic and anthropogenic. It may be true that populations are never in perfect equilibrium because of these types of stochastic features. Clarke (1977), however, argues that the Maring population he studied possesses, not a static equilibrium, but a persistent though changing adaptation (which represents "relative permanence"), and that, in the absence of contact, their way of life would persist in the area for an indefinite period of time.

Vayda and McCay (1975) find it useful to investigate response of people to hazards as a focus of ecological anthropology, and emphasize the need to understand individual and group responses. They stress homeostatic mechanisms, as opposed to static equilibria, and system properties like resilience.

Human populations can relatively rapidly accommodate to some types of environmental change by changes in behaviour (c.f. Brightman 1987 for boreal forest Algonquians). This type of adjustment to perturbations can lead from one type of relatively stable adaptation to another which reflects the changed situation. It is conceivable that a series of such changes, both in the "natural" world and in the cultural world, may cause progressive change in the adaptations of a group over time, that is, cause historic (directional) change in culture.

Some changes may be "once only" types of change, or of such infrequent occurrence as to preclude any prediction. Other changes may be of a more or less regular or cyclical recurrence. A concept which has been usefully applied in ecology, and which may be of assistance in conceptualising some types of perturbations of the human ecological system is that of "disturbance regime". This assumes that some types of perturbation may recur with a loosely predictable interval, subject to change over long periods of time, and that these periodic disturbances form part of the environment to which organisms must adapt if they can persist in the environment. Unusually cold winters or summers, severe fire years, or crashes of game populations might be such factors in human ecological systems.

For a culture to exist over time in an environment, it must achieve a stable adaptive mode *or must be able to flexibly respond to changes in environment or the cultural environment* such that it tracks environmental changes, and is resilient enough to deal with stochastic events such as natural disaster or input of new technology from outside. Authors such as Richard Nelson (1982) have assumed that a stable adaptation is necessary; authors such as Foin and Davis (1987) suggest that human ecosystems, like "natural ecosystems", may be subject to random perturbations which may prevent human populations from reaching an "equilibrium" state, and to which human populations must continue to respond and adapt. Berkes (1987) and Gadgil and Berkes (1991) emphasize sustainability of subsistence adaptations, allowing for change and response to change within system parameters, without fundamental disruption of "essential ecological processes and life support systems" (Berkes 1987:84).

Focus on the adaptive relationship between culture and land is not necessarily environmental determinism, because there is more than one possible adaptive mode in any given region, and because of the interaction of culture and environment (e.g. people determine the environment through land use practices as well as environment constraining what people can do).

> ...Rappaport (1971a p. 262) suggests that a society's cognized model will tend to be favoured by "selective forces" if it functions in an adequate way. He defined an "adequate" model as one that elicits a pattern of behaviour which contributes to the well-being of the population, and which also maintains the ecosystem in a productive state...
> Even for the pre-industrial world, however, it must be recognized that very similar environments are exploited in very different ways, and that many of these were equally "adaptive" as regards the maintenance of ecosystem stability, at least in the short term. In the longer term, severe degradation did of course take place... Different origins, technologies and degrees of interaction with neighbouring populations; and different conceptions of what constitutes an acceptable livelihood will all lead to different cultures being imposed on nature [sic], even though nature must influence what strategies of ecosystem management have adaptive value, and so tend to persist. (Bayliss-Smith 1977:16)

I examine aspects of the ecological relationships of the Wet'suwet'en from a perspective of "adaptation", assuming that there may be conscious or latent adaptive functions to aspects of land tenure, resource management, and plant resource perception and utilisation. I do not attempt to explain all aspects of these subjects in adaptive terms, because there is much more to human culture than ecological adaptation[3]. Nor do I hold to an environmental deterministic view, because history, cultural context, and cultural integrity will all affect possible relations with land and subsistence base. However, I do maintain that the characteristics of the land and the biota do provide some constraints and limit possible adaptive strategies which a culture can successfully pursue.

Place of Ethnobotany

Ethnobotany, in brief, is the study of the interaction of people and plants. It began as a discipline with the description of the uses of plants by traditional or aboriginal peoples (Ford 1978). During the nineteenth century, various compilations of Native American plant uses were made by botanists. Because of the uneven quality of the previously recorded data, botanists by the latter part of the nineteenth century were undertaking specific studies of the uses of plants by contemporaneous native tribes in the United States. As anthropology began to emerge as a formal discipline, ethnologists also began to do ethnobotanical studies. As might be predicted, the focus and interests of the ethnologists differed from the approaches taken by botanists. Botanists had maintained a strong utilitarian bias, and organized their materials by the scientific classification of the plant species used (Ford 1978) (a focus which still characterises some modern ethnobotanical studies carried out by botanists). In contrast, the ethnobotanical studies carried out by ethnologists emphasized the cultural importance, and indigenous knowledge, perception and classification of plants (Ford 1978:39).

In recent decades, ethnobotany *per se* has been variously viewed as a branch of ethnobiology and as a type of ethnoscience. These perspectives emphasize different aspects of ethnobotany, although it must be recalled that formal ethnobotany antedates either "ethnobiology" or "ethnoscience", and historically did not develop as a subdiscipline of either. Some people have felt that ethnobotany, as a branch of ethnoscience, deals primarily with the cognitive aspects of botany among traditional peoples (Ford 1978:41,43). Other viewpoints emphasize the connections of ethnobotany with other aspects of ethnobiology and ethnoecology, which is the view adopted here.

Ethnobotany is at the nexus of the ecological interface of human populations, because plants are key elements of the ecosystems of which people form a part. The ethnobotany of a group reflects and interacts with subsistence adaptations. A complete understanding of a group's relationship to land is not possible without awareness of native perception and use of plants as resources and as components of the landscape. For non-horticultural peoples, this relationship is focussed on the collection, use, and management of wild plants, while for horticultural or agricultural groups, cultivars, and management of agroecosystems will be a primary focus.

Utilisation of wild plant resources can be profitably examined from perspectives like optimal foraging (see Chapter 2), although most of the optimal foraging literature regarding people deals with animal or fish prey species. Two noteworthy exceptions are Hawkes *et al.* (1982) which deals with hunting and gathering decisions for the Aché of Paraguay, and O'Connell and Hawkes, (1982), which is a provocative study of diet breadth and optimal foraging among the Alywara of Australia.

Ethnobotanical data are relevant to issues of cognitive anthropology, as the principles by which people name and classify plants reveal aspects of the working of the mind and the similarities and differences between different cultural groups. Pioneering studies in ethnoscience and cognitive anthropology such as those by Harold Conklin (1954) are based on ethnobotanical data. Studies by Berlin *et al.*(1966, 1973, 1974), and others too numerous to reference here (see Chapter 6 for further discussion) have carried on the inquiry about how plants are classified, and how this classification related to intrinsic properties of plants and to human culture.

Ethnobotanical studies are also crucial to understanding aspects of human health and health maintenance in traditional populations. Ethnobotanical investigations focussed on traditional foods can clarify indigenous nutritional status, and careful documentation of indigenous plant medicine preparations can contribute to a general understanding of human healing, as well as potentially provide new plant derived medicines for western biomedical use. As Etkin (1986), Johns (1990) and Berkes and Farkas (1978) have pointed out, foods and beverages can provide therapeutic effects, and medicines may also have nutritional value such as providing vitamins or minerals to the diet. It is my belief that study of the plants themselves and their biochemical constituents, traditional gathering and preparation techniques, and indigenous concepts of the nature of disease and healing and properties of medicines, are all needed to provide adequate information to evaluate medicinal plant use. Nina Etkin (1986) has called this the "biobehavioral" approach.

> ...while many anthropologists and other social scientists propose to place their observations within a broad biobehavioral framework, their interpretations more typically reflect a perspective that views plants rather narrowly as cultural objects. Thus, considerable research attention has been devoted to the relationship between medical cosmologies and perceptions of the biological universe, culturally patterned selections of plants for foods and medicines, and the psychosocially integrative dimensions of ethnomedical and dietary behaviors. On the other hand, botanists and pharmacologists have been more interested in biological studies which are frequently devoid of cultural and other contextual data. Collectively, then, the literature of ethnobotany and ethnopharmacology is largely botanically uninformed or anthropologically naive, and at present a multidisciplinary understanding of plant use is more a conceptual ideal than an operational reality. (Etkin 1986:2)

While I do not treat medicines and healing in detail in this thesis, this is the approach I have taken to the investigation of both plant medicines and foods. I believe that there is an empirical basis to healing practices and dietary choices, and I have attempted to document properties of the plants themselves as well as cultural perceptions and uses in an attempt to elucidate the factors which may bear on the choices of which plants are used for foods and medicines by the Wet'suwet'en.

> ...in the same sense that it would be inappropriate to invoke symbolic and other meanings to "explain" all cases of plant use in ethnomedicine, it would be equally misguided to ascribe their use solely to the presence of pharmacologically active constituents or to presume that empirical observations and symbolic ascriptions are mutually exclusive (Etkin 1986:15).

Conclusion

The documentation of ethnobotanical and ecological knowledge of traditional peoples is important at the present time when traditional cultures are rapidly being overwhelmed by "world culture" and the details of cultural knowledge and adaptation are being lost. Not only does this represent an important preservation of heritage for individual traditional cultural groups, but it also represents an invaluable data base of human adaptation to environment and use of the environment which is needed to temper the overwhelming change of the human/environmental relationship world over. Without the knowledge of traditional peoples, we cannot explore the relationship of peoples to their environments and determine which kinds of adaptations may be sustainable.

Ecological relationships must be "fine tuned" to be viable. Although it is not true that traditional adaptations were static and unchanging, but were characterized by innovation and change in the face of new challenges and opportunities, they still were shaped by an intimate acquaintance with the land and its nature in one place, and were attuned to ensuring survival in that context. Without adequate documentation, that "fine tuning" is being lost, and broad brush approaches carry with them inevitable probability of failure or system degradation because of lack of sensitivity to local conditions (Clarke 1977).

The documentation of ethnobotanical knowledge of traditional foods and medicines can be important. The search worldwide for new medicines derived from plants is well known and will not be reemphasised here. Some health problems of indigenous populations in changing environments can be shown to relate to changes in diet and loss of traditional food sources or food processing techniques (e.g. Nabhan 1990, 1991; Borré 1990). The complex interactions of "foods" and "medicines" for the maintenance of health will also be mentioned only in passing at this time. For many populations worldwide, traditional foods and medicines remain a viable and affordable way of maintaining health, where alternatives may not be available or understood.

For the Wet'suwet'en, the documentation of their cultural knowledge of plants is most important from the perspective of preservation of their own heritage in the face of profound shifts in subsistence and economy and their place in Canadian society. Preservation of their plant heritage is part of their own understanding of their past and their relationships with the land, and can reinforce their cultural identity. Continuation of use of foods and medicines can promote health in a way which affirms the value of their own cultural knowledge.

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[1] Kari and Hargus n.d. provide an extended discussion in tables 5 and 6 of the treatment of Wet'suwet'en variously as "Babines" or "Babine-Hagwilgates", or as a subgroup of the Carrier.

[2] The Interior Cedar Hemlock Zone is characterised by*Thuja plicata* Donn., and *Tsuga heterophylla* (Raf.) Sarg. forest with *Picea glauca* x *engelmannii,* and *Abies lasiocarpa* (Hook.) Nutt. Seral forests are dominated by *Pinus contorta* Dougl. or *Populus tremuloides* Michx. and *Betula papyrifera* Marsh. The Sub-Boreal Spruce Zone has zonal forests dominated by *Picea glauca* x *engelmannii* with seral stages dominated by *Pinus contorta* and *Populus tremuloides*. The Coastal Western Hemlock forests at the elevations which are present in the territories of the Wet'suwet'en contain a mix of *Tsuga heterophylla* and *T. mertensiana* (Bong.) Carr. with *Abies lasiocarpa* and *A. amabilis* (Dougl.) Forbes. The heather dominated Alpine Tundra is characterised by *Cassiope mertensiana* (Bong.) G. Don, *C. lycopodioides* (Pall.) D. Don,*Phyllodoce empetriformis* (Sw.) D. Don and *P. glanduliflora* (Hook.) Cov.

[3] Durham argues that, as the adaptive significance of cultural "phenotypes" (=traits) decreases, the likelihood of other factors than contributions to an individual culture bearer's "inclusive fitness" being the reason for the trait increases. That is, that the explanation of cultural traits not having strong adaptive significance in this sense, will be found in other factors such as individual pleasure, historical factors, etc.

A Consideration of Territory among the Wet'suwet'en

Chapter 2

Introduction

The cultural features of the aboriginal groups of the Northwest Coast of North America represent an anomaly in the world of peoples whose subsistence does not include food production (Rubel and Rosman 1983:3). The population densities, large villages and at least semi-sedentary lifestyle, defended territory, warfare, stratified societies and accumulation of wealth achieved by Northwest Coast societies are usually characteristic of groups with horticulture (Suttles 1968). Food storage is basic to all of the cultures in the Northwest Coast, especially the preserving of salmon for winter consumption. Woodburn has characterized this type of society as a delayed return system (Barnard 1983) in contrast to the immediate return systems characteristic of groups such as the !Kung and Hadza. In part the adaptation of the Northwest Coast enables high population densities because the people are not limited to the productivity of the actual land area they exploit; the anadromous fish which are central to all of the cultures of the Northwest Coast represent the resource base of the entire North Pacific ocean (Hunn 1990).

Northwest Coast cultures occupy a strip along the west coast from Northwest California to Southeast Alaska. Along the major salmon-bearing rivers which traverse the coastal mountain belts are found inland extensions of coastal type cultures which grade into the prevailing types of adaptations found inland in each area. The Columbia, the Fraser, the Skeena and Nass, the Stikine and the Taku Rivers are areas where inland extension of coastal type cultures occurs.

As has been discussed elsewhere (Suttles 1968, Richardson 1982), the Northwest Coast is not uniform with regard to environment or social organization. Richardson (1982) distinguishes five subareas of the coast which differ in patterns of control of productive resources: Northwest California; Western Oregon, Chinook, and Southern Coast Salish; Central Coast Salish; and Northern Matrilineal. I would like to discuss the Northern Matrilineal subarea in more detail. The Northern Matrilineal subarea includes the Tsimshian (including the Niska'a and Gitksan), the

Haida, the Haisla, the Tlingit and the Eyak of Northwest British Columbia and Southeast Alaska. As Richardson points out, "Resource allocation in this subarea was almost entirely based on ownership of areas by matrilineal corporate groups. In most cases the areas owned were extensive and contained multiple resources" (1982:104).

I have conducted fieldwork in Northwest B.C., primarily among three groups which range from inner coastal conditions to the edge of the boreal forest (*sensu lato*) in the interior of northern British Columbia. The Gitksan are a Tsimshian speaking group living on the middle and upper reaches of the Skeena River; the Haisla are Northern Wakashan speakers with matrilineal inheritance who live on Douglas Channel and Gardner Canal, and the Wet'suwet'en are Athapaskan speakers living on the Bulkley River and the northwestern headwaters of the Fraser River system.

I would particularly like to focus on the Wet'suwet'en people and their adaptations. In many ways they are more comfortably treated as "Northwest Coast" people than as "Subarctic Athapaskans". They feast together with the Gitksan, and intermarry; in recent years the two groups have formed a common Tribal Council and are pursuing a common land claim. The Wet'suwet'en are lumped with the Carrier by nearly all authors and are placed variously in Plateau or Subarctic Culture areas, despite their obvious affinities with coastal peoples. General reviews of their ethnography and history are found together with that of the central Carriers (Tobey 1981, Morice 1893 etc.). Morice does mention in his early work that the Babines (including both Babines and Wet'suwet'en, Nato'tenne and H'wotso'tenne) differ from his "Upper" and "Lower" Carriers in some aspects of language and culture. However, he then lumps information about the Carriers in a broad sense, and does not even consistently differentiate the Chilcotin. Authors such as Steward (1960), Duff (1951) and Kobrinsky (1977) have considered the Wet'suwet'en to represent a special case of Tsimshianized Carriers, who have borrowed heavily from their more coastward neighbours, while Aberle (Dyan and Aberle 1974), Rosman and Rubel (1971; Rubel and Rosman 1983) and Ives (1987) contend that many coast-like features of these peoples are ancient aspects of the culture and society.

The Wet'suwet'en are indeed transitional in culture between Northwest

Coast and Interior Athapaskans. They have a matrilineal organization, with a crest system closely similar to other Northwest Coast groups, particularly the Gitksan and Haisla, from whom some of their crests are explicitly derived. They have chiefs, nobles and commoners, and formerly had slaves, also in common with other Northwest Coast peoples, and in contrast to the typical Subarctic Athapaskans of the northern Interior. The association of corporate groups called "Houses" (***yikh***) with ownership of specific fishing sites, and hunting grounds, including resources like root and berry patches, follows the pattern shown by the Gitksan (Adams 1973, Daly 1988, Duff 1959, Gottesfeld and Anderson 1988) and Niska'a (McNeary 1976).

However, the fundamental organization of the seasonal round has much in common with northern Athapaskan groups (Kobrinsky 1977; Heffley 1981; Emmons 1911) in that the Wet'suwet'en gathered as a large group for summer fishing, dispersing to separate areas for winter hunting and trapping (Fig. II-1). Thus the Wet'suwet'en, in contrast to the Gitksan and coastal peoples, were traditionally dispersed in winter and concentrated in a large village in the summer. Summer fishing sites are the focus of integration of the entire group (Mills n.d., Daly n.d.) in a fashion reminiscent of many northern Athapaskan groups (Kobrinsky 1977), whereas for the Gitksan, in common with coastal peoples, the feast season and time of group residence in large villages was early winter (Daly 1988).

The Origins of Matrilineality among the Wet'suwet'en and Central Carrier

The possession of matrilineal Houses and clans with associated defended territories by an Athapaskan speaking group has sparked debate since the late nineteenth century. Authors like Morice (1892-93), Jenness (1943), Duff (1951) and Steward (1960) have seen these traits as recently assimilated by a "typical" nomadic Athapaskan hunting society, borrowed rather than truly a feature of Athapaskan culture. Steward (1960) used the Carrier of Stuart Lake as a test case for a simple model of diffusion of a constellation of traits from the Coast to the Interior. In his model, the cline

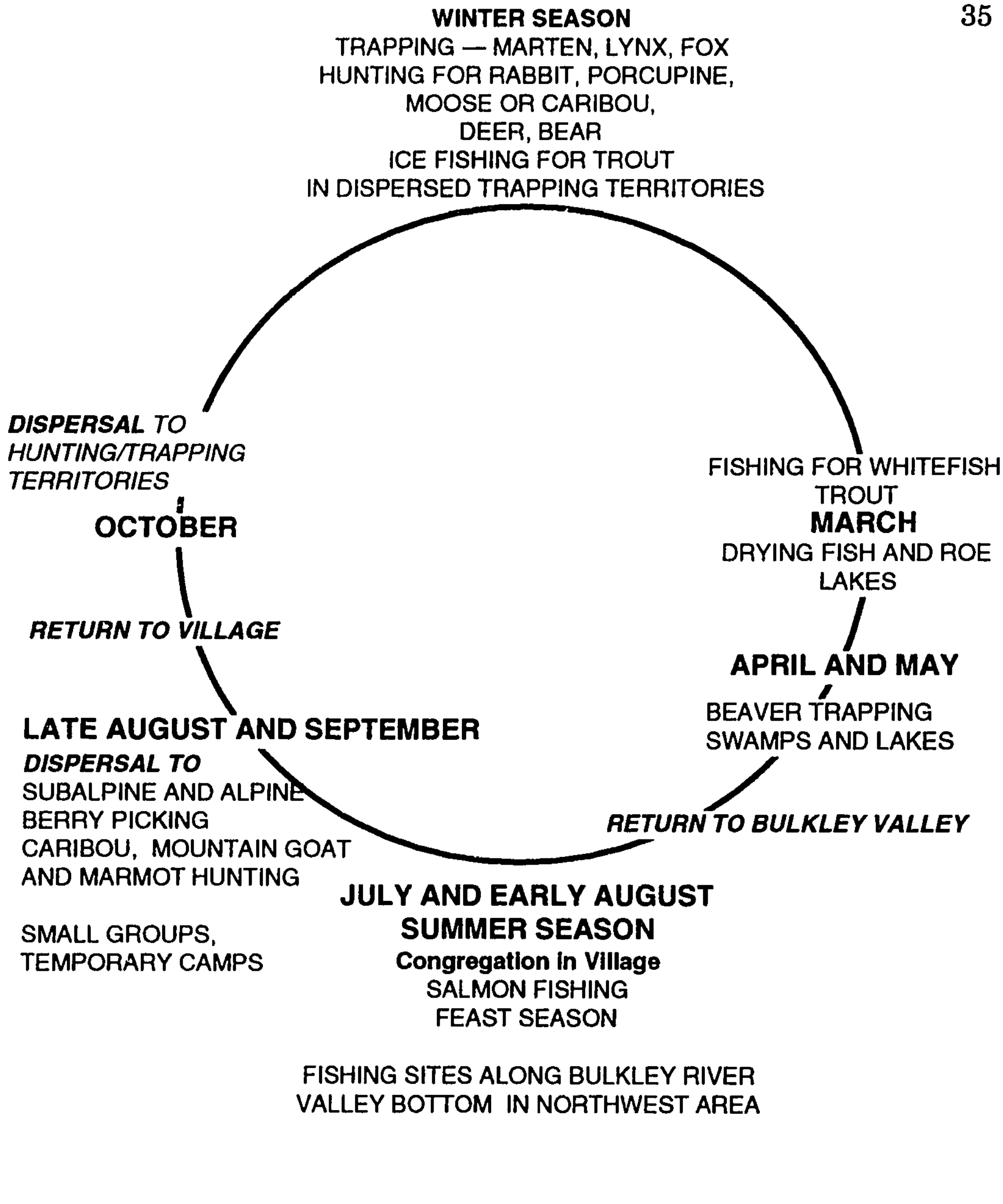

Figure II-1 ANNUAL CYCLE OF MOVEMENT AND SUBSISTENCE ACTIVITIES OF THE WET'SUWET'EN (LATE NINETEENTH/EARLY TWENTIETH CENTURY) in "coastal" features reflected intensity and duration of contact between coastal and Athapaskan peoples. He believed that the diffusion of the entire matrilineal crest, feast and territory complex had occurred in the time period after white traders impinged on Coast, and that its adoption had an economic causation. These traits were seen as being adopted to facilitate trade and to control trade and generation of potential surplus for trade (Steward 1960). For Steward, the pattern described by Goldman (1941) for the Alkatcho Carriers represented vestiges of the preexisting patrilineal pattern, influenced by the kinship and feast pattern of the Bella Coola with whom they traded and feasted.

In contrast, various authors have presented evidence that matrilineality or at least, matriorganization, (Krech 1980, Hosley 1977, 1980; De Laguna 1975; Rubel and Rosman 1983) may be ancient in Athapaskan society. Hosley argues:

> Thus the Northwest Coast potlatch was not diffused outward to other groups of Athapaskans [from the tribes in contact with coastal peoples] any more than were the unilineal clans. Both were present as a part of the original core culture, and came to be elaborated on when environmental circumstances permitted (1977:126).

Murdock argued cogently for matrilineal exogamous moieties originating in the NaDene ancestors of the Eyak, Tlingit and Haida, and diffusing thence to the Tsimshian (*sensu lato*) and Haisla, where the original moieties were further elaborated into the so-called phratries with their constituent clans (cited in De Laguna 1975). Slobodin (1980) discusses diffusionist hypotheses, both coast to interior and the reverse. He then reiterates the concept that social organization, like linguistic structures, only diffuses 'under conditions in which these traits would be independently elaborated even in the absence of culture contact" (Murdock cited in Slobodin 1980). However, trade relations and culture contact can shape the form of the adaptation. De Laguna (1975) believes that matrilineality and crests are Athapaskan adaptations which were shaped by contact with powerful neighbours from the coast to assume features borrowed from the Tlingit and Gitksan in areas such as the Stikine and the Skeena.

The Wet'suwet'en themselves believe that both matrilineality and territory possession are fundamental features of their culture (Mills n.d.), although they readily acknowledge that specific crests and names derive from other groups such as the Kitimat (Jenness 1934:232) or the Gitksan (names such as Kloumkhun[Xlo'omgan] which means 'timber avalanche' in Gitksan, Sara and Tommy Tait personal communication).

One must remember that the Wet'suwet'en participated in a feast system with coastal peoples (and interior peoples), not in isolation. Feasting together with members of different ethnic groups naturally molded the lineages and crests into a mutually intelligible pattern throughout the Northwest Coast. The chief incentive to feasting together was the maintenance of trade relations and alliances. Benefits to the Wet'suwet'en from adoption of a crest and clan system which shared the common features of the North Coast were considerable. A common system for Northwest Coast facilitated trade and minimized risk by creating allies based on common crest and clan associations (Mills n.d.). The equivalences of the Northwest Coast crests and groups are given in Seguin (1985); articulation of the Wet'suwet'en with the system is discussed in Jenness (1943) and explicitly detailed by Mills (n.d.). The status differential between the wealthy coastal peoples and the interior people and the desire to participate in the pan-tribal system so they could have advantage of trade both created incentives for the Wet'suwet'en to adopt a crest and clan system which was similar to that of the Northwest Coast. The Wet'suwet'en, at least in the period immediately prior to Eurocanadian contact and the proto-historic period, traded with the Gitksan, Niska'a, Tsimshian and the Haisla, as well as with the Carrier of Fraser Lake and the Babines.

> The exchange of goods over a long period prior to white contact was facilitated by the aboriginal adoption by the Wet'suwet'en of the clan crest and feast name system of the Gitksan and Nishga. As Jenness points out, trade was conducted between clan members across the Gitksan-Nishga-Wet'suwet'en language barrier. Membership in a clan gave the Wet'suwet'en kin in an associated house among the Gitksan and Nishga. Clan affiliations linked the Wet'suwet'en to all their neighbours" (Mills n.d.: 5).

The arguments made by Steward regarding the possession of the clan system for trade do have some validity; however Mills (n.d.) argues that these advantages antedate first contact with white traders.

Mills (n.d.), Daly (n.d.) and others, including myself, have argued that contact between Gitksan and Wet'suwet'en is not recent, on the basis of ethnohistory, *ada'ok* and *kungax* (Gitksan and Wet'suwet'en oral histories). Archaeological evidence at least supports prolonged occupance of the area for the past 4,000 years (Ames 1979). It is difficult to ascertain whether present groups were actually in residence in the area for the whole period.

Oral histories suggest prolonged trade and contact with both Haisla and Gitksan. Jenness assumed that the large numbers of Gitksan language titles and shared crests, and even clan names, indicated recent borrowing of the matrilineal clan, house and crest, and feast system from the Gitksan.

The linguistic evidence, however, may be suggestive of more prolonged contact. Not only feast words and titles have been borrowed into Wet'suwet'en from Gitksan. Terms for plants and some terms for marine foods are Gitksan loanwords (Rigsby and Kari n.d.; Chapter 6). Kari (n.d.:7) emphasizes that in general Athapaskan languages are "notoriously conservative regarding loan words"; speakers usually coin new terms for new concepts. Moreover, Gitksan also contains loanwords from Wet'suwet'en such as the words for moose, bull caribou, and yellow pond lily. In addition, at least one Gitksan title that I know of is a Wet'suwet'en word. The presence of loan words in both languages suggests interaction, and probably intermarriage as well, for a prolonged period of time. Certainly intermarriage, bilingualism and common feasting characterize the historic period.

Unusual features of the phonology of Wet'suwet'en may also indicate prolonged contact with Gitksan:

> Gitksan has probably played a role a role in the preservation of the *k series in Babine [=Wet'suwet'en], as Gitksan also distinguishes k and q. Also the Gitksan labio-velar series may have contributed to the preservation of the labiovelars in Babine... (Kari n.d.:13)
>
> If we seek a motive for the shift in the Babine vowels, it is most interesting to find that Gitksan also has five long vowels, i, e, a o, u..." (Kari n.d.: 17)

The occurrence of chiefly titles originating in one language group in the feast system of another group is not limited to the Gitksan and Wet'suwet'en, but is a general feature of the northern Northwest Coast. Since all of the coastal groups feasted together at times and met on common ground when they participated in the Nass and Kitimat oolachan fisheries, songs, crests and prerogatives were given away as gifts and now occur in several groups. The title Legaix, for example, which was the name of a series of powerful Coast Tsimshian chiefs in the early to mid nineteenth century, is present among the Haisla (Olson 1940) and may have originated among the Heiltsuk of Bella Bella (R. Daly written communication). Olson (1940) lists the titles and names of the Haisla in Kitamaat Village. A large number of them are noted as being of Tsimshian derivation, and one title is described as being Tlingit in origin. The Haisla Beaver crest is called by the Wet'suwet'en word Tsayu, whose derivation from the word for beaver is obvious in Wet'suwet'en. The Wet'suwet'en in turn say that their eagle and beaver crests derive from the Haisla.

This puts the prevalence of foreign crest terms and titles in Wet'suwet'en into some perspective. Other feasthall terms seem to be examples of the borrowing of Gitksan terms to replace Wet'suwet'en terms, rather like the adoption of French terms in English, because they are high status (e.g. ***amale***, from the Gitksan ***amhalaayt***, for feast headdress instead of the older Wet'suwet'en term ***taastl'o*** (Charles Austin, personal communication)).

Hudson (n.d.) discusses the Stuart Lake Carrier, where both Morice and Steward did a lot of their work. Hudson suggests that matrilineality is fundamental for the Carrier, and that a combination of numerous factors acted to superimpose a system of patrilineally organized trapping territories over top of the previous matrilineal system. Harmon, who first established European presence in Stuart Lake in 1811, documents a full blown feast system (Harmon 1957:253-254) and territory (:250,253).

Father Morice established a missionary presence in Fort St. James in 1885 and made it the centre of his efforts for the next nineteen years. Although a student of the language and culture, certain features of the indigenous system were abhorrent to him, particularly matrilineal inheritance, which he considered ungodly and unnatural. He also attempted to eliminate the feast system. He emphasized that patrilineal inheritance of tools, wealth and traplines was the Christian way, and that those who adhered to the Native system were acting in a way which displeased God.

Fort St. James was a centre of the fur trade since the 1820's, placing strong pressure on the economic system to produce furs for trading, rather than to pursue subsistence activities. In addition Hudson (1983) describes the oscillations in the Fraser River salmon runs. The fishing sites were basic to the matrilineal territory system. In the early twentieth century a rockslide in the Fraser Canyon heightened the oscillation in the salmon by eliminating one of the principal stocks, contributing to both the weakness of the matrilineal territories and fisheries at the time when Steward studied the Carrier, while their participation in hunting and fur trading were strong.

The Alkatchos studied by Goldman may have a derived bilateral system, rather than representing the "primitive" Carrier condition (Rubel and Rosman 1983). They are in contact with the Bella Coola people, who have a bilateral kinship system, and trade and feast with them (De Laguna 1975). Under the influence of these trading partners, there would be an incentive to adopt a system which could be congruent with the Bella Coola.

Settlement Pattern, Annual Round, and Optimal Foraging Models

Optimal foraging models have found application in various aspects of ecological anthropology, including studies of diet breadth (c.f. O'Connell *et al.* 1982), hunting efficiency (Hames andVickers 1987) and patch selection (Hames and Vickers 1987; Hawkes *et al.* 1982). In this section I will discuss the applicability of Horn's model to Wet'suwet'en territoriality.

Heffley (1981) reviews data for three Subarctic Athapaskan groups as a test of the effect of Horn's model of optimal foraging. She sets out the hypothesis that variations in settlement pattern and seasonal patterning of group size and dispersion will be correlated with the types and seasonal availability of food resources each group depends on. Horn, studying colonial nesting Brewer's blackbirds, defined two basic patterns of prey occurrence and modelled what configuration of predators would be most efficient at exploiting what pattern of prey (Heffley 1981). His classes are "clumped and unpredictable" and "stable and dispersed" (see Winterhalder 1981a,b for further discussion of Horn's model and other aspects of optimal foraging). Clumped and unpredictable prey are most efficiently pursued from a central place. This is particularly true if there is information sharing among foragers, which is a notable feature of hunting and gathering groups (Heffley 1981). Stable and dispersed prey are more efficiently pursued by dispersed foragers.

Heffley notes there is a pattern which is not discussed by Horn which occurs in resources utilised by northern Athapaskans. That is the clumped and predictable pattern of anadromous fish such as salmon, which are both very concentrated and highly predictable in their spatial and temporal occurrence. This pattern allows stable aggregations of people to exploit them, and is the basis of the Tenana (and Wet'suwet'en) summer encampments. The semipermanent villages of the Tenana were located at the fishing weirs used for the early July run of whitefish. Since the number of places where fish could easily be taken was limited, the fishing villages acted as nucleating centres for the local band. The clumped and predictable pattern also forms the basis of the winter aggregations of Ingalik and Gitksan winter villages, because of the predictable harvesting of large seasonal surpluses of fish which can be dried for winter food supply.

The Chipewyan, pursuing caribou, mobile, unpredictable and aggregated prey, are likewise mobile, and remain in fairly large groups which can fan out to reconnoiter a large territory, so enhancing the chances of the group encountering prey. This pattern of mobility in a fairly large group also seems to have been characteristic of the Kutchin (Heffley 1981).

Optimal foraging analysis is useful in consideration of patterns of aboriginal movement on the land. Central place foraging allows information exchange and trade, which, as Heffley (1981) and Winterhalder (1981a,b) point out, significantly enhances the efficiency of resource harvest.

The Wet'suwet'en (Fig. II-1), as mentioned above, have a typical Athapaskan pattern of aggregation in summer at centralized fishing spot (Kobrinsky 1977) where the presence of a clumped predictable resource concentrates the opportunity to obtain food resources. People harvested and stored large amounts of salmon, and through potlatching, shared the resources of their winter territories and validated titles and territories.

They also had the benefit of the "central place" and could exchange information about the state of various harvestable resources in different areas of the Wet'suwet'en lands prior to dispersing for goat and caribou hunting, marmot hunting, and berry picking. The return to the village after these activities would allow for exchange of information and sorting of people to winter foraging groups before leaving for the winter hunting and trapping areas. During the winter dispersed and relatively stable animal resources were chiefly harvested, along with fish, which could perhaps be best considered under the patchiness model. In the spring fishing for spawning whitefish would again be harvesting a clumped stable resource. The beaver trapping which followed could be considered as dispersed and stable, although each lodge in effect represents a "patch". Beaver trapping was followed by return to the summer fishing village once again.

Horn's model can deal adequately with some of the resources the Wet'suwet'en depended upon. I have listed a variety of resources in Table One according to their classes of distribution, including Heffley's new clumped, predictable class.

Table II-1

Distribution Pattern and Predictability of Selected Resources

Clumped, Predictable	Stable, Dispersed	Clumped, Unpredictable
salmon (chinook and sockeye)	deer	woodland caribou
marmots?	moose	berries?
	bear	
	trout	
	furbearers	
	porcupine	
	beaver	
	ptarmigan	
	rabbits*	
	grouse*	

* populations subject to major fluctuations

Horn's model provides a useful way of looking at some food resources used by the Wet'suwet'en, but other resources are harder to usefully characterize by these classes. The model works less well where patchiness and seasonality of resources are significant variables. Marmots, mountain goats, berries, and fern rhizomes are key resources for the Wet'suwet'en where a short season of harvest (except for fern rhizomes, which can be harvested throughout the non-growing season) combines with a stable but clumped distribution. That is, within patches at the right time, the resource is abundant and productive. Outside of the patch the resource is absent or too sparse to harvest. At the wrong season, the resource may not be present at all, or is unsuitable for harvest. Patch productivity for these resources is critical (see Winterhalder 1981a,b for discussions of these variables in optimal foraging models; see also Hunn 1981 for a discussion of Sahaptin root patch productivity). By patch productivity, I mean harvest per unit time within the patch (see Hawkes *et al.* 1982).

Distance of the resource patch from other key resources and /or the central place of the foraging group is also limiting. Timing of harvest and travel time and effort are major factors in the usability of a resource (c.f Hames and Vickers 1982). Gene Hunn discusses this factor for the Sahaptin (1982) and concludes that their population was limited by the travel distance required between harvestable resources, given seasonal time constraints. That is, that the requirement for mobility to harvest a number of key resources actually limited the amount of any one resource that could be harvested. These constraints are especially true for plant foods of low caloric yield such as fresh berries, where there has to be enough payoff in terms of calories gathered per unit time to pay for the effort and time expended in harvesting them. Therefore, berries distant from camp or village are only a resource if the yield of a patch is sufficient to enable a picking crew to harvest and bring back a large supply. This is facilitated by drying berries on the site (thereby increasing the ratio of calories to weight which must be carried), which was a universal practice if the berry patch was distant from the village.

This same low yield, combined with year to year variation in productivity of different berry patches resulting from climatic and other variables, makes central place foraging with information exchange important. For example, hunters who have checked out the mountain slopes on shorter trips from the village can bring back information about the state of berry patches. Then expeditions can be coordinated and planned which will produce a sufficient harvest of berries to repay the effort. This kind of coordination of berry harvest has been reported for the Gitksan (Andy Clifton personal communication 1990).

Winterhalder (1981b) discusses a model of patch to patch migration developed by MacArthur and Pianka, and contrasts it with observation of the way Cree foragers actually move when looking for harvestable resources. People use their intelligence to maximize the encounter of productive resources and minimize energy output and time expenditure. In addition, the movement gets a better payoff if the target area can yield several resources. Wet'suwet'en people apparently often combined such activities as berry picking in montane berry patches with marmot and goat hunting on adjacent cliffs and scree slopes to access resource patches of different types at the same season with the same investment of travel energy.

Territorial implications of resource patchiness will also be touched upon in the following section.

Economic Defensibility and Territory

Richardson (1982) concludes that the economic defensibility (='defendability') model discussed by Dyson-Hudson and Smith (1978) best explains variations in patterns of resource accumulation and sharing on the Northwest Coast.

> A territorial system is most likely under conditions of high density and predictability of critical resources....If a resource is so abundant that its availability or rate of capture is not in any way limiting to a population, then there is no benefit to be gained by its defence and territoriality is not expected to occur (Dyson-Hudson and Smith 1978:25).

Richardson concludes that certain resources on the coast such as shellfish and salal berries were so abundant that access to them was rarely restricted.

> The resources most frequently subject to access restrictions on the Northwest Coast were predictable and abundant, but also *geographically restricted* to limited areas or *patches*. This third variable of resource patchiness was not explicitly included in the economic defensibility model, but seems essential to explaining resource control patterns on the Northwest Coast (Richardson 1982:95.; emphasis mine).

Resource patchiness is a key concept in understanding Wet'suwet'en territory. Discussing territoriality in the Northern Matrilineal area, Richardson (1982) says:

> The geographical and *temporal* restrictions of resources put a premium on management of both resources and labor. In this situation the tightly organized unilineal kinship groups should perhaps be expected . . . The factor of patchiness would also be important in an analysis of resource exploitation emphasizing organization of labor and change in seasonal settlement (Richardson 1982:108, emphasis mine).

This recognition of the importance of distribution of resources in space and time for the development of territoriality is discussed by Dyson-Hudson and Smith.

> The cost-benefit ratio of a territorial strategy is highly dependent on the pattern of resource distribution, and it is this relationship which must be examined in attempting to account for the presence or absence of territorial organization in any population. For our purposes, the important parameters of resource distribution are predictability and abundance. Predictability *has both a spatial component* (predictability of location) *and a temporal one* (predictability in time) (Dyson-Hudson and Smith 1978:24, emphasis mine).

In order for territory to be viable, two conditions must be met. First, there must be resources of intermediate abundance such that limitation of access is a worthwhile strategy. As discussed above, patchiness of resources can favour territorial behaviour. Second, the scale of patchiness of the environment has to be such that each territory or set of territories provides a range of habitat and resource patches so that the range of subsistence requirements can be largely met. Ritualized sharing and flexibility in allocating people to territories can overcome some spatial and temporal variation, as can trade with groups from other areas. Watanabe discusses semi-sedentary adaptations among northern dwellers (1968). His analysis of the influence of topography in mountainous areas with narrow valleys and riverine resources with regard to resource distribution and the viability of group territories is broadly applicable to the Gitksan and Wet'suwet'en. The mountainous environments of the Ainu and the Gitksan and Wet'suwet'en juxtapose a range of habitat types and resource areas within a discrete spatial area which can be exploited from one or a few base camps. This is geographically and ecologically unlike the gently rolling boreal environment of northern mid-continent or even the environments of groups in Interior Alaska, where the influence of steep topography and altitudinal zonation in creating a diverse landscape is absent.

Ownership of resources on the landscape is typical of the Northern matrilineal area. Territories are bounded and defended and encompass a variety of resource values including crabapple trees, berry patches, fishing sites, sea otter trapping rights, and beach salvage rights for marine mammals. The presence of warfare and territorial defence suggests that population pressure existed and that some stress on the resource base existed. The potlatch has been suggested to be a response to episodic failure of resources by Suttles (1968), who suggests that the stimulation to overproduction provided by the prestige associated with potlatching would be adaptive in the rare times of scarcity. While this analysis does not seem to be applicable to the Wet'suwet'en or Gitksan because feasts were not superabundant give-aways and feast attendance entails reciprocal indebtedness, feasts also provide a way to define and defend territory, within and between groups, without resorting to warfare.

Wet'suwet'en Territory

I believe matrilineality is fundamental in Wet'suwet'en culture, and that the Gitksan-Wet'suwet'en territory system is not an artifact of trapping. Wet'suwet'en territories are stated to involve rights to hunt and trap, to fish and to pick berries. They are sites of supernatural occurrences of the owning family. In addition, fishing sites at Hagwilget Canyon and at Moricetown Canyon were owned. Each Chief had his/her spot on the weir and the canyon bank where the fish trap could be set. Apparently less limited fishing space at Hagwilget than Moricetown led to more latitude in the use of the fishing stations there; all group members could use fishing stands when the owners were not using them, in contrast to Moricetown, where explicit permission was necessary (Jenness 1943). Hagwilget was a site borrowed from Gitanmaaxs in response to a fish disaster, so the origin of fishing stations would be, of necessity more *ad hoc*. These sites were destroyed or disrupted in the 1950's in the alteration of both canyons for "salmonid enhancement" by the Department of Fisheries.

Potlatching and territory are inseparable among the Wet'suwet'en. Sara Tait (Chief Wi halite or Tiyin ko) stated that the people would go out on the land and work hard for one or two years to amass sufficient stores of skins, furs and dried meats and other foods to hold a potlatch[1]. The hosts would give away dressed hides of various species such as caribou, and dried meat as potlatch gifts. Alfred Joseph, Chief Gisday wa, states that distribution of smoked beaver from the territory at feasts served to validate the group's ownership of their lands.

Ownership of territories is a chiefly prerogative and goes with assumption of a title. Among the Wet'suwet'en, as among the Gitksan and Niska'a, the territories are associated with corporate "House" groups. The Wet'suwet'en "Houses" refer to traditional lineage feast houses which existed in the physical sense in the summer village. The groups sharing a winter territory were called by some feature of the winter ground, not by their summer feast house name (Mills n.d.), and any dwellings there were not called by the name of the feast house. (The Wet'suwet'en language distinguishes winter houses from feast houses or ordinary smoke houses. The feast house is a physical manifestation of the corporate lineage, where the other two are not).

The Chief manages the resources of the territory on behalf of the members of the house. Property cannot be bought or sold, but a group can cede a crest or "mountain" (hunting ground or expanse of territory) as compensation for wrong doing such as a murder of a member of another group (see Table II-3), and one instance of a trade of property is indicated by Jenness (see Table II-3) . In the past, young women or men of the lineage could also be given in compensation. Mills (n.d.) interprets this practice as a sort of living "peace bond" arrangement.

Chiefs organised the harvest of the various resources, such as beavers, mountain goats or berries, such that they were not depleted. Deliberate conservation is especially evident for beaver. Harvesting of resources required permission from the chief. The members of the House had the right to harvest the resources with his permission. Chiefs also organized the hunt together, moving through one another's territories in a set sequence (personal communication of Johnny David, Alfred Mitchell and Alfred Joseph to Richard Daly).

The variation in richness of territories as well as temporal variation in quality of resources was dealt with by the recognition of affinal rights and rights through the father's side. This meant that a given family could utilise a number of different areas. This gives the system flexibility in terms of the groupings of people actually engaged in resource harvesting, and in the intensity of exploitation of different areas. This is also a feature of Gitksan territory use (Gottesfeld and Anderson 1988).

There is some flexibility in terms of who is responsible to manage or harvest the resources of a territory. If there is no appropriate male heir (e.g. chief's sister's son), for example, the son of the former chief may continue to look after the territory on a caretaker basis. After his death, the territory should revert to control of the rightful chief (Mills n.d.:53).

As I have argued above, the feast and territory system is not recent among the Wet'suwet'en or Carriers. Harmon describes various examples of feasts, including a shame feast, at Stuart Lake in 1811, six years after first direct contact (1957:253-4). Mills (n.d.) argues that the institution of the feasthall could not have been established so fast if it were a response to alterations of economic factors by introduction of trade on the coast. She argues that the feast system is related to indigenous trade between coast and interior which predates European fur trading. It is probable that trade in resources like oolachans and grease, seaweed, saskatoon wood for arrows, soapberries, hemlock 'cambium' and mountain goat furs and caribou hides is ancient. Certainly these resources were not in demand by the Euroamerican and Eurocanadian traders, who sought mink, marten, fox and beaver fur from the Interior. The long distance aboriginal trade in obsidian from the Mt. Edziza area and Anaheim Peak I also find compelling evidence of early and vigorous pre-contact trade (Ives 1987; MacDonald and Cove 1987).

A different argument for the antiquity of the feast/territory system is that the use of furs like marmot fur or caribou hides in the feast system, and the use of beaver and berries for food at potlatches suggests that all of the resources of the land were used to demonstrate ownership of territory, repay debts and build prestige. The gifts at the potlatch are not items which were introduced by traders; and the furs used in the potlatch to validate ownership of territory were not the furs sought by the white fur traders. This suggests that the feast system and the territory system are fundamentally different from the "trapline" in the Eurocanadian sense, and that they antedate it. Trapping for the Europeans simply involved a change in preferred species (and so perhaps of emphasis in exploitation of territories) and the conversion of these furs into trade goods including staple supplies, hunting and trapping equipment, and new prestige items for the feasthall.

The presence of detailed and diverse patterns of migration, with stories and traditional "calendars", suggests long continuation of traditional movements of groups of people between discrete winter hunting areas and summer fishing sites. Patterned traditional movements over long periods of time most logically correlate with persistent groups utilising discrete areas or territories.

Shifts in territory and migration have occurred from the earliest oral histories, and continued into the protohistoric period without the perturbing influence of Eurocanadian presence. One such shift, which occurred about 1820 (Jenness 1943), brought the Wet'suwet'en to Hagwilget in the Bulkley Canyon in response to a large rockslide which blocked fish migration to their traditional fishing place at Moricetown Canyon. The Gitksan ceded them rights to one side of the canyon, where they built the village of Tse-Kya (Hagwilget), and incidentally came into close proximity with the neighbouring Gitksan village of Gitanmaax a few kilometres downstream.

Jenness (1943), Steward (1960), Kobrinsky (1977) and others are, of course, correct in attributing important population shifts and changes in the nature of the feast and territory systems to the intrusion of white men in Northwest British Columbia, as elsewhere in Canada (e.g. Leacock 1969, Brightman 1987 etc.). The instabilities caused by European presence led to population shifts such as the elimination of the Tsetsaut by the Gitksan and Niska'a and apparently the historic period migration of Gitksan to Bear Lake.

The Tlingit did monopolize European trade on the Stikine River (Emmons 1911) and Tsimshian traders did prevent direct contact of traders with Gitksan and Wet'suwet'en for a while. This certainly stimulated trade activity between Coast and Interior in the proto-historic and early historic periods, as such trade was the only way Interior peoples could access metal tools, blankets, guns and other desired goods. MacDonald attributes the late rise of fortresses by Tsimshian and Gitksan, associated with important trade routes and controlling them, as perhaps being associated with early

European trade (MacDonald 1987).

Kobrinsky (1977) states that the Carrier territories apply only to furbearers, while game harvesting for food is unrestricted within band territory. This situation is similar to those described by Nelson for the Kutchin (Nelson 1986: 157). He argues that therefore territoriality is a recent measure aimed at protecting fur harvesting rights; in effect that the territories really are traplines, while the real native system for game (but not fishing rights) is general access. The range of territory patterns discussed for the northern Northwest Coast by Richardson makes such an argument tenuous; access to all resources may not be controlled in all areas. The Tlingit territory pattern, for example, encompasses complete division of the land and water into owned territory, but some resources are treated as commons and are open to exploitation by anyone who wishes to harvest them (Richardson 1982). The Haida designate some areas as commons open to resource gathering by any Haida, while areas including patchy, scarce or more highly valued resources are held as private property with exclusive rights of access (Richardson 1982). The argument given by Kobrinsky (1977) that in Stuart Lake territories were mostly pertinent to furbearers, and therefore homologous to the trapping territories which developed across the Canadian North in response to fur trade may therefore by spurious[2]. A characteristic of the North Coast adaptation is that specific resources, ranging from mountain goats to fern root or berry patches, may be owned, but other resources on the land base may be open to exploitation by others, at least of one's own group (Richardson 1982). The fact that the Stuart Lake people hunt where they want while respecting ownership of furbearers may not represent such an exception to the coastal territory pattern as Kobrinsky (1977) suggests, given these various provisions for certain types of common exploitation, or certain zones in which common exploitation could occur.

Among the Wet'suwet'en commons may extend primarily along recognized travel corridors, where a sort of "free zone" existed for those who had to pass through another group's territory to reach their own. Travellers along trails were, according to Alfred Joseph (Chief Gisday wa) allowed to hunt for immediate subsistence in the vicinity of the trail, but were not permitted to leave the trail area or harvest other resources. His territory is in the Gitumden area south of Houston and is traversed by a major trail connecting the headwaters of the Bulkley River system with the headwaters of the Fraser River system (Fig. II-2). Possibly some areas adjacent to village sites were also used as common resource areas. Richard Daly (personal communication) states that some berry patches adjacent to Gitksan villages were used in common with the understanding that they were actually the property of a particular chief; this was acknowledged in the practice of giving a gift to the chief in return for use of the berry patch. A common marmot hunting area was also reported to have existed in the Babines (Alfred Joseph to Richard Daly, personal communication). Some common village resources are also reported for the Tsimshian and Niska'a (Richardson 1982).

Role of territoriality in conservation

Conservation of animal resources is suggested as a feature of territoriality (e.g. Feit 1973, Speck 1915; McCay and Acheson 1987, Berkes 1989:73, Gadgil and Berkes 1991:5, see also Chapter 3). This may also be a benefit of territorial management of patchy plant resources. Territoriality, which allows control of access to harvestable resources, gives incentive to engage in management activities like controlled burning, which is necessary for maintenance of productive huckleberry and blueberry patches (Chapter 4). Expending effort for management activities does not pay off if someone else can harvest the enhanced resources.

Territoriality and ownership would promote conservation of root foods, which can easily be depleted by overharvesting, by retaining the knowledge of when each patch was harvested and how long it will take to regrow an optimum biomass for harvesting again. There is evidence that women elders did control the harvest of various plant foods, temporally and spatially. Harvesting at appropriate intervals and densities of harvesting may enhance the value of the resource, where overharvest depletes or eliminates it. This coordination is easier to achieve when the ownership and management of the resource is clearly allocated. Turner and Kuhnlein (1982) report development of incipient cultivation of coastal root crops in the central British Columbia coast. Productive root patches were owned resources of individual chiefs.

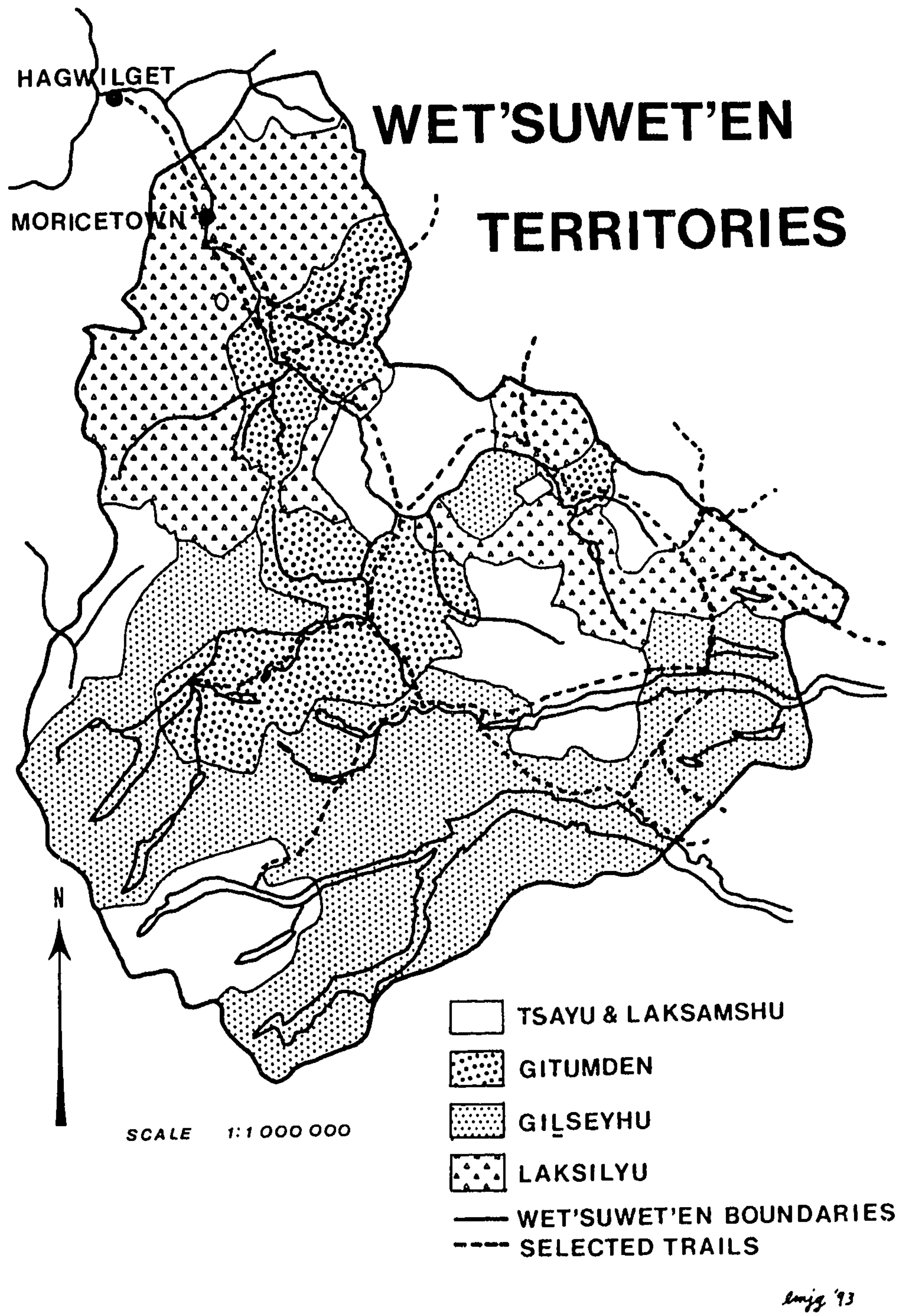

Figure II-2 (after Gitksan-Wet'suwet'en Traditional Territories Map prepared by Gitksan-Wet'suwet'en Tribal Council)

Conclusions

A review of the literature suggests that matrilineality and feasting with crests in some form may be a basic Athapaskan culture complex (Hosley 1977, 1980; De Laguna 1975; Krech 1980; Slobodin 1980). For the Wet'suwet'en, therefore, some of the aspects of their modern feast/crest/clan/house system appear to derive from Athapaskan roots. Other aspects bespeak long inter[illegible] with the Gitksan and other coastal peoples like the Haisla, especia[illegible]lope and Kemano people. Territoriality itself seems a logi[illegible]wth of characteristics of the landscape and of its resour[illegible] [illegible] 1968, Richardson 1982). The economic defensibility model app[illegible] by Richardson suggests that territorial defence of resources will occur when the resources occur with high density and predictability. Richardson further explores resource distribution and concludes that the resources most likely to be subject to access limitations [=territoriality] are those that are geographically restricted to limited areas or patches (including exploitable areas like fishing places) and temporally restricted in harvesting opportunities. The Wet'suwet'en landscape is mountainous with a diversity of habitats, and key resources are either spatially or temporally patchy, but include resources of relatively high density and predictability *within the patches.* The presence of territoriality is therefore not surprising, given Richardson's discussion. Territoriality involves utilization of resources, rights of control and management of resources, and historical factors, including relationships with neighbouring groups and with Eurocanadians. The particular forms of both Wet'suwet'en feast/crest system, and the nature of their annual round and territory system is their own unique adaptation, and reflects both the land and their history.

TABLE II-2
List of the Clans and Houses of the Wet'suwet'en
from Victor Jim, except for Twisted House
1988

There are 13 houses each with its House Chief:

Tsayu (Beaver Clan)
  Wiilat Yex 'the House of Wiilat'
  C'keen Yex 'Beaver House'
Laksamshu, (Owl Clan) (They amalgamated with the Beaver in the days of smallpox)
  Mesdzii Yex Owl House
  Saa Yex Sun or Moon House
  Twisted House
Gitúmden (Wolf/Bear Clan)
  Cass yex, Grizzly House
  Anskaski (now joined with **Cass Yex**)
  Kai Yex Weniits, House in the Middle of Many
Gilseyhu (Big Frog Clan)
  Yex T'sa Wit'ant Thin House
  Yex T'sa Wil k'us Dark House
  K'ay Yex Birch House
Laksilyu (Small Frog Clan)
  G'en egh la Yex, House of Many Eyes
  Tsee kal k'e Yex House on a Flat Rock
  Kwen Beegh Yex House Beside the Fire

TABLE II-3*

List of the Territories Associated with Wet'suwet'en Houses
From Jenness 1943

Gitumden Clan

Grizzly House

1. An area about 20 miles long by 25 miles wide around Tiyee Lake near Telkwa known as chwchwt
2. A strip about 3 miles square at Lamprey Lake, between François and Morice Lakes. (Given to Grizzly House in compensation for a murder by Gil̲seyu)
3. An area of unspecified extent around a creek north of Moricetown known as xał tatsali kwa, "the river in which people place their packs of meat to protect them from flies."
4. Two small lakes for trapping beaver in the Babine Mountains north of Barrett Station, known as uwitak.

House in the Middle of Many and Anskaski Clan

1. A tract about 20 miles long by 15 miles wide along the middle reaches of the Morice River known as tsamik'aitchan "the bottom of the mountain on which the 'stone berries' [*Sedum divergens*] grow."
2. An area of undetermined extent around Trout Lake, between Owen Lake and the wagon road running to François Lake. Formerly there existed on Trout Lake a large potlatch house surmounted by the figure of a raven, the principal crest of conjoint clans. The area was known as t'a.k'as'lenli "Where the water flows into t'a.k'as lake"
3. The territory around a creek that flows into Owen Lake, known as tazgli kwa, "tasgli river".
4. A tract around Rose and Old Woman's Lakes, just west of Burns Lake, known as djakaz, "middle place".

Gil̲seyhu Clan

Dark House

1. An area about 60 miles long by thirty miles wide around Tagetochlain (Poplar) Lake, between Morice and François Lakes, known as tagitsoxlen, "the place where the hunter watches for caribou to swim across."
2. An area about 25 miles long by 15 miles wide between the foot of Morice Lake, Morice River, and two creeks that join this river from the southwest and northwest. It belonged originally to the Tsayu or Beaver Phratry [Clan], but was exchanged for a fishing station at Moricetown. It was known as talbitskwa.

Thin House
(Chief Guxwlet's territories)
1. The area from Hagwilget canyon to Moricetown, about 35 miles long by 28 miles broad known as dizkle, "dead trees all pointing in one direction in the water." [*this is the original chief's name and territory of the Wet'suwet'en, and the first chief name according to the kungax, see Mills 1987 p. 66]
2. A tract about 25 miles square around Owen Lake and Nadina Mountain known as pitwinni.
3. A tract about 8 miles square halfway between François Lake and Houston, known as tatak, "creek joining two lands".

(Chief Chaspit's territories)
1. A tract about 20 miles square around Atna Lake, near Morice Lake known as gilenpin diltan, "place around the head of the lake."
2. A tract about 50 miles square just south of Morice Lake known as neneka.
3. A tract about 35 miles long by 15 miles wide at the west end of Ootsa Lake known as taiłla, "swampy place where brush grown in the water."
4. A tract about 40 miles square on both sides of François Lake, known as t'se konakaz, "one-eyed woman," because there is a tiny lake in the middle of a wide plain."

Birchbark House
1. A tract about 30 mile long by 25 miles wide around the west end of Ootsa Lake, known as netanli, "waterfall"

Laksilyu Clan

House of Many Eyes
1. An area about 20 miles square around Topley, known as alk'at, "beaver dam on top."
2. An area about 10 miles square at the head of the Telkwa River, known as tse'tseniłla, "much cottonwood coming down the river."

House of Top of a Flat Rock
1. An area about 15 miles long by 20 wide on each side of the Bulkley River around Moricetown, known as ta'perte, "trail beside the water"

House Beside the Fire
1. A tract on the Zymoetz River below McDonnell Lake, known as kasklai k'watlat, "many grizzly at its end."
2. The Bulkley Valley from Barret Station to about Telkwa and Tyee Lake, known as chost'let.
3. The lower part of Buck Creek and the country around Houston.

Recently this has been given to the House of Many Eyes in the same clan.

Laksamshu Clan

Sun or Moon House, and Twisted House

1. A tract about 15 miles long by 10 miles wide at the head of a creek flowing from the southeast into the Zymoetz River, together with the mountain at its head. It was known as uiyeni, "far across."
2. A tract around a small lake and mountain at the head of Reiseter Creek that flows into the Bulkley River west of Smithers. It was known as guskibewinni, "lake containing suckers."
3. A tract about 8 miles long and 2 or 3 miles wide along the Morice River known as nełsilyet, "source of nełtsi or Bulkley River."

Owl House

1. A tract about 10 miles long and 5 miles wide at the head of the Suskwa River, wedged between territories belonging to the Gil seyu clan. It was known as alkane.te, "trail crossing a beaver dam".
2. A tract about 40 miles long by 20 miles wide around the end of François Lake known as nestikyet, "source of Nesti Creek."
3. A tract around two small creeks flowing from the south into Tahtsa Lake.

Tsayu Clan

Beaver House

1. An area around Telkwa River and Mooseskin Johnny Lake, known as taltse-wiyez.
2. A small area around Day Lake, near Forestdale, known as ndettsane.
3. An area around the head of Buck Creek known as nełtsisklat.
4. An area around Decker Lake, known as ndettlat.

Note: I have called the "Phratries" of Jenness "Clans",, and his "clans" simply Houses in keeping with modern Wet'suwet'en practice. I have retained Jenness's orthography except for Gilseyhu and Gitumden, which are written the way Victor Jim, former Vice-President of the Gitksan-Wet'suwet'en Tribal Council, spelled these words. There are some discrepancies between the generalized map produced by the tribal council and the summary of individual territories listed here. These may reflect errors on the part of Jenness, who did not accompany his informants to their hunting territories, but relied on verbal descriptions of their locations, they may reflect changes in ownership over the past fifty to sixty years, or they may reflect generalization in the drafting of this preliminary map for public use.

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[1] I am here using the terms "potlatch" and "feast" interchangeably, as do modern Wet'suwet'en. A "feast" is not simply a large ceremonial shared meal, but involves the validation by the assembled guests of the clan business conducted, and their payment with food and gifts for being witnesses.

[2] Although modern Carrier traplines are associated with patrilineal control, Harmon (1957) alludes to territories with mountains and rivers for boundaries in the early 1800's. What relationship the modern traplines may have to these ancient territories, and what relationship these territories had to matrilineally controlled fishing sites is difficult to specify at this point in time.

Conservation and Traditional Beliefs: An Analysis of Gitksan and Wet'suwet'en Subsistence[1]

Chapter 3

Introduction

In order for a human population to have a long term sustainable adaptive strategy in an environment, it is conceptually necessary to have mechanisms which stabilize the levels of exploitation of resources and the human population at levels below the carrying capacity of the environment. Two conditions are implicit in the concept of carrying capacity: levels of exploitation or harvest of resources must not exceed the rate of replacement, regeneration or productivity of the populations of resource species; and disruption of essential ecosystem parameters, such as loss of soil, disruptions of nutrient cycling, or alteration of disturbance regime not exceed the buffering capacity of the system. This leads logically to the hypothesis that ideologies of conservation, or practices which effect conservation of the environment, must be incorporated into human cultures which have long-term sustainable adaptations to their environment[2].

In the past it was common to assume that hunting and gathering peoples had insufficient population or insufficient technological ability to alter the balance of their environment and so had no need of conservation (see Berkes 1977 for a discussion of this) or that they were so "in tune with Mother Nature" as to "instinctively do the right thing" and conserve the plant and animal species and the environment on which they depended (Nelson 1973, Anderson n.d.). Upon reflection it is apparent that human technology is sufficient to eliminate key plant and animal species with unrestricted exploitation even in hunter-gatherer societies, and few today would argue for the "innate closeness with nature" as the driving force behind the sustainable adaptations of numerous traditional cultures.

However, few studies elucidating what factors serve to maintain the balance of resource harvest with the productive potential of resource species have been made. Three such studies deal with the conservation ethics and ideology of North American Subarctic Indian groups: the Waswanipi Cree of Quebec (Feit, 1973), the Chisasibi Cree of James Bay (Berkes, 1977, 1987) and the Koyukon of west central Alaska (Nelson, 1982). Recent papers by

Hames (1987), Stock (1987), Carrier (1987), and Brightman (1987) also review the relationship of groups in the Amazon, Papua New Guinea, and boreal Canada with their environment to explore whether these several traditional small scale societies did or do have practices and ideologies which effect conservation of resource species.

In this paper I will review aspects of the culture, resource exploitation and beliefs of the Gitksan and Wet'suwet'en peoples of Northwestern British Columbia to examine the relationship of their cultural practices and beliefs to resource conservation.

The Gitksan are a Tsimshian speaking people living in the middle and upper portions of the Skeena River drainage in Northwestern British Columbia. They are an inland group with a classic "Northwest Coast" type of adaptation. Their environment is riverine and montane, rather than coastal and marine, and the vegetation of their territory spans the transition from the coastal edge of the Interior Cedar-Hemlock biogeoclimatic zone (Haeussler *et al.* 1985), with montane Coastal Western Hemlock on the mountain slopes, to Sub-Boreal Spruce (Pojar *et al.* 1984) in the northern and eastern parts of their range.

The neighbouring Wet'suwet'en are Athapaskan speakers, and are intermediate in their subsistence adaptations between the Northwest Coast and more typical Subarctic Athapaskans; their social organization is closely similar to that of their Gitksan neighbours, with whom they feast and intermarry. The territories of the Wet'suwet'en contain a fringe on the west and northwest which encompasses Interior Cedar Hemlock, Coastal Western Hemlock and Mountain Hemlock biogeoclimatic zones, but the bulk of their lands lie within the Sub-Boreal Spruce zone.

The major traditional subsistence activities of both groups include fishing for anadromous salmon, chiefly sockeye *Onchorynchus nerka*, chinook *O. tshawytscha* and steelhead (sea-run rainbow trout) *Salmo gairdneri* ; hunting large game such as black bear, deer, mountain goats, woodland caribou (now locally extremely rare), and moose (since the 1920's); trapping small game, especially snowshoe hares, marmots and beavers; fishing for lake fish such as whitefish or lake char (particularly for the Wet'suwet'en); and berry picking, root[3] and shoot collection, and tree 'cambium"[4] harvesting.

In this environment, resources tend to be patchy, and for a number of key resources, the opportunities for exploitation may be limited both spatially and temporally. Exploitation of seasonal resources may be quite intensive when they are available, with a view to harvesting enough of these key resources to ensure winter survival. A considerable elaboration of ideology about conducting oneself on the land and the proper way to harvest resources exists, particularly with regard to salmon and large game species.

The most fundamental concepts include: a holistic world view with people as a part of the environment, rather than distinct from it; the ideology of respect for living things, particularly animal species and fish; and the concept of reciprocity. As with the cosmologies of other native North American peoples, the world and the forces within it are conceptualized as sentient, with spirit beings or essences which can be offended or can extend help to humans (e.g. Nelson 1982, 1983, Tanner 1979, Feit 1973, Young *et al.* 1989). In practice, these concepts translate into a series of attitudes and practices which shape the nature of subsistence activities and of the relationships of people to the land.

Avoidance of waste is the fundamental corollary of respect for the land and the animals and plants which allow the survival of people through the gifts of their substance. The cosmology of both the Gitksan and Wet'suwet'en contains a strong theme of reincarnation, and respect for the dead. Proper treatment of the remains of animals and people allows or facilitates reincarnation. This concept forms an important foundation to the practices of respect toward animals and fish procured for food. The proper demonstration of respect for the remains of animals and fish, and the appropriate disposal of any parts which will not be consumed, is paramount to ensure their survival through reincarnation, and the subsequent success of the hunter or fisher is obtaining the species for future needs. This theme, too, is common to the Koyukon (Nelson 1982, 1983), and to diverse Cree groups (Feit 1973; Tanner 1979; Berkes 1987; Brightman 1987).

In the following section, I will detail a number of examples of the beliefs and practices of the Gitksan and Wet'suwet'en with regard to the land and the plants and animals which they utilize from my own research.

Gitksan and Wet'suwet'en Beliefs and Practices

A fundamental constraint on resource use among the Gitksan and Wet'suwet'en is the division of the land into owned territories or sites. The land is divided up into a number of territories, usually coincident with a watershed, with the boundaries running along the drainage divide and encompassing the full range of altitudinal zones from valley bottom to the alpine. These territories belong to corporate groups called houses (Gitksan ***wilp*** or Wet'suwet'en ***yikh***) and are administered by a chief on behalf of the members of the house. Flexibility of allocating people to resources through the territory system is accomplished by recognition of affinal rights to the territory of the House of one's spouse and rights to the "father's side". If one's own territory is depleted or insufficient in a particular resource, these kin rights are invoked to share in harvest of richer territories.

The chief, at least ideally, controls access to and harvesting of the resources of the territory, including mountain goats, berries, beavers, fur-bearers, and fishing sites. In addition, some fishing sites, especially along the major rivers like the Skeena, Kispiox or Bulkley, and berry patches may be owned by a group different from the group which owns the surrounding territory. Berry patches quite near to village sites also may be used in common by the residents of the village, although in theory they are in fact owned by a particular house, and gifts to the chief were formerly exchanged in token of this fact (Richard Daly personal communication 1991).

The ownership of the resources, and the long term vested interest in the resources of a territory, give incentive to manage harvest of species in a way to conserve the resources (McCay and Acheson 1987, Berkes 1989:73, Gadgil and Berkes 1991:(5)). This pattern of resource exploitation is made possible by two primary ecological factors: the (relatively) dispersed, stable nature of the animal species populations (c.f. Winterhalder 1981, Heffley 1981); and the telescoping of a variety of distinct habitat types by the mountainous nature of the landscape, similar to the Ainu territories described by Watanabe (1968).

The implications of territorial division of the landscape for conservation will be discussed below under the different resources. The case of fishing for anadromous fish is a distinct case and will be discussed below under fishing.

The concept of "respect" is a general theme pervading the Gitksan and Wet'suwet'en relationship to the land and its resources. In the introduction I have discussed the concept that respect involves avoidance of waste and the proper treatment of the remains of dead animals and fish. Specific details about what is proper treatment of remains will be discussed below under fishing and hunting.

Another theme which pervades traditional Gitksan and Wet'suwet'en beliefs is that of the generative power of women and the extraordinary nature of menstruation and menstrual blood. Women who are menstruating, and especially young women just experiencing the transition from girlhood to womanhood, are seen as having extraordinary power in consequence of their condition. Menstrual blood is not "clean". Contamination with menstrual blood will destroy a man's hunting, trapping or fishing luck. This extends to customs such as the prohibition of young teenaged girls touching any of their male relative's hunting, fishing or trapping gear, or the belief that the equipment will be contaminated and require ritual cleansing if a menstruating woman or teenager steps over it. In traditional puberty observances, girls were prohibited from eating any fresh meat, fish or berries for a whole year after menarche. This was explained by the belief that the spirits of the fish, animals or berry plants would be offended by this and then refuse to give themselves to the people. In Native belief, the spirit of the animal lingers in the flesh for a time after death. This is documented for the Koyukon (Nelson 1983) and is implicit in certain statements of the Gitksan such as the taboo against eating fresh bear meat. Consumption of fresh food could offend spirits which were still felt to be present; dried foods no longer contained any spirit essence.

The power contained in a pubertal girl was thought to be so strong that if she looked up at a mountain, it would "dry up" (become barren and unproductive for game and berries). Therefore, she was prohibited from looking up at mountains for the puberty year. Traditionally she wore a hood to protect the land from her gaze; in more recent times girls were made to wear a kerchief tied like a visor which restricted visibility. These taboos and dietary restrictions are explained in terms of respect, and form an important part of the body of traditional practices designed to ensure the continued productivity of the land and continuity of food supplies.

Berries

Berries were the most important plant foods in terms of amounts collected and consumed, and in terms of cultural value. Wild berries are still collected and distribution of berries, along with newer introduced fruits like apples, still takes place at feasts. Berries are not subject to overharvest in the sense that animals or fish are, because only a portion of the plant is harvested. However, conservation of berries may require habitat manipulation, as their occurrence and productivity are affected by ecological succession and competition (Minore 1972). The territory system includes berry patches, and maintenance of berry patches was one of the responsibilities of chiefs (Mills n.d.; see Chapter 4).

> ...When it is the right time he [the Chief] burns the berry patches so the berries are fat and plump. If he didn't do that the berry patches 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, quoted by Antonia Mills n.d.:156).

The restriction of right to decide when a berry patch needs burning and who burned it by the territory system ensured some coordination and consistency of management of the berry patch resource. Differing perceptions of resource value and ecosystem functioning led the B.C. government to institute a policy of fire suppression, including berry patch burning by Indians (see Chapter 4.). Since the cessation of berry patch burning, traditional berry patches have become overgrown and are no longer productive. Now people utilize natural burns and logging slashes.

The burning of berry patches was intimately involved with the system of reciprocity between corporate house groups characteristic of Gitksan society (see discussion Chapter 4:). The 'Father's side' traditionally performed the burning and was compensated for their service. In practice, the men of the 'Father's side' would have access to the berry resources of the territory through the rights of their spouses and children, and would be familiar with the land being managed.

One traditional Wet'suwet'en elder expressed the belief that the berry patches are less productive now because young girls pick there and don't observe traditional taboos. She then went on to describe a practice whereby the pubertal girl was required to pull the leaves off the branches of the berry patch as a ritual to renew the patch. This practice is no longer followed, as puberty rites for girls are now much curtailed or not followed at all.

Root patches

The territory system probably had an effect on conservation of the root foods as well, although this is more speculative. The restriction of ownership and harvesting rights ensured that knowledgeable elder women would make the decision when a given fern rhizome or Chocolate lily bulb patch was ready to harvest. This would entail deciding among alternate patches available to a given group, requiring a knowledge of the intrinsic productivity of various patches and the time since last harvest. The necessity to monitor fern patches arises because rhizomes harvested by the Gitksan and Wet'suwet'en require several years at minimum to regrow sufficient biomass to be harvestable. Too frequent harvesting of specific productive patches could easily deplete the patches, leaving only inedible undersized rhizomes.

I postulate that periodic harvest of the root patches may actually enhance the growth of the fern rhizomes and chocolate lily bulbs. Harvesting of patches will increase productivity by thinning the plants and reducing competition between them, as only the larger plants will be harvested. Harvest would also remove larger older plants whose growth may be slowing down, increasing the average growth rate of the patch, would serve to aerate the soil, and might reduce competition. This kind of effect of harvesting has been demonstrated for patches of basketry materials in the Sacramento Valley of California (Margaret Mathewson personal communication).

The distinction between a harvestable resource and a non-resource is linguistically encoded for the fern rhizomes by the Gitksan: only *Dryopteris expansa* (K.B. Presl) Fraser-Jenkins & Jermy rhizomes of sufficient size for eating are called by the name for edible fern root (***ax***). Plants with small rhizomes are called by the generalized name for non-edible fern rhizome (***dumtx***), which includes individuals of *Athyrium filix-femina* (L.) Roth and *Dryopteris filix-mas* (L.) Schott. as well as undersized *D. expansa*. Although *Dryopteris expansa* is widespread in its occurrence in the Skeena drainage, only in specific habitat types does it attain the density and growth rate necessary to become a harvestable resource. Thus the identification, location and conservation of fern rhizome patches would have been culturally important, given the importance of fern rhizomes as good carbohydrate sources which could be stored for winter use. Fern rhizome also served as a famine food. A group which maintained harvestable patches within range of wintering sites would have access to a potential food source in case of late winter food shortage.

<u>Fish</u>

Salmon and steelhead are the most important single resource of the Gitksan and Wet'suwet'en people. Far more than the peoples of the Coast, who have other marine resources such as cod, halibut, and shellfish, the Gitksan and Wet'suwet'en depend on the salmon. The Gitksan refer to themselves as people of the salmon. Gitksan means 'Skeena River People'; the Skeena is the lifeblood of the country, bringing the salmon to sustain the people. The stores of dried salmon made possible their winter subsistence in permanent winter villages. For the Wet'suwet'en too, the salmon are the most important resource of their land, the focal point of their traditional summer gathering together and feast time.

The continuity and reliability of the salmon runs are therefore of paramount importance. The indigenous approaches to ensuring the security of the salmon runs involve first the principle of respect. For example, respect for the salmon requires that the fisherman club the salmon as soon as it is removed from the water to avoid its suffering in the air and dying a lingering death. The corollary of this respect is the admonition not to waste. The consequence of failure to respect the fish is the probability of failure of the salmon runs in the future. If affronted, the fish may return to the sea and refuse to give themselves to the people.

One of the most important religious observances of the traditional year was the first salmon feast. The first fish caught in the spring would be shared with the whole village. Everyone would partake of a small bit. Once a man showed disrespect to the first fish, complaining about his portion and the smallness of the fish. He cursed the fish. The remainder of the spring salmon run turned around and went back down the river, leaving the people in great privation (from Judith Fitzpatrick, told to children at Kitwanga Elementary School in the Gitksan language and culture programme, 1987).

In 1984 a Native Fisheries Technician Training Programme was organized in Hazelton to train Gitksan and Wet'suwet'en people in fisheries management techniques for co-management of the resource. The trainees went to the village of Kitwancool to talk with an elder about traditional Gitksan fishing. When questioned directly about traditional fish management and conservation practices, the elder stated that all fish remains must be returned to the water. That was all that was necessary to renew the fish. He added parenthetically that all animal remains must be burned.

The Gitksan people still retain these beliefs, sometimes resulting in poignant cross-cultural miscommunication. In the past decades, fish stocks in many drainages have declined due to the prevalence of heavy commercial fishing pressure off-shore coupled with problems of mixed stock fishery management. Fisheries Officers assess the fish "escapement" to spawning areas by doing "dead counts" of spawned out fish on sample river reaches. In order to avoid counting fish twice, they customarily pick up each carcass and throw it into the bankside vegetation. This constitutes a violation of the traditional respect for the remains of the salmon, and according to the traditional view, would make it impossible for those fish to reincarnate and return. (People also believe that the young fish fry upon emergence obtain their food from the rotted carcasses of their parents in a sort of analogy to the feeding of children by humans.) In the view of traditional Gitksan, the decline of Kitwancool River fish stocks is attributable to the improper behaviour of the fisheries officers, who actually caused the decline by their disrespect, and their depletion of the food supply of the young.

The Wet'suwet'en believe all unused fish parts must be burned. The following example illustrates the currency of this belief: a couple of years ago I was visiting a friend in his smokehouse in Moricetown. My friend was checking the fish in the smoke house and observed that some of the belly strips had been cut too thick, and so had spoiled. His elder cousin instructed that the spoiled belly strips were to be thrown into the fire of the smoke house, not thrown down on the ground for the dogs or just trampled underfoot. In a legend of the related Carrier people recounted by Jenness (1934: 111) the logic for this behaviour is explained:

> One day he ate a salmon and burned all the bones except a rib. When he returned to the old woman she asked him, "What have you done? One of the boys has a pain in his side." "I buried a rib," they boy answered; and she commanded, "Dig it up and burn it." he dug it out and burned it; at once the [salmon] boy was healed.
> (That is why Indians never throw away any part of a salmon, but burn in the fire whatever they or their dogs fail to eat. It is like other fish. When it is killed the Indian may eat its body, but its soul or essence returns to the water and becomes a fish again.)

The same legend discussed above regarding proper disposal of fish remains teaches that all edible parts of the fish must be consumed. Any part of the fish that is consumed will be reincarnated. This leads logically to the prohibition of waste of any edible part of a fish. A Gitksan legend underscores this (Boas 1916:192-206; Halpern 198 ; John Cove 1987). In the legend, a young man eats a dried fish that his mother had been keeping hidden in a wooden storage box. The result is that the young man is honoured by the chief of the spring salmon, because it was his flesh which had been stored in the box. Until the flesh was eaten, the salmon chief could not reincarnate properly and lay in a lingering illness near to death. It is disrespectful to waste fish, and eating the fish, accepting the gift of its substance, shows respect.

The allocation of fishing sites and fishing rights has indirect effects on conservation. The first order effect is to allocate people to resources by organizing people to harvest fish at the places where fish can be harvested. In traditional times, as to a lesser extent at present, only certain places were efficient places to harvest salmon. These places became traditional fishing sites and were owned property belonging to certain chiefs.

The Gitksan utilize a number of productive fishing sites, which were traditionally fished with fish traps, sometimes basket traps in conjunction with weirs, sometimes large fish traps called ***wo'o***, and sometimes dipnets in special sites. Today most sites are fished with gilnets because of the intervention of the provincial and federal governments[6]. One effect of the dispersion of fishing sites is to increase the specificity of harvest by groups such that they harvest different fish runs.

The Wet'suwet'en also used the large fish traps, weirs, basket traps and dipnets, but their fishing effort was concentrated in one or two highly productive canyon sites where the smokehouses were built, and where the summer feasts took place. Today their fishery is largely conducted with long gaff poles and with dipnets.

The most important way that traditional beliefs effect conservation involves the fact that the processing of fish in the smokehouse for storage is considerably more time consuming than harvesting them. Processing time then becomes the bottleneck. The effect of this is to limit the catch at a site to how much fish can be processed by the women of the group per unit time, which is considerably less than the amount which can be harvested with fish traps or nets. Because salmon fishing is in the peak of summer, fish is perishable and must be processed promptly and watched constantly in the smoke house to prevent its spoiling and ensure winter food supply. Three adult women were required to work constantly to keep up with the catch of one large trap during peak times. When sufficient fish to process had been obtained, then the trap was taken out of the water and ceased fishing (Percy Sterritt, personal communication).

In modern times a limitation on net fishing is effected by the desire to avoid waste as well. Because traditional fish traps have been replaced by gill nets, unwanted species or sizes of fish can no longer be thrown back into the river alive. Pink salmon *Onchorynchus gorbuscha* are not utilized by either Gitksan or Wet'suwet'en. They are smaller than other salmon species and lower in fat and flavour, particularly bv the time they have been travelling inland for several hundred kilometres. The pink salmon run overlaps the later of the two main sockeye salmon runs. The result of this is to shorten the effective season for sockeye for the Gitksan, because late in the season too many pinks will be caught in each net set. It is tedious to pick the net when only a portion of the fish is desired; it is moreover distasteful to people to kill fish they will not use.

At Moricetown Falls, the Wet'suwet'en fish primarily by gaff, but also employ dipnets. In recent years they have been disturbed by increasing numbers of pink salmon pooling up below the falls. (The presence of large numbers of pinks is due to Department of Fisheries and Oceans salmonid enhancement efforts). These pinks are inadvertently injured by gaffs, resulting in wasted effort and wounded fish, and are caught in dipnets. One response has been to detail several young men to deliberately catch the pinks in dipnets and manually transport them above the falls to release them.

One recent event in Moricetown demonstrates that the underlying values regarding respect for and waste of fish retain considerable force. A young man was fishing for pink salmon with a rod and reel in Moricetown Canyon in summer of 1984. He was reputedly drunk, and deliberately killing the unwanted fish. A very large fish, perhaps a spring salmon, got on his hook, and before he could react, pulled him off the ledge into the boiling waters of the canyon where he drowned. Another young Wet'suwet'en man commented that this happened because he was tormenting fish and treating them with disrespect. This is a modern instance of the kind of event narrated in many teaching stories about the consequences of failing to respect the fish.

Game:

A hunter should take the gift of an animal when it is offered. To refuse to take an animal is the rejection of its gift of itself. *If the gift were rejected, the animal might be offended and not offer itself to you in the future.* It was not a random event which placed the animal in the hunter's path. If the hunter does not need the meat himself, he should distribute it to others in the community. He will gain prestige and will receive return gifts later.

Among the Dunne-Za, hunters encounter their prey in dreams prior to their actual encounter during hunting (Ridington 1982). The concept of "following your dream" is prevalent among Gitksan, too (Percy Sterritt, personal communication; Richard Daly, personal communication). The successful hunter or trapper is given supernatural knowledge of the animals he will receive, and information necessary to obtain them (see Tanner 1979 for similar views of the Mistassini Cree).

If an animal can be used, it is proper to take it when given the opportunity. Among the Gitksan and Wet'suwet'en, as among other North American Native groups (Feit 1973; Brightman 1987) there is the concept that utilization and proper treatment of the animals is the appropriate way to ensure their continuation. There is the implicit understanding that the resources of the land are put there for the purpose of being used, that in the use and consumption *with proper respect* is the renewal of the resources.

The story of the bear who gave himself to the people is a teaching story prevalent among both the Gitksan and Wet'suwet'en. A brief synopsis of the story follows. It was winter and a family was starving. In some versions of the story they were subsisting on winter-harvested fern roots. The children were suffering from sores, or else the little boy had been inadvertently burned in the fire. When the parents were away, a man dressed in black came to the camp [really the bear]. He "does something to himself" [that is, sliced some fat off his hams] and gave it to the children, telling them how to use the fat for medicine. [It is used both for burn medication and for sores or excema.] Then he described the use of devil's club for purification and gaining hunting luck to the children, instructing them to tell their father. He left, leaving tracks in the snow. The father followed the tracks and killed the bear for food, who thus saved the family by giving himself to them. This story has several lessons: that animals have specific purposes, that they give themselves to people who need them, and that hunting luck will be increased by following the appropriate rituals, here taught by the animal himself.

If a hunter has completed all of the fasting, bathing with devil's club and spiritual preparation, and perhaps "doctoring" his gun, before hunting or trapping, he expects that he will be successful in his ventures. He has done what is necessary for the animals to give themselves to him. If he has conducted rituals and set out to hunt and does not take an animal when he could have, this can lead to severe misfortune as consequence of the "violation of contract".

There are some limitations on when and where animals are taken, and on which types are sought. The Wet'suwet'en do not hunt moose or bear when they are on green grass (e.g. in the spring). At this time the moose concentrate on south facing slopes with new grass where they would be easy to deplete. They wait to hunt these large mammals until the fall when the grass has dried, or in the winter, times when the animals are in good condition, or when the people have greater need of the food and preservation is easier.

Gitksan elders are aware that there are differences in taste of animals depending on where they have been feeding. They prefer to take moose in aspen forest or on willow flats, because the flavour will be better than moose which are browsing on young hemlock. Some hunters expressed a preference for specific types or ages of animals. One hunter stated that a three year old dry cow moose was the best animal to hunt.

The Wet'suwet'en and Gitksan both believe one must burn remains of animals to be respectful and help the animals reincarnate. Sometimes the Wet'suwet'en instead hung the bones up in trees where predators would not disturb them. A Wet'suwet'en elder suggested that sometimes these hanging bones could be boiled up or ground up for food in famine situations. As with fish, waste of wild meat is disrespectful and to be avoided. The Wet'suwet'en utilised hides from all species harvested. Today hides may not be processed because of the enormous work involved in t[illegible] hide processing, but hunters still skin out the meat and pack it [illegible] way rather than quartering a moose with the hide on, a practice so[illegible] white hunters use.

As discussed above, there are taboos against consumption of fresh wild meat by girls in the year following menarche and by menstruating women. These beliefs are still practiced in a number of families today. Assorted sanctions are believed to follow violation of this taboo, including loss of hunting luck by the man [kills will be bloody inside, the animal will only be wounded and the hunter will get nothing but blood, the gun will not shoot straight] and painful menstruation for the woman. The man must purify his gun in a special ceremony to restore his luck. Interestingly, commercial meat from domestic animals is exempt from this taboo, because they are not involved in the ideology of the human relationship with the landscape and the deriving of sustenance. In modern times traditional hunters may hesitate to share fresh meat with others because they cannot be sure that the meat will not be eaten by teenaged girls or menstruating women.

Several species were of particular importance in traditional times. For the Wet'suwet'en beaver are is some sense symbolic of the territory. At the present time people still trap beaver in their traditional territories and prepare smoked beaver meat for distribution at potlatches. The provision of beaver meat given to others is a demonstration of and validation of rights to the territory. Wet'suwet'en people explained to me that they take only large beavers; they always leave some young to carry on.

Before the entry of moose into the Skeena Valley in the 1920's, bears were the most abundant large mammal. Bears, deer, mountain goats and woodland caribou were the principal large game species. In Gitksan, the most common word for bear, ***sim smex***, means "real or true meat". But bears are both powerful and human-like. A recognition of this by the Gitksan was the traditional prohibition on consumption of fresh bear meat. Fresh bear meat was believed to give one taboo ideas, to inspire people to commit prohibited sex acts. Bear meat therefore had to be processed in the smokehouse before consumption. Interestingly, in view of its historical importance, many contemporary people no longer eat bear.

The Wet'suwet'en practiced den hunting of bears. In strong contrast with the restrictions on bear hunting and consumption among the Koyukon (Nelson 1983), women both hunted and consumed bears.

Mountain goats were another important large mammal traditionally hunted for their meat and hides or wool. Mountain goats occupy restricted ranges and do not readily disperse across intervening lowlands to occupy new habitat. Mountain goat hunting areas were important resources of House territories, and goat hunting was formerly under strict control by the chiefs. Parties of men would make specific expeditions to alpine areas in late August for goat hunting. These trips might be combined with berrying expeditions by women, or used for activities like berry patch burning along with goat hunting.

Goats are easy to eliminate in the absence of conservation practices because of their low dispersal ability, and low reproductive rates. In the absence of human predation, goats have essentially no predators in their extremely precipitous habitat, and do not flee if surprised from above. One would anticipate, therefore, that mountain goats would be particularly appropriate for indigenous conservation practices. Traditional stories and oral histories tell of the disastrous consequences of failure to respect goats, of waste and overhunting (Cove and MacDonald 1987, Harris 1974, Robinson 1962, Jenness 1934). The gist of the story of the mountain goats of Temlaham is, in brief, that the people began to kill animals in a wanton manner, wasting them and slaughtering animals needlessly in large numbers, tormenting animals for sport. The result was that the goat people killed nearly the entire human male hunting population in revenge, leaving alive one survivor who remembered the laws regarding respect for animals so he could bear witness and teach the people of the future. The story is told to underscore the need for respecting the animals, and to avoid waste or unnecessary killing.

Discussion

The constellation of practices and beliefs about organizing subsistence activities on the land and the indigenous beliefs about what kinds of things promote healthy fish and game populations and berry patches contain a number of elements which acted to promote conservation, and other elements which, from our external perspective, do not appear to be intimately related to the productivity of resources or to their conservation.

The territory system and the prohibitions against waste militate against overharvesting. Other factors which could limit harvest are practices like the limitations on season of hunting moose and bear by the Wet'suwet'en. The generalised reciprocity which accompanies the obtaining of wild meat could act to promote conservation, reducing incentive to accumulate surplus, and reducing the demand for meat by other members of the group. Accumulation for potlatch could work to elevate harvests by stimulating overproduction (see Carrier 1987 for a Melanesian example). However, this kind of accumulation is only undertaken by a group when they have to give a major feast, such as a funeral or headstone feast, or a shame feast to atone for a killing, so there is not a continuous incentive to overproduce. Moreover, any food not eaten will be taken home to share or eat later and will not be wasted, so it will conserve the supplies of receiving groups.

From a perspective of biological ecology, it is difficult to see how the taboos on the eating of fresh meat by menstruating women or young teenaged girls effect conservation. They are strongly tied in with the ideology of respect for animals, but this aspect of it would not seem to have a biological rationale. Similarly, the requirement that girls in their puberty year not look up at mountains because they would "dry up" and be barren of game or berries is not easily explicable in terms of ecological concepts.

The ritual disposal of animal and fish parts is not immediately interpretable in a biological paradigm either, although critical in Native ideology. These practices again are part of the proscription on waste and requirement for respect due to entities which give themselves for human food. In the Native system, these gestures are required to enable the animals and fish to reincarnate to give themselves again for the sustenance of the people. Those who waste or fail to treat animals or fish with respect jeopardize their future hunting or fishing success, and in the instance of salmon, may jeopardize the subsistence base of the entire community by causing the failure of a whole run of salmon, upon which the people may be reliant for survival. From the perspective of population biology or nutrient cycling, however, these practices would not affect the status of fish or game populations[6].

Summary and Conclusions

It is logical that if an adaptation has been stable[7], then conservation must be occurring, given two factors: possession of technology adequate to over harvest a given resource (Berkes 19[illegible]), and reliance on animal and plant species whose life cycle occurs within the range occupied by the people so that fluctuations in the abundance of the species exploited can be correlated with the behaviour of members of the group (Nelson 1982). Where the traditional subsistence base involves migratory species with large geographic ranges, the local ideology may not encompass conservation, because the members of the local group cannot be familiar with the finiteness of the resource nor observe the effects of their own actions independently from the operation of other unknowable factors (Nelson 1982). This is implicit, though not stated directly in the discussion of Chipewyan foraging strategies in Heffley (1981). Similarly, if groups are not stable in their geographic range, and more than one group may traverse and use the resources of an area, conservation is not likely to occur, as Brightman (1987) discusses for boreal forest Algonquians in the late eighteenth and early nineteenth century. For stable groups occupying stable geographic ranges and reliant on non-migratory animals, conservation practices are likely to develop.

For the Gitksan and Wet'suwet'en, all of the important game species were non-migratory, making the development of conservation practices likely, although the salmon which are crucial to their subsistence strategy are migratory. Game species such as mountain goats, hoary and yellow bellied marmots, porcupine, beavers, and woodland caribou figure in teaching stories or are associated with territories.

Anadromous fish, although migratory, are not quite like migratory caribou or bison. That the Chipewyan did not have a prohibition against waste when caribou were abundant (Heffley 1981) underscores the difference in ideology between peoples harvesting caribou and salmon. The details of the life cycles of Pacific salmon species makes their occurrence both spatially and temporally highly predictable, in contrast to Barren Grounds caribou, although occasionally stochastic factors can lead to failure of the run or inability to fish the run. The occurrence of random variability in fish returns, coupled with people's heavy reliance on salmon species, may lead to the kind of ideological types of "conservation" practices reported here, notably the ideology of respect and the prohibition of waste with the understanding that the agency of humans is required for the continuation of the fish. Limitations on processing capacity, combined with ideology of no waste and the brief time periods that the salmon are available at any given site, makes overfishing of stocks highly unlikely under aboriginal conditions. (Under modern conditions, the impacts of global markets and offshore fisheries with the high processing and catching capacities of the commercial fleet means that salmon conservation practices of a different order are now needed to avoid collapse of the fishery.)

The function of territory in conservation for the Algonquin has been suggested by Speck (1915), although family hunting territories may represent a post-fur trade adaptation of the Algonquin(Leacock 1973, Brightman 1987). In Micronesia regulation of resources in specific territories by chiefs has been demonstrated to have various conservation functions (Alkire, n.d.). Through the use of permanent and temporary taboos on harvest of reef areas, requirements for permission for group net fishing, and rules of reciprocity, critical reef productivity was maintained and the subsistence base of the islanders remained viable. I have suggested that in Northwest British Columbia territory with chiefly regulation also served to conserve key resources, although the specific mechanisms of control were different. Various authors have suggested the importance of territory in limiting access to common-property resources and promoting conservation (Acheson 1987; McCay and Acheson, 1987; Berkes 1987, 1989; Hames 1987; Ostrom 1990). However, territory alone is not sufficient to ensure conservation, as Carrier points out for the Ponam Islanders of Papua New Guinea (1987).

For the Gitksan and Wet'suwet'en, as for other traditional peoples, the various beliefs about the relationship of humans to the land and to the resources which sustain the people are rich and multifaceted, integrated into all aspects of society. They do not have a reductionist perspective which allows separation of the biological from the moral or mythical. Adherence to a wide variety of practices which we might separate into "biological" and "spiritual" realms is seen as necessary for the maintenance of the relationship of the people and the land with its plants and animals which sustain human life.

Conservation is interactive with ideology. As Anderson (n.d.) points out, it is in the realm of ideology and myth, which entrain the emotions, that the motivation to defer present gratification for the future common good is obtained. Myths or teaching stories imbue lessons on conservation, which makes possible long term sustainable adaptation, with sufficient emotional loading to make them memorable and to inspire people to put the lessons contained in them into practice.

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[1] A version of this chapter has been submitted to the Journal of Human Ecology for publication.

[2] See Ostrom (1990), McCay and Acheson (1987), and Berkes (1989) for discussions of mechanisms of long term stability of communities and their resource bases. These authors emphasize that bounding the resource using community, multidimensional valuing of resources, and social controls over resource users are prominent features of communities with long-term sustainable adaptations. Such features serve to distinguish common-property resource systems from open-access systems which lead to overexploitation and depletion of resource bases.

[3] "Root" is here used in the colloquial sense of underground food parts. The important "root" foods of the Gitksan and Wet'suwet'en actually are rhizomes and bulbs. Rhizomes are underground stems from which true fibrous roots arise.

[4] 'Cambium' is the term in the ethnographic literature which has most commonly been used to designate the edible portion of inner bark widely collected in spring by native peoples of western North America. Anatomically the tissue harvested is probably secondary phloem. Some recent authors have used the term 'inner bark' for this food. This word is also not entirely satisfactory, as it may encompass more than the edible layer.

[5] In the summer of 1992, the Gitksan and Wet'suwet'en were attempting to reinstate the use of large fish traps in co-management of the Skeena/Bulkley River salmon fisheries with the Federal Department of Fisheries and Oceans.

[6] Phosphate input from salmon carcasses disposed of in water might enhance aquatic productivity and indeed, if rather indirectly, nourish the emerging fish fry, depending on the location of processing sites in relative to spawning beds (see Stock 1987 for a discussion of similar practices among the Cocamilla of the Amazon in *varzea* lake ecosystems). The effect of human fish wastes, however, is likely to be insignificant in comparison to the carcasses of the spawners on the spawning beds, particularly before interception of the bulk of the returning fish by the commercial ocean salmon fishery.

' The concept of "stability" has been used in a number of different and sometimes contradictory senses. See Chapter 1 and Foin and Davis (1987) for a discussion of the concept of "stability" in human ecological and ecological contexts.

Aboriginal Burning for Vegetation Management in Northwest British Columbia[1]

Chapter 4

Introduction

The Gitksan and Wet'suwet'en peoples live in the drainage of the Skeena River in Northwest British Columbia (Fig. VI-1). The Gitksan are a Northwest Coast people of Tsimshian language. The Wet'suwet'en of the Bulkley Valley are Athapaskan speakers who live in close proximity to the Gitksan and have had a long history of interaction and mutual borrowing. Their traditional way of life involved fishing for salmon along the major rivers, hunting and trapping, and gathering of berries, tree cambium, and wild root foods. The Wet'suwet'en village of Hagwilget is 7 km upstream from the Gitksan village of Gitanmaax (Fig. VI-2). They are culturally similar groups in many ways and occupy a similar environment.

The environment and vegetation of the Gitksan and Wet'suwet'en territories is transitional between the Northwest Coast and the boreal Interior. The landscape is mountainous except where major river valleys occur. It is densely forested with coniferous forests to timberline except in the valleys around Hazelton, where substantial areas of deciduous and mixed wood forests occur. The forests are in the Interior Cedar-Hemlock, Coastal Western Hemlock and Mountain Hemlock Biogeoclimatic Zones in the west and Sub-Boreal Spruce and Engleman Spruce-Subalpine Fir Biogeoclimatic Zones in the east (Ministry of Forests and Lands, Research Branch 1988).

The vegetation communities of the Skeena and Bulkley Valleys around Hazelton, an ancient centre of aboriginal population, show the influence of a relatively intense fire history. The vegetation of the Skeena and Bulkley Valleys around Hazelton has been distinguished as the "Hazelton variant" (ICHmc3) (Ministry of Forests and Lands, Research Branch 1988) of the Interior-Cedar Hemock Zone. It is characterised by high prevalence of seral[2] communities dominated by aspen and birch with scattered conifers, or by pine stands (Haeussler et al. 1985). This suggests the influence of the aboriginal populations on the vegetation of the region although certainly settlers, prospectors and railroad crews have contributed to the present

GITKSAN AND WET'SUWET'EN TRADITIONAL TERRITORIES

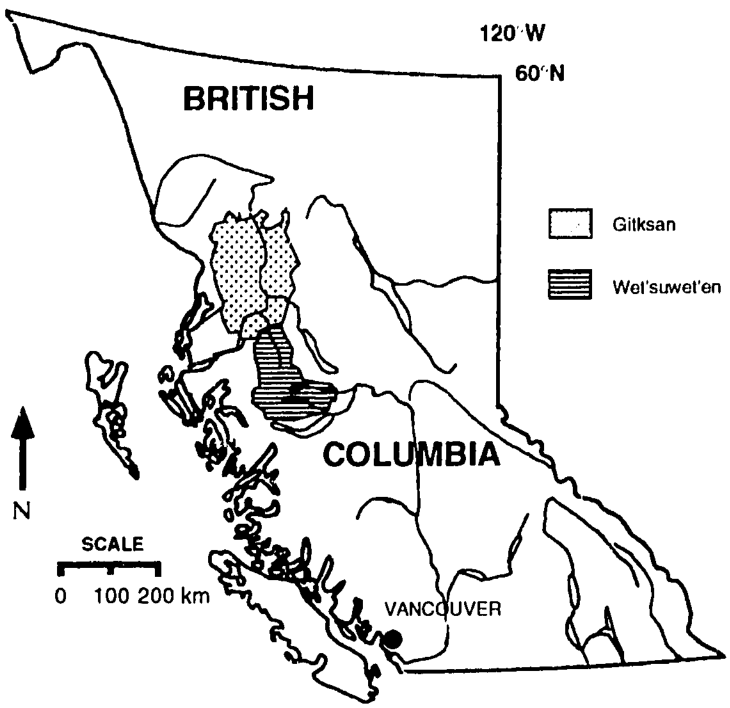
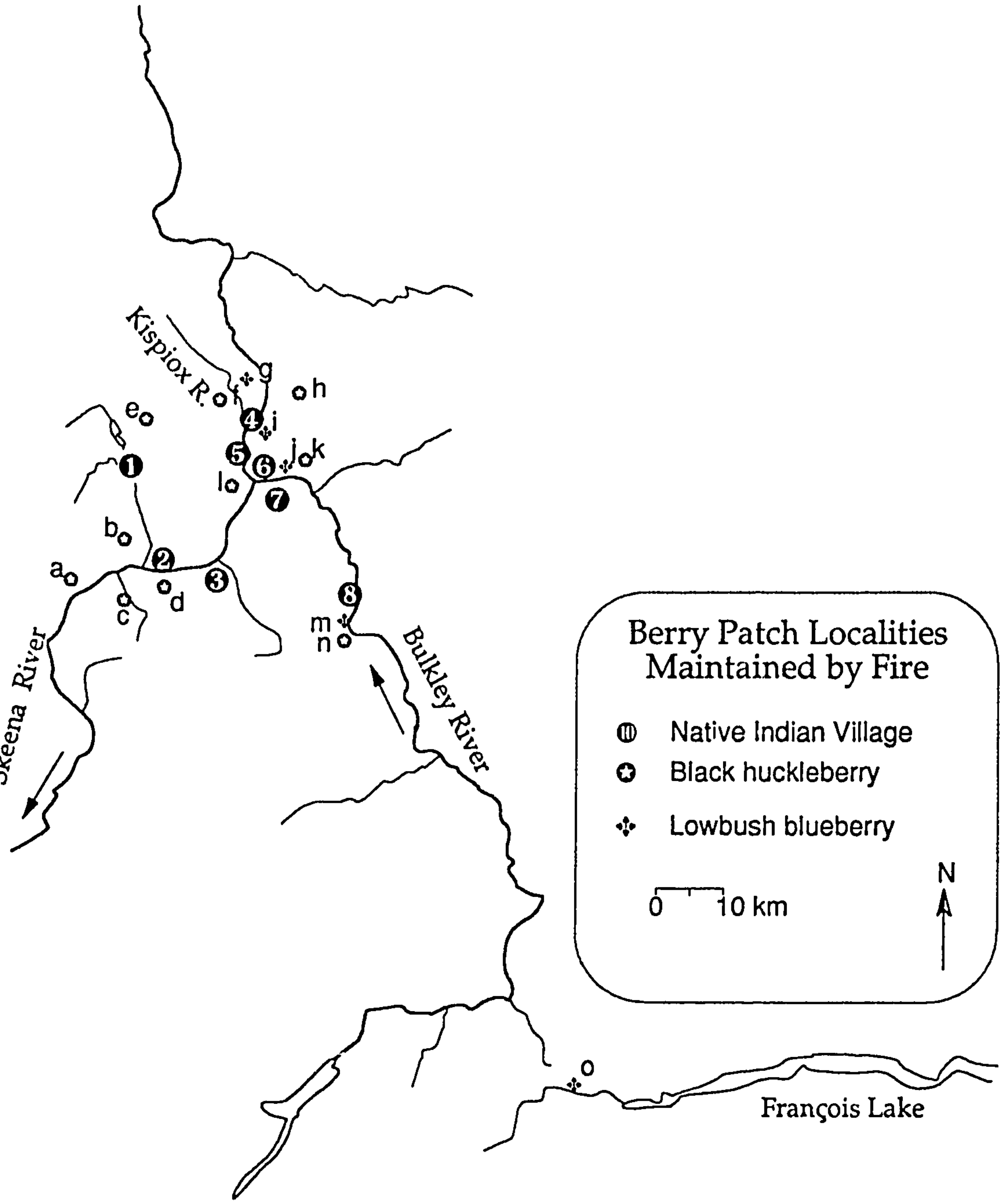


Figure IV-1 Index Map of Gitksan and Wet'suwet'en Territories.

Fig.IV- 2 Locations of berry patches identified by consultants as having been managed by burning. Gitksan Villages: 1 Kitwancool; 2 Gitwangak; 3 Kitsegukla; 4 Kispiox; 5 Glen Vowell; 6 Gitanmaax. Wet'suwet'en Villages: 7 Hagwilget; 8 Moricetown. Berry patches: a Wilson Creek; b Mountain by Gitwangak; c Price Creek; d Shandilla; e Moonlit Creek; f Mountain by Kispiox; g Valley by Kispiox; h Cariboo Mountain; i Flat between Salmon River and Pinenut Creeks; j Two Mile; k Nine Mile Mountain;l Mountain west of Hazelton; mValley by Moricetown; n Hills by Trout Creek; o Nadina Crossing.


Kispiox R.
Skeena River
Bulkley River
François Lake
Berry Patch Localities
Maintained by Fire
Native Indian Village
Black huckleberry
Lowbush blueberry
0 10 km
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prevalence of seral vegetation[3]. The importance of pre-European burn practices on the local vegetation is corroborated by descriptions of the vegetation of the Skeena in 1879 given by Dawson (1881). He describes a distribution of vegetation types quite similar to the modern vegetation. At the time of Dawson's visit significant Euro-Canadian influence on the vegetation probably was confined to the previous two decades.

The inference that aboriginal people modified the fire regime of the area is corroborated by anecdotal accounts of deliberate burning for berry production by Gitksan and Wet'suwet'en people. In addition, annual spring burning of sites around modern Indian villages continues to the present. The areas burned at present are largely Reserve land, and so, like private land, not subject to the policies and regulations of the B.C. Forest Service, which suppressed traditional burning practices in the 1930's and 1940's.

Principal berry species managed by burning were black huckleberry (*Vaccinium membranaceum* Dougl.) and low-bush blueberry (*V. caespitosum* Michx.). Soapberries (*Shepherdia canadensis* (L.) Nutt.) may also have been managed by burning, at least in some locations. The other main function of burning was clearing of areas around village sites. The clearing of floodplain sites for garden patches by burning is a relatively recent phenomenon.

Methods

To investigate the role of fire in traditional land management, I interviewed 14 Gitksan elders and other knowledgeable people and 4 Wet'suwet'en elders with an interest in traditional practices regarding burning practices. These interviews were conducted in English.

In addition, I monitored and mapped spring burning for the 1991 season in Kitwancool, Gitwangak, and Gitanmaax (Gitksan villages); and Hagwilget and Moricetown (Wet'suwet'en villages). I mapped freshly burned areas during weekly visits to the reserves from March 15-May 7 using large scale airphotos as a base.

I looked at archival sources to corroborate the existence of aboriginal burning and to define the historic occurrence of fires and nature of the regional vegetation as a background to the ethnographic investigation.

Results

Gitksan and Wet'suwet'en consultants are aware that the Gitksan and Wet'suwet'en formerly used prescribed burning for vegetation management. The most important form of vegetation management by burning was the renewal of berry patches. Berries of many species were the most significant plant foods utilised by the Gitksan and Wet'suwet'en. In traditional times, the collecting of large stores of berries was a late summer activity which involved the congregation of groups of people at productive berry patches, a sustained harvesting effort, and processing of the berries into large dried berry cakes which were then transported back to village sites for winter provisioning. In the annual round of the Gitksan and Wet'suwet'en peoples, obtaining enough berries to dry and preserve for the long winters was of paramount importance. Given the low caloric value and small size of individual fresh berries, the location and maintenance of large and productive berry patches with predictable harvests was necessary, so that enough fruit could be collected and processed to be worth the travel time, and time and effort of picking and drying the fruit. Burning was the mechanism to enhance or maintain berry patch quality.

The principal species used for berry cake production were black huckleberry (with supplemental high bush blueberry, *Vaccinium ovalifolium* Smith, not preferred because of its lower sugar content), low bush blueberry, and soapberry. Saskatoons, *Amelanchier alnifolia* Nutt., were also processed for berry cakes (People of 'Ksan 1980). Blueberries and huckleberries could also be preserved for winter in grease. The only species listed above not mentioned as being managed by burning is the saskatoon.

Berry patch burning occurred throughout the territories of the Gitksan and Wet'suwet'en. I have accounts of specific berry patches managed by burning near most of the modern Gitksan and Wet'suwet'en villages (Fig. VI-2; Table VI-1). In addition, low elevation areas are reported to have been burned for berries adjacent to Kispiox, Gitanmaax, and Hagwilget, and near Kitsegukla and Moricetown.

Among the Gitksan and Wet'suwet'en, ownership of resources is primarily through the House group (***Wilp*** or ***Yikh***), or its matrilineal kinship extension, termed the ***wilnaa'dahl*** in Gitksan. These corporate institutions own and manage resources such as fishing sites, berry patches, and hunting and trapping territories on behalf of their members. The Chief (***Simoogit*** or ***Dineza***) nominally owns and excersises control over the resources (Daly n.d.). Berry patches were owned and managed under this system, although by common consent the owners of significant berry patches near village sites frequently opened these to all villagers, who later acknowledged the ownership by making small public gifts to the chief of the owning group (R. Daly personal communication 1991). Among the duties of the Chief was deciding when and where to burn berry patches. Pat Namox (Wet'suwet'en Chief Gaslebah) described the duties of a chief:

> ...When it is the right time he [the Chief] burns the berry patches so the berries are fat and plump. If he didn't do that the berry patches 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, quoted by Antonia Mills n.d.:156)

Montane Berry Patches

Black huckleberry does not occur widely in the valley bottoms, and huckleberry patches vary widely in their productivity. Gitksan consultants refer to traditional berry patches as occurring "half way up the mountain", that is, in the montane and lower subalpine forest zones dominated by conifers (principally western hemlock and subalpine fir) at about 3000-4000 feet in elevation. These berry patches were traditionally burned to maintain or enhance their extent and productivity. Special berry camps adjacent to productive patches were used year after year for harvesting and processing berries.

Traditional Gitksan huckleberry berry patch burning took place in the early fall. Burning was frequently done by groups of men who were engaged in mountain goat hunting in areas above the berry patches. (Berry harvests were and are conducted by women, while men assisted when not preoccupied by autumn hunting). In at least some instances, berry patch burning might be done by groups of women. A berry patch adjacent to the village of Kispiox at relatively low elevation is reported to have been burned off by a group of women in the 1920's. Traditionally burning was done by the 'Father's side' (***wilksi 'wiitxw*** in Gitksan) and the service was paid for with a feast (Kathleen Mathews interview). This is consistent with the ideology of balanced reciprocity between Houses which informs most Gitksan and Wet'suwet'en social relations (Richard Daly personal communication 1991). In practice, the 'Father's side' used and had access to the berry resources of the territory it would burn on behalf of spouses and children, and the men would likely be intimately familiar with the territory being managed, although not responsible for managing and regulating harvest from it.

Late August and September are mentioned by the Gitksan as the time when burning was done. At this time, nights are cool and fall frontal storm systems are likely to bring precipitation. Also in clear weather, night fog or frost usually follow clear warm weather. Thus hazard of intense uncontrolled burning is reduced. Consultants agree that in the old days they knew how to burn to avoid extensive wildfire and hot burns. This kind of a burn would severely curtail berry patch production by consumption of the organic surface layer of the soil and the destruction of huckleberry rhizomes. By contrast, a light burn stimulates vigorous sprouting and enhances berry patch production (cf. Minore 1972, 1975).

Wet'suwet'en consultants have not mentioned Fall burning, but apparently did manage black huckleberry patches on the ridges between Trout Creek and Moricetown. The time of year that these patches were burned was not mentioned, but my consultant added that those who decided the time for burning could tell when it would rain, and would set the fires prior to a rainfall to ensure that they did not spread excessively.

Consultants vary in their recollection of burn intervals and the length of time required after a burn for a berry patch to become productive again. Some people believe that berry patches were burned every four years to maintain productivity. Others suggest that four years after a burn the berry patch would be at peak productivity and that knowledgable elders (women) would monitor productivity and decide when the next burn was needed. Consultants are universal in commenting that berry patches have lost their productivity at the present time because of burn suppression by the Forest

Service. Both fewer and smaller fruits are now produced in overgrown berry patches.

Huckleberry patches lose their productivity when invaded by taller shrubs and conifers (Minore 1972) However they have extensive rhizome systems and sprout vigorously if the aboveground stems are removed (Minore 1975). A surface burn which does not consume the organic soil horizons will stimulate vigorous sprouting of black huckleberry and, within a couple of years, production of large and abundant berries on the new growth.

Low Elevation Berry Patches

The other principal berry species was lowbush blueberry. It occurs from valley bottom (ca 450') to timberline (ca 4500'). This species is now not significantly utilised, perhaps because many formerly productive localities are now private land or farms. It occurs generally on well drained droughty gravelly soils and is often found as an understory in open pine stands. In the vicinity of Hazelton, many areas in the valley bottom were formerly burned for lowbush blueberry production. (Fig. VI-2, Table VI-1). Most of these areas are either (non-Indian) private land or have undergone forest succession and no longer support a significant lowbush blueberry resource. Anecdotal reports state that the whole land looked blue with berries on the rolling upland between Gitanmaax and Hagwilget. This area was reported to have been maintained by frequent burning (Alfred Joseph interview). Today, productive lowbush blueberry localities are rarely encountered.

Lowbush blueberry patches were reported by one elder to have been burned about every four years. Burning for lowbush blueberry may have been done in the spring as well as fall by the Gitksan. Spring burning is possible for lowland sites; burning in such areas is done soon after the snow melts off and before the days lengthen and atmospheric humidity decreases. Often more shaded and moister sites are still snow covered, providing effective firebreaks.

Wet'suwet'en elders report spring berry patch burning on the valley flat or lower hills between Hagwilget and Two mile and adjacent to Moricetown (S. to Evelyn, around Trout Creek). This burning was probably primarily for lowbush blueberry. In addition, hills south of Moricetown may have been burned for black huckleberry. Burning for berries was formerly carried out near François Lake also (no specific locality described). No evidence of fall burning by Wet'suwet'en people has yet been obtained.

Soapberry is another low elevation species which is reported to have been managed by burning. Soapberries are nitrogen fixing shrubs which typically occur on excessively drained gravelly soils and frequently occur in seral pine stands. Soapberry plants are long lived shrubs; however, older stems grow very slowly and fruit sparsely if at all. Soapberries are highly valued as a feast food; they formed (and still form) an important trade item, as they do not occur on the Coast but are utilised in feasts there. Soapberries are relatively laborious to pick; variation in plant productivity is therefore significant. If large volumes of soapberries are desired, a large area of highly productive plants is needed. Both burning and pruning are reported as practices which enhance soapberry productivity by promoting growth of new branches.

Suppression of Berry Patch Burning

Interviews suggest that the last berry patch burns occurred in the early thirties to early forties. Consultants mention that the "Forestry" has forced the discontinuing of berry patch burning, and that 'you would get arrested if you tried to burn a berry patch now'. I was told of an instance of a fire crew being mustered to put out a set berry patch fire in 1931 on the mountain just west of Gitwangak. The deliberate suppression of aboriginal burning is documented by the discussion of fire suppression efforts in the Annual Reports of the Prince Rupert Forest District from the 1930's:

> Indian-caused fires have decreased during the past two years. As early as possible in the Spring all Indian settlements were visited and our policy explained in plain words. Notices were written out and posted at Indian trading posts which seemed to get results. Three fires were started in what we call Siawash [sic] country. Two of these were extinguished by the Indians before we arrived. The other one was being fought by Indians and settlers when our patrol arrived on the scene. ...It appeared to be of incendiary origin. (Anonymous 1932: 3)

A massive public education and propaganda campaign to reduce forest fires included indoctrination sessions for Indians as they returned from the coastal canneries on the importance of care with their camp fires and special presentations at pow-wows (Anonymous 1935,1936, 1940, 1942). Anyone suspected of deliberately setting fires was subject to criminal prosecution, and several convictions were obtained. The Forest Service offered reward for information on incendiary fires to increase the effectiveness of the law (Anonymous 1933,1935). In addition, removal of any economic incentive to start fires was attempted by deliberately circulating rumours in Indian communities that the government lacked money to pay or feed fire fighting crews, although the government continued to pay non-Indian fire fighters:

> The Indians are very hard up ...but our propaganda suggesting that no men will be put on fire payrolls appears to have put a stop to the usual large number of fires in Siawash country. (Anonymous 1933: 3)
>
> The Indians in the back country were told that the Government had no money and could not fight fires. Fortunately we had a favourable season and were able to stick with this to a large extent (Anonymous 1934: 4).
>
> Recently visible signs of restiveness has been apparent among the Red men, presumably due to the gradual infiltration of knowledge that the White men are not only paid for fighting fire, but receive their board in addition. (Anonymous 1939: 4)

Grass and Brush Burning

Burning in the springtime around village sites, on southfacing slopes and on floodplain sites to control brush and encourage growth of grass continues to the present day. I have observed modern spring burning in the Kitwanga River valley near Kitwancool and adjacent to all of the Gitksan and Wet'suwet'en villages. Discussions with consultants suggests that this is not a recently introduced practice, although production of forage for domestic animals and clearing of floodplain garden sites are clearly associated with post-contact activities. Consultants maintain that they "always" did that. Clearing village sites for defensive purposes and reducing summer fire hazard may have been pre-contact reasons for village site burning. It is possible that forage for game species may have been a motivation as well. Management of Chocolate lily patches may have been an antecedant of the modern practice of floodplain garden site burning.

Euro-Canadian settlers also burned brush and fields (Sheila Ryan, personal communication April 1991; Prince Rupert Forest Regional Annual Reports, 1930, 1932,...). Some non-Indians still burn brush, fields or roadsides, as well as windrows from modern land clearing.

Modern Indian burning is largely on Reserve lands, both because villages and many garden areas are reserves, and because Reserve lands are not subject to Provincial Forest Service regulation as they are under Federal jurisdiction. Many sites around villages are subject to annual burning. Some areas are burned at longer intervals. Decisions as to which areas will be burned and when are largely individual decisions and reflect land ownership of different parcels on reserves. The vegetation burned is usually either grass or scrub dominated by aspen, hazel, red osier, rose, and willow. Some areas with young lodgepole pine are also burned. The effects of burning are to encourage grass growth, in particular earlier green-up, and to kill or damage above ground parts of shrub species or young conifers. All of the deciduous shrub species resprout after fire and are not eliminated by being burned. However, succession to forest with a dense shrub understory is retarded by repeated burning.

Floodplain sites in cottonwood forest may also be burned (depending on the location of the house sites, smoke houses or gardens). Fig. VI-3 shows paired photos of burned and unburned sites in cottonwood forest. Burning in cottonwood forest thins the canopy by scarring or killing some trees (though mature cottonwoods have thick bark and are fairly fire resistant), eliminates cottonwood reproduction, and suppresses shrub species such as black twinberry, red osier, rose, willow and hazel.

A relatively recent phenomenon was the clearing of floodplain sites for garden patches by burning. This was reported to me by an elder from Kitwancool, and confirms my casual observations of garden site burning in the Kitwanga River Valley south of Kitwancool. This last practice is obviously a post-contact phenomenon, but may have its antecedants in management of floodplain meadows for Chocolate Lily, *Fritillaria camschatcensis*, bulb production. This plant occurs today in grassy and herb dominated openings on the floodplains of rivers such as the Kitwanga,

Fig. VI-3 Upper photo shows unburned cottonwood floodplain forest at Gitwangak Village, April 16, 1991. Lower photo shows burned cottonwood floodplain forest across highway from first site, burned April 12, 1991. This area was the location of a smokehouse (now burned down and replaced with a new one by the house) for many years and has undergone repeated burning. Note very sparse cottonwood cover and (burnt) grass understory with very sparse shrubs.

Figure IV-3 removed due to poor print quality.

upper Skeena and Kispiox Rivers. Practices which discourage brush and cottonwood invasion would encourage Chocolate Lily, which was formerly an important carbohydrate food. As this plant has not been actively gathered for approximately the past 60 years, it is difficult to gather specific information on harvesting and management practices.

The third type of site burned was steep south or west facing grassy or brushy slopes. A site adjacent to Gitwangak (Snake Hill, Fig. VI- 4), and a site above the Kitwancool garden/floodplain site fall into this category, as well as sites in the Bulkely Canyon adjacent to Hagwilget and along Moricetown Canyon.

No differences between Gitksan and Wet'suwet'en spring burning around village sites were observed, except for the absence of Wet'suwet'en sites in floodplain cottonwood. The lack of Wet'suwet'en cottonwood sites may be due to ecological differences in the village sites, as the two Wet'suwet'en villages are located above bedrock canyon fishing sites which lack extensive floodplain forest. I present maps of spring burning for Gitwangak and Gitanmaax, Gitksan villages, and Moricetown, a Wet'suwet'en village, all in the ICHmc3 (Hazelton variant) (Fig. VI-5).

The Wet'suwet'en practice spring burning around village sites. There is also evidence of frequent burning of meadows and slopes around other reserves no longer occupied, but still utilised for fishing and trapping.

Discussion

Burning by other Northwest Indian groups

Niska'a burning for berry production is reported by McNeary (n.d.:113), although he provides no detail of species managed. He suggests that burning took place in the spring. The Niska'a occupy territories in the drainage of the Nass River to the west of the Gitksan territories.

No information has been obtained on Tsimshian berry patch burning. It is likely that the "Canyon Tsimshian" of the Terrace area, whose territories meet the Gitksan territories between Terrace and Hazelton, did practice berry patch burning.

The Haisla, despite their wet coastal environment, apparently formerly burned to enhance berry production. "Berries were especially important,

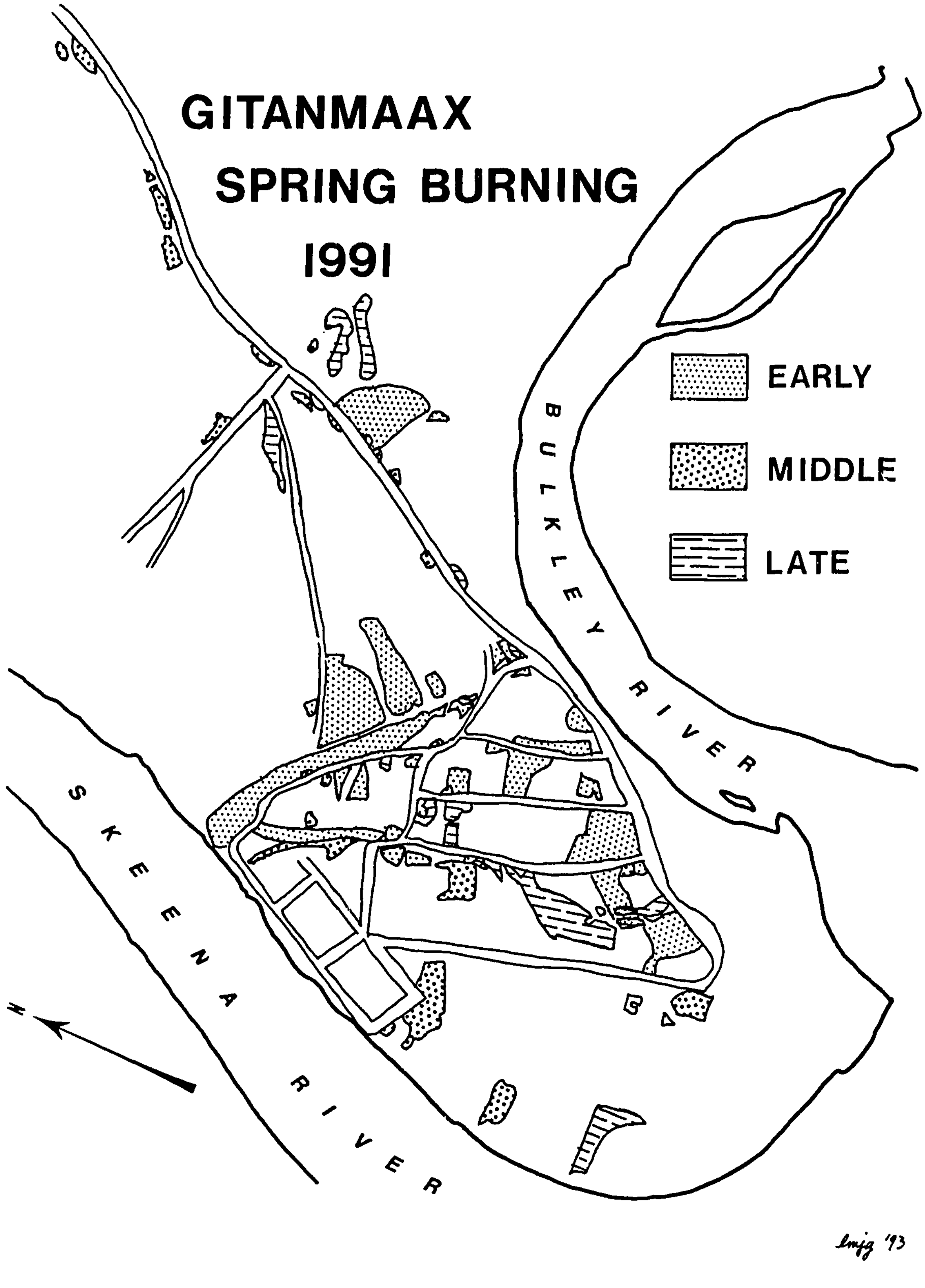
Figure IV-4 removed due to poor print quality.

Figure VI-4 Snake Hill burn, Gitwangak, March 21, 1991. This southfacing slope is subjected to annual spring burning.

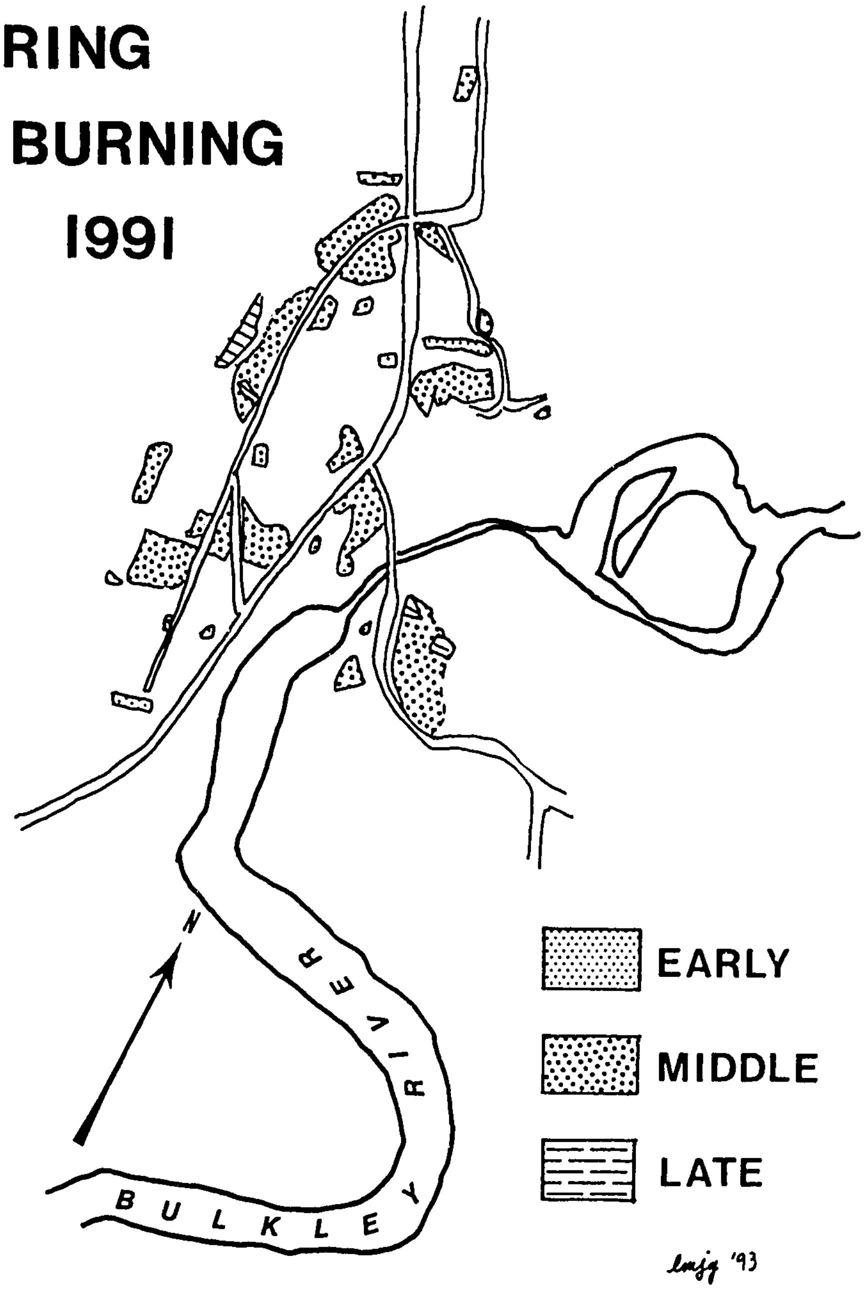
Figure VI-5 Spring burning, 1991 for Gitanmaax, a Gitksan village, and Moricetown, a Wet'suwet'en village. The sites are in the ICHmc3 (Hazelton variant). Early, mid season and late burned area is shown For Gitanmaax, early = 3/27 and 4/3; middle = 4/10, and late - 4/25. For Moricetown, which is a higher elevation and slightly later site, early = 4/3; middle = 4/10 and 4/16; late = 4/25.

a) Gitanmaax

b) Moricetown


GITANMAAX
SPRING BURNING
1991
EARLY
MIDDLE
LATE
BULKLEY RIVER
SKEENA RIVER
N
lmjg '93

MORICETOWN SPRING BURNING 1991



and the Haisla burned areas to encourage their growth" (Lopatin 1945: 14). No modern Haisla burning has been observed or reported. The principal berry species used by the Haisla are *Vaccinium alaskaense* Howell, *V. ovalifoliom* Smith, *V. parviflorum* Smith, and *Sambucus racemosa* L. These may produce abundantly under partial forest canopies such as those produced by windthrow or avalanche disturbance, and in natural openings bordering wetlands and along streams. They may also respond to fire.

The Carrier of the central interior of British Columbia practice spring burning of grass and marsh areas at the present time (personal observations and personal communication, A. S. Gottesfeld, 1992). Berry patch burning by the Carrier has not been reported or observed.

Comparison with burning practices in northwest North America from the literature

In other areas native peoples practiced landscape burning for encouragement of berry and root crops, and seed production. Turner reports burning for berry production by the 'Nlakapamux (Thompson), Lillooet, Okanagan-Colville, Kootenay, Nuxalk (Bella Coola), Kwakwakaw'akw (Southern Kwakiutl), Nuu-chah-nuulth, and Haida (Turner 1991). Suttles suggested that the Coast Salish burned to improve berry yields (1962). Norton *et al.* (1984) comment that berry patches were burned by Indians in Western Washington. Burning for improvement of berry yield is reported by Lewis for the Slavey Indians of Northern Alberta (1982). Burning for production of root crops such as avalanche lily corms (*Erythronium grandiflorum* Pursh.) and camas (*Camassia quamash* (Pursh.) Greene and *C. leichtlinii* (Baker) Wats.) was practiced by the Straits Salish, Lillooet and 'Nlakapamux (Turner 1991). The Indians of Western Washington apparently burned "prairies" on an annual basis to promote root and rhizome production (Norton 1979 a, 1979b, Norton *et al.* 1984). The Kalapooya Indians of the Willamette Valley burned the native grasslands for enhancement of the tarweed (*Madia* spp.) seed production, which was collected in quantity for human consumption (Boyd 1986), and the Wiyot Indians of Northern California burned "prairies" to enhance sunflower seed production (Lewis and Ferguson 1988).

Certainly the Gitksan and Wet'suwet'en used fire to manage berry patches and enhance production. It is not known if fire was used to enhance root crops. It was possibly a factor in burning valley bottom meadows, as these are the environment where Chocolate Lily occurs. The other significant root crop, the spiny wood fern, grows best in organic surface horizons and so would probably not be enhanced by burning. Burning around village sites would likely have increased hazelnut (*Corylus cornuta* Marsh) production, but no elders have mentioned burning as a factor in hazelnut abundance or production.

Landscape burning was carried out by aboriginal peoples for a variety of reasons other than enhancement of plant food gathering. Anderson (1991) reports that the Sierra Miwok of California burned areas with California redbud to produce sprouts suitable for basketry. Lewis (1982) and Lewis and Ferguson (1988) report that the Slavey Indians of Alberta burned for a number of reasons including reduction of fire hazard around living areas, improvement of forage for furbearers and game species, and for reducing brush to promote ease of cross country travel. Boyd (1986) reports use of fire by the Kalapooya as a hunting tool to encircle and drive deer. Various Indian groups of Northern California and southern Oregon are also reported to have burned for game management and maintenance of travel corridors (Lewis and Ferguson 1988).

Hazard reduction and enhancement of forage may have been reasons for Gitksan and Wet'suwet'en burning. In particular, it is recognized that spring burning encourages grass, which was valued in historic times for cattle and horse feed.

Changes in Gitksan and Wet'suwet'en use and collection of berry resources

Modern berry collection now focuses in highly productive patches in clearcut areas and in fortuitous natural burns which are accessible by truck. Elders comment that one such burn at "Meziadin" (300 km to the north along Highway 37 from Hazelton) which occurred in 1959 should be reburned. My observations confirm that much of this burn is heavily invaded by willow 4-5 m tall and young pine and spruce, and that the highly productive area for berry production is significantly reduced in area over the eleven years I have observed it.

The principal species still collected are black huckleberry, highbush blueberry and soapberry. Lowbush blueberry is no longer an important resource, probably because of changes in both land management and access. Many low elevation sites have been eliminated either by land clearing or gravel pit development, or by forest succession. Higher elevation sites are not accessible by logging roads and suppression of burning has allowed forest succession to proceed. Although these changes have occurred, some Gitksan and Wet'suwet'en families presently consider the regular burning of brush and grassland, especially berry patches, to be one of their hereditary, aboriginal rights and, as such, to be part of native land claims campaigns and negotiations.

Summary and Conclusions

Aboriginal landscape burning was important in Northwest British Columbia. It had two main purposes: enhancement of berry patches and reduction of brush around living and gardening areas. Burning was widespread.

Berry patch burning was suppressed by the B.C. Forest Service in the 1930's and early 1940's and has not been practiced since that time. This has resulted in forest succession and ecological changes in former berry patches. Ecological changes resulting from altered fire frequency are masked in many lower elevation areas by other changes in cultural practices such as land clearing for agriculture and industrial clearcut logging. Modern subsistence activities reflect these modifications, with lowbush blueberry no longer an important economic species, and black huckleberry collection conditioned by logging disturbance and/or road access. Wild berries now play a minor role in annual nutrition as families are integrated into the market economy of modern Canada, but they retain a high cultural value. They remain required items at many weddings, special family gatherings, and especially at funeral potlatch feasts and totem pole raising feasts.

Table VI-1

Localities of known managed montane berry patches

1. Cariboo Mountain
   (S. Howard)
2. Mtn. by Gitwangak and "Wilson Creek" (several different patches)
   (Andy Clifton; Art & Kathleen Matthews, Dora Johnson)
3. Mtn. west of Hazelton
   (Neil Sterritt Jr., Neil Sterritt Sr.)
4. Babine Trail (Nine Mile Mountain)
   (Percy Sterritt, Alfred Joseph, Elsie Tait)
5. Price Creek
   (Buddy Williams)
6. Mountain across from Kispiox
   (Percy Sterritt)
7. Shandilla area
   (Dora Johnson, Emsley Morgan, Ray Morgan)
8. Ridge up Moonlit Creek east of Kitwancool
   (Peter Martin)

(Designations are English names for the areas; the Gitksan names for these localities were not collected. The names of consultants mentioning each area are given in parentheses.)

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[1] A version of this paper has been submitted to Human Ecology.

[2] Seral communities are the changing plant communities which develop during ecological succession. They are not self perpetuating in the absence of disturbance, but will be succeeded by plant communities of different composition until a stable, self-perpetuating climax is formed. The entire sequence from bare ground and colonisation to the development of a stable climax is called a sere, and the different stages seral stages.

[3] Lightening caused ignition is rare in the area, particularly for the valley bottom locations where the "Hazelton variant" is prevalent.

Wet'suwet'en Ethnobotany: Traditional Plant Uses[1]

Chapter 5

Introduction and Setting

The Wet'suwet'en are an Athapaskan speaking people who occupy the drainage of the Bulkley/ Morice River and the western headwaters of the Fraser River system in the area of François Lake in Northwestern British Columbia, Canada (Fig. V-1). Their territory is transitional between the boreal interior and the Northwest Coast, as is their culture. Many features of their social organization and ecological adaptations are shared with the Gitksan, a Tsimshian speaking people, and the Haisla, a Northern Wakashan speaking group with whom they have long histories of interaction, while other features of their way of life are similar to more interior Athapaskan groups.

Little material on the ethnobotany of the Wet'suwet'en has been previously documented. Morice (1893) made pioneering studies of the Wet'suwet'en and Carrier in the late nineteenth century. He did not differentiate Wet'suwet'en plant uses or names from those of the Carrier or even the Chilcotin. An unpublished manuscript on Carrier ethnobotany was produced by Harlan Smith 1922-23. No serious ethnobiological work has been done with the Wet'suwet'en people until the present study.

The Wet'suwet'en live in the villages of Moricetown and Hagwilget, which are Indian Reserves, and in the surrounding communities of Northwest B.C. Many ties exist with the Babine of Fort Babine, who speak the same language with minor dialectical variation. The Wet'suwet'en were long classed as Carrier Indians, but recent studies have argued for their distinctness (Kari n.d., Kari and Hargus n.d.).

Vegetation of the Wet'suwet'en territory includes a fringe of more coastal forest types of the Interior Cedar Hemlock Zone (Haeussler *et al.* 1985) near Moricetown and Hagwilget and the Coastal Western Hemlock Zone at the western margin of their territory, while the bulk of their territory is in the Sub Boreal Spruce Zone (Pojar *et al.* 1984).

Until the past thirty to fifty years, the annual cycle of the Wet'suwet'en

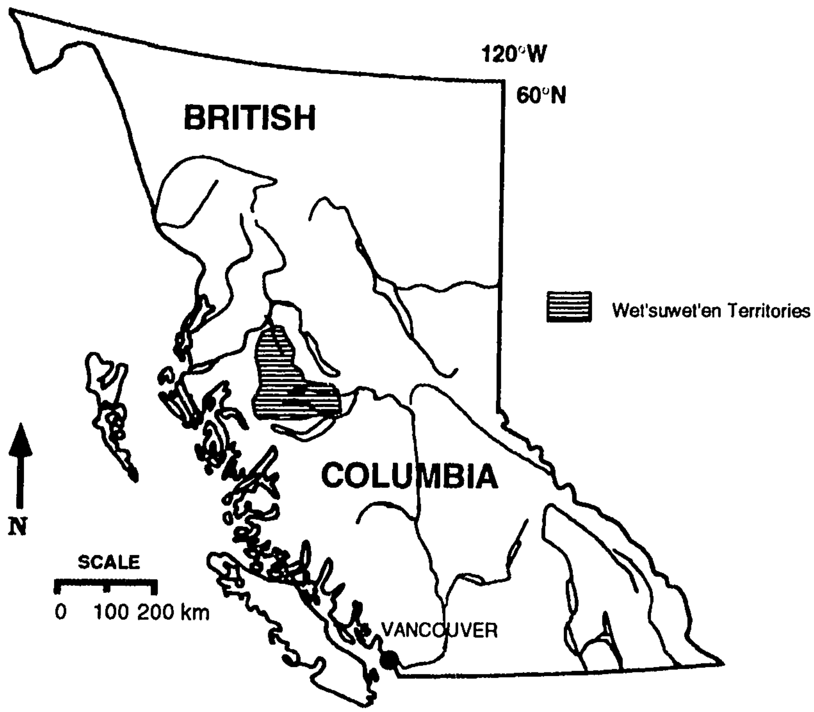

Figure V-1 Map of British Columbia showing Wet'suwet'en Territory involved congregation on the Bulkley River to fish for salmon in Moricetown or Hagwilget Canyons and dispersal to hunting and trapping territories in the winter (Daly n.d.). Groups from different winter hunting territories converged on the summer villages in time for the arrival of the salmon in early summer, arriving from widely scattered areas within a span of a few of days. Chinook (*Onchorynchus tshawytscha* (Walbaum)), sockeye (*O. nerka* (Walbaum)) and coho salmon (*O. kisutch* (Walbaum)) were fished with dip nets, weirs, and gaffs.

The summer was the feast time for the Wet'suwet'en, when an abundant and concentrated food resource brought all the people together. Important group events such as funeral feasts and succession to new titles took place during the summer feast season (Mills n.d.). The bodies of important people might be transported for long distances back to the village to be buried (in historic times) or cremated with proper rites. This contrasts with the pattern seen in Coastal peoples, who dispersed to fish in the summer and came together in winter villages for a feast season.

In the fall the people dispersed according to their clan affiliations to their widely separated hunting and trapping areas and families spent the winter hunting, ice fishing, and trapping. Trapping territories included areas in the Hazelton and Babine mountains, the Nechako Plateau, and the Tahtsa ranges of the Coast Mountains. In the spring, after beaver hunting and trapping, all the Wet'suwet'en would again congregate in the Bulkley Valley, bringing furs and smoked lake fish with them.

Because of their patterns of movement, different groups of Wet'suwet'en people had access to the resources of very different biotic zones at different time of the year. The salmon and the red cedar were shared by all in the summer fishing season in the canyons of the lower Bulkley. The resources of the ecological communities of the montane and alpine slopes of the Hazelton Mountains, with western hemlock (*Tsuga heterophylla*), amabilis fir (*Abies amabilis*), mountain hemlock (*T. mertensiana*), subalpine fir (*A. lasiocarpa*) and spruce (*Picea engelmanii x glauca*), interspersed with wet meadows and dry screes and avalanche tracks, were available to the groups with western hunting and trapping territories. The resources of the rugged Babine Mountains with spruce or lodgepole pine (*Pinus contorta*

Dougl.) forests, and dry alpine meadows were utilized by groups with trapping territories in the northeast part of the Wet'suwet'en lands. The Nechako plateau country, with rolling spruce and pine forests, aspen (*Populus tremuloides* Michx.) woodlands, grassy slopes and willow (*Salix* spp.) swamps, increasingly drier to the east, made the resources of other ecological communities available to Wet'suwet'en people with territories in the southerly portion of their lands.

Plants are used by the Wet'suwet'en people for medicine, for food, and for material culture. Medicines are derived from barks, roots, and foliage of a number of different species. Foods include green vegetables, fruits and berries, inner bark or 'cambium', and root foods. Technological materials include fibre plants, wood, and dyes and pigments. A summary of Wet'suwet'en plant uses is presented in Table V-1.

Methods

The information for this chapter was collected during 1987-1992 by interviewing 32 Wet'suwet'en elders and knowledgeable people[2] about the names and uses of plants. Consultants included both men and women. Most of the consultants are middle aged or elderly people of traditional upbringing who are fluent speakers of the Wet'suwet'en language. Interviews were conducted in Wet'suwet'en, with a translator, or in English. Where possible, plants in the field, fresh plant specimens or dried "case" specimens of known botanical identity (Bye 1986) were used for verification of the identification of the plants discussed. Colour photographs and line drawings were also employed for verification of plant identification.

All of the ethnobotanical information and Wet'suwet'en names reported here have been derived from interviews with living people. Not all of the plant uses reported are still being practiced by the Wet'suwet'en because of the extensive changes in subsistence and culture in the past sixty years, but all of the plant uses reported here have been observed or practised by the consultants in the recent past. Reported historical uses of plants not confirmed by living elders have not been discussed in this paper.

Voucher specimens of plants of important ethnobotanical species are on deposit in the ethnobotany collection of the herbarium at the Royal British Columbia Museum in Victoria, British Columbia, Canada (V), with some duplicate vouchers to be deposited at the University of Alberta Herbarium (ALTA).

Medicinal Plants

Many of the medicinal plants used by the Wet'suwet'en are used by other Indian peoples of northern British Columbia. Plants are generally employed as decoctions or infusions for internal or external use, mashed as poultices and wound dressings, or eaten. Many medicines are derived from the bark or inner bark of the plant (Gottesfeld 1992a). "Wood medicine" ***dicin yu***[3] is the term for medicinal decoctions made from barks or inner barks, often mixtures. The same concept is present among the neighboring Gitksan where it is called ***haldokum gan***[4] . Roots and rhizomes are often used as poultices for arthritis and rheumatism. Crushed leaves or chewed inner bark serve as dressings for sores and wounds. Plants are also employed as fumigants for warding off disease or cleansing taboo violations. Some plants are also believed to bring luck and may be employed as amulets. A discussion of the more important medicinal plants follows.

Devil's club, 'big thorn', ***whisco*** (*Oplopanax horridum* (Smith) Miq.), Araliaceae

The inner bark is used in medicinal mixtures with ingredients such as subalpine fir bark, spruce bark, or mountain-ash bark, or boiled alone (Fig. V-2). These decoctions are used to treat colds, flu, or tuberculosis, or as tonics and preventative medicines. Devil's club is reported to be good for heart disease. The inner bark is also used fresh, worn around the neck as an aromatic treatment for colds. The bark is burned on the stove top to treat people with colds or to ward off sickness in a house. Bathing in devil's club infusions is part of the ritual cleansing which men undergo before hunting or trapping.

Devil's club roots can also be dug up and used. They can be chewed for cough medicine. They are reported to be stronger than the stems.

Indian hellebore, ***konye*** (*Veratrum viride* Ait.), Liliaceae

This poisonous root finds its primary uses for ritual purification and bringing or restoring luck. It is intimately associated with rites to ensure or restore luck in hunting. Usually the dried rootstock is grated and the powder used for purification, but sometimes an infusion of pieces of the dried rootstock and other ingredients may be made and the liquid used for washing. It is also used as a fumigant. It apparently was used in the sweat bath in the past. A piece of the dried rootstock may also be carried as a luck charm. The root can also be used externally in the treatment of sore or inflamed joints. Indian hellebore was never taken internally by the Wet'suwet'en.

The Wet'suwet'en regard this plant as extremely powerful and dangerous and treat it with the utmost respect and care. When gathering ***konye***, it is proper to leave a gift in the hole from which it has been dug and cover the hole again with soil. Men should take roots from a 'female' plant which has dried flowers on top. Women should use roots from a 'male' plant which lacks dried flowers.

Red-osier, ***kak dilk'i'n***; ***wikak dk'i'n***; ***k'ëntsik*** (*Cornus stolonifera* Michx), Cornaceae

The bark or inner bark of this plant is used in medicinal mixtures for various purposes. It may be boiled with subalpine fir and spruce bark, with mountain-ash and black twinberry bark, and with devil's club. It is taken for coughs and respiratory ailments. A decoction of red-osier inner bark can be used to treat psoriasis by soaking the affected part in the solution. A decoction of red-osier inner bark is also used internally for treatment of postpartum hemorrhage.

Black twinberry, 'bearberry', ***sis mï' cin*** (*Lonicera involucrata* (Rich.) Banks), Caprifoliaceae

The inner bark of of black twinberry is highly valued as a wound dressing and for treatment of infection. It is particularly described as being an effective medicine for burns. An infusion of the inner bark or the raw fresh bark chewed is applied to the burn. An eye medicine can be made from the inner bark of black twinberry. It also forms one of the ingredients of medicinal mixtures of barks used for coughs and respiratory illness.

Mountain-ash, 'smelly or stink wood', ***dicin ilhtsin*** (*Sorbus scopulina* Greene), Rosaceae

It is also called ***honca ts'iy cin*** and ***cinic hikh***. The inner bark is scraped off the larger stems and dried, or used fresh. It can be infused alone and taken for bad colds, flu and general sickness, or it can be mixed with other ingredients such as devil's club, subalpine fir bark, and black twinberry bark and boiled together for a strong medicine effective against such diseases as whooping cough. Mountain-ash was used along with yellow pond lily root for treatment of tuberculosis in the recent past.

Subalpine fir, ***ts'otsin*** (*Abies lasiocarpa* (Hook.) Nutt.), Pinaceae

The bark and pitch of the subalpine fir are highly valued for medicine. The pitch may be taken alone internally for sickness or to aid in healing external wounds, or the bark may be mixed with other barks in medicinal decoctions (see devil's club, mountain-ash, and black twinberry).

Spruce, ***ts'o*** (*Picea engelmannii* x *glauca* and *P. mariana* (Mill.) Brittl, Sterns & Pogg.) Pinaceae

Spruce (*P. engelmanii* x *glauca*) bark is used similarly to subalpine fir bark, and both may be specified in recipes for medicinal decoctions. The young "tips" or terminal buds of young spruce trees are used to make medicine for colds. Black spruce (*Picea mariana*) foliage could also be used for medicine. The pitch of the black spruce was chewed to clean the teeth and as an oral antiseptic.

Juniper, juniper boughs, ***detsan / detsan'il*** (*Juniperus communis* L.), Cupressaceae

Juniper boughs and 'berries'[5] were used to make a medicinal decoction that was used as a tonic and for treatment of flu. A medicine could also be made from the juniper for treatment of venereal disease.

Lodgepole pine, ***cindu*** (*Pinus contorta* Dougl.), Pinaceae

The young "tips" of pine, or newly expanding terminal buds can be used to make medicine.

Yellow pond lily, ***khëlht'ats*** (*Nuphar polysepalum* Engelm.), Nymphaeaceae

(The leaves are called by the same name as plantain (*Plantago major*L.) leaves, ***dilkw'akh nelhdic*** 'frog blanket').

The medicinal uses of yellow pond lily rhizome, ***khëlht'atsghih***, are as a tonic, in medicinal mixtures which are taken internally in the treatment of tuberculosis, and as a poultice for rheumatic joints and fractures.

Cow parsnip, ***ggus*** (*Heracleum lanatum* Michx.), Apiaceae

The root of the cow parsnip, ***ggusghih***, is used as a poultice for rheumatism. A decoction of the root can be used for a cough medicine.

Soapberry, ***niwis*** (*Shepherdia canadensis* (L.) Nutt.), Elaeagnaceae

The berries are used for the treatment of stomach ulcers. They are good for arthritis also. A decoction of the inner bark of the branches was used for a laxative or sore stomach.

Prickly rose, rose plant, ***tselhghïl t'an*** (*Rosa acicularis* Lindl.), Rosaceae

The whole plant, roots and stems is boiled to make medicine. It is "good for everything".

Stinging nettle, ***holhts'ic*** (*Urtica dioica* L.), Urticaceae

The roots of the nettle are boiled for medicine. It is good for "anything". A decoction of nettle root with cow parsnip root, spruce bark and subalpine fir bark is taken internally for skin rash.

Broad-leaved plantain, 'frog blanket', ***delkw'akh nelhdic*** (*Plantago major* L.), Plantaginaceae

The leaves of the plantain are applied directly to sores that are not healing, or a decoction of the leaves can be used to treat sores or swellings.

Large-leaved avens, ***ilk'it bin*** (*Geum macrophyllum* Willd.), Rosaceae

The green leaves of the avens are boiled for treatment of wounds and rashes. The affected area is bathed with the liquid. It can be mixed with the black twinberry bark ,which has similar properties, or with the inner bark of red-osier dogwood. All three ingredients boiled together are reported to make a good medicine for washing open wounds. A decoction was also used as a hot soak to treat arthritic swelling.

Wild sarsparilla, ***scanistles*** (*Aralia nudicaulis* L.), Araliaceae

The rhizomes of wild sarsparilla were boiled in combination with a variety of other roots and barks for a tuberculosis remedy.

Snowberry, 'grouseberry', ***c'itsit mï'*** (*Symphoricarpos albus* (L.) Blake), Caprifoliaceae

A decoction of this plant is used for an eye medicine.

Pin cherry, ***smïts'ok*** (*Prunus pennsylvanica* L.), Rosaceae

A decoction of the bark is used for cough medicine.

Red elderberry, ***luts*** (*Sambucus racemosa* L.), Caprifoliaceae

This plant is used for medicine. Jenness (Smith 1928) reports the use of a decoction of the roots as a purgative.

Yarrow, ***bi'il yesonë*** (*Achillea millefolium* L.), Asteraceae

A decoction of this plant is used as a skin wash to treat itching.

Scouring rush, ***lawzi'*** (*Equisetum hyemale* L.), Equisetaceae

A decoction of scouring rush is used to aid in passing urine in cases of kidney dysfunction.

Cinder conk, black burl, ***tl'eyhtsë*** or ***dic'ah ci'ists'o'*** (*Inonotus obliquus* (Pers: Fr.) Pilat.), Hymenochetaceae

Slivers of this fungus were burned on the skin as a moxibustion treatment to relieve pain (Gottesfeld 1992b).

Traditionally diseases were treated by home herbalists or "Indian doctors", ***diyin*** , using plant or animal derived remedies. In addition, Indian doctors (shamans) used medicine songs and spiritual powers derived from supernatural beings as part of their healing power. Sixty-five years ago shamans, the Kalutl'em (***GGelulhem***) Society, and the more powerful and prestigious K'yan Society, were much involved in treatment of serious illness which was believed to be spiritually caused (Jenness 1943). Jenness states that the importance and numbers of such practitioners was decreasing at that time (in the mid 1920's) (Jenness 1943).

At the present time, home herbal or animal product remedies continue to be used, but the other forms of medicine have been largely displaced by modern physicians. Cases of illness which did not respond to other treatments, including treatment by M.D.'s, have been diagnosed as 'Indian Sickness' in the recent past and required initiation by the ***GGelulhem***. A number of people treated in this manner are still living.

Some of the plants used by the Wet'suwet'en are known to have active ingredients which may be involved in their efficacy. Recent studies have affirmed the empirical basis and potential efficacy of many ethnomedical herbal treatments even though the understandings of disease etiology and therapeutic treatments may not replicate biomedical approaches (Browner 1985, Browner *et al.* 1988, Etkin 1986). A comprehensive review of the biochemistry and pharmacology of Wet'suwet'en medicinal plants is beyond the scope of this thesis, but a few examples will be discussed below.

The bark of various species of pine is known to have antibacterial properties (Moskalenko 1986). This would suggest their effectiveness for purposes such as treatment of wounds, and perhaps in oral preparations for coughs and respiratory illnesses. The root and stem bark of elderberry is emetic (Kingsbury 1964). Research in progress on the constituents of devil's club extracts demonstrates several triterpenoids but the bioactivity of the isolated compounds has not yet been demonstrated (Feng, personal communication). Some clinical studies from the 1930's suggest hypoglycaemic properties for devil's club extracts (Brocklesby and Large 1938, Justice 1966). Juniper boughs and 'berries' contain a large number of compounds including flavonoids, benzenoids, lignans, alkenes, diterpene polyprenoids, malic acid, malonic acid, oxalic acid, phenyl pyruvic acid, aconitic acid, tartaric acid, vanillic acid and ascorbic acid which have been isolated by a number of different investigators (*e.g.* De Pascual *et al.* 1980; Lamer-Zarawaka 1977; Linder and Grill 1978). The 'berries' show antitumor and antiviral effects *in vivo* and *in vitro*, and have shown embryotoxic effects *in vivo* in rats (Agrawal *et al.* 1980; Belkin *et al.* 1952; May and Willuhn 1978 and others). The antiviral properties of juniper 'berries' would be beneficial in the treatment of respiratory illnesses. The ascorbic acid content might also have health benefits. Indian hellebore (*Veratrum viride*) is recognized by the Wet'suwet'en as potentially deadly. The plant contains a number of toxic alkaloids which can cause death through depression of central blood pressure (Edwards 1980; Jeger and Prelog 1960; Kingsbury 1964). The properties of external washes or of the smoke of burning dried Indian hellebore root remain unknown. Cow parsnip contains abundant furanocoumarins which damage to DNA in the presence of ultraviolet radiation, causing blistering (Camm *et al.*, 1976). Skin blistering could be involved in a counter-irritant treatment of swollen rheumatic joints.

Food Plants

Food plants traditionally used by the Wet'suwet'en included roots, green vegetables, tree 'cambiums'[6], numerous wild berries[7], and plants used for beverages (Table V-2). A number of different berries and small fruits formed quantitatively and nutritionally the most significant plant foods. Few other foods rich in carbohydrate are available in this region. Only two root vegetables were extensively used by the Wet'suwet'en, spiny woodfern rhizome, *Dryopteris expansa* (K.B Presl) Fraser-Jenkins & Jermy, (Turner *et. al.* 1992) and chocolate lily bulbs, *Fritillaria camschatcensis* (L.) Ker-Gawl. Inner bark or 'cambium' of pine, hemlock and spruce were harvested in early spring for food when at their most palatable and nutritious stage. A few plants were harvested as green vegetables by the Wet'suwet'en in the spring. Nutritional analyses of various fruits and vegetables used by the Wet'suwet'en are discussed in Chapter 8. Several plants were steeped in hot water to make teas. Sometimes a medicinal value is suggested by Wet'suwet'en people, but the general feeling is that these infusions were drunk simply as beverages. Some beverages like labrador tea or infusions of conifer needles may contain significant ascorbic acid, and perhaps other nutrients (Berkes and Farkas 1978, see Chapter 8 for further discussion).

Berries

Berries of all sorts were eaten fresh, dried on racks "like raisins", or preserved fresh in rendered grease and stored in underground storage houses. Blueberries (*Vaccinium* spp.) in particular are described as being stored in this way. Berries were also formerly preserved by being made into berry cakes. This process was essentially identical to that described for the Gitksan (People of Ksan 1980). Wooden racks were placed on a frame over a small fire. The rack was lined with leaves of skunk cabbage, ***c'it anco*** (*Lysichitum americanum* Hultén & St. John), or thimbleberry (*Rubus parviflorus*) and cooked berries were ladled on in several layers to allow partial drying and prevent the berries from spilling (Gottesfeld 1991). The leaves were stripped off the dried cakes, which were moistened to make them flexible and rolled up on a stick. These berry rolls were hung in a dry place for long term storage (Naziel & Naziel 1978). Huckleberries (*Vaccinium membranaceum* Dougl.), saskatoons (*Amelanchier alnifolia* Nutt.) and soapberries (*Shepherdia canadensis* (L.) Nutt.) are particularly described as being preserved in this way.

Today berries are still widely picked, but are usually preserved by canning in glass jars. Huckleberries and highbush blueberries (*Vaccinium ovalifolium* Smith) are most widely collected. Soapberries are another important berry still in use today. The bitter fruits contain saponins, which causes them to froth when whipped. Like many other western Indian people (Turner 1981), the Wet'suwet'en prepare soapberries by beating them into a froth called "ice cream", or they may eat the boiled berries by the spoonful.

Formerly the abundant kinnikinik (*Arctostaphylos uva-ursi* (L.) Spreng.) berries were important in the diet of the people. The fruits of the bunchberry (*Cornus canadensis* L.) were also collected.

Root foods[8]

In the past, ***diyï'n***, the rhizome of the spiny woodfern (*Dryopteris expansa*), was an important staple food, as it also was among the Gitksan, Tsimshian, Haisla and a number of other Indian groups of Coastal British Columbia (Turner *et al.* 1992). The fern rhizomes were dug in the fall after the leaves had withered, or in the winter by shovelling the snow off to expose the dried tops of the plants. Apparently they are not damaged by freezing. Elders who have eaten this plant remember its flavour with pleasure, and comment that it was the "potatoes" of their people.

Annual trips were made to Blue Lake from Hagwilget to gather and store ***diyï'n***. The meadows at the heads of Corya and John Brown Creeks west of Moricetown were other areas where ***diyï'n*** was picked. A stock of stored fern rhizome, rich in carbohydrate (Turner *et al.* 1992; Kuhnlein 1990), provided a welcome source of calories in late winter when other foods might be growing scarce. To prepare this food, it was slowly baked overnight in a pit covered with birch bark and earth. Each individual leaf base was then pulled off and peeled before eating. This food was generally eaten with rendered grease or fish oil, and often accompanied by dried spring salmon eggs.

The other important root food was ***c'inkalh*** the bulblets of *Fritillaria camschatcensis*, locally called wild rice. These bulblets can be collected in reasonable quantity in rich, moist low elevation meadows in the northwest part of the Wet'suwet'en territory. They can be gathered in spring and fall. They were pit cooked or boiled and served with sugar or salt.

Tree 'cambiums'

The tree 'cambiums', ***misdzu***, (from the hemlock *Tsuga heterophylla* (Raf.) Sarg.) and ***k'inïh***, (from the pine *Pinus contorta*), were formerly prized plant foods. Spruce 'cambium' was also utilized. The 'cambium' of the hemlock was often obtained by trade from Gitksan people, as it is more widespread and abundant in the Gitksan territory. Hemlock 'cambium' was gathered in the spring by removing the bark of mature trees and scraping the 'cambium' layer from the bark. It was preferentially harvested from stands with a southern exposure because 'the sun makes the sap sweeter' (personal communication, R. Daly 1991). The 'cambium' was pounded after collection. Some people remember dried hemlock 'cambium' cakes, while others recall shavings. It has been described as tasting like saskatoons.

Pine 'cambium' was widely gathered in the Wet'suwet'en territories. It is harvested in May or June when the sap rises in the pines and the bark is loose. It is obtained by removing the bark from a standing tree with axe or knife, and carefully scraping the outer surface of the exposed wood. Much of it was probably consumed fresh, especially by children, as it is rich in sugars (see Chapter 8) and tastes sweet. It was also dried on wooden racks over a slow fire much as berries were dried by the Wet'suwet'en, or hung to dry as individual strips over a piece of cord. The dried strips were then crumbled to resemble cornflakes and stored for winter.

Green Vegetables

The young flowering stalks of the cow parsnip or "wild rhubarb" (***ggus***, *Heracleum lanatum*) are gathered in spring, peeled, and eaten fresh. They can be eaten raw, fried lightly, or roasted in a campfire. Some modern Wet'suwet'en have used new technology to preserve this prized vegetable by freezing.

Another vegetable eaten by the Wet'suwet'en was stonecrop (*Sedum divergens*, ***tsë mï'***). It was gathered in May before it flowers. The Wet'suwet'en people cook the small fleshy leaves of this plant, frying it lightly. The same species is eaten by the Gitksan and the Niska'a, who class it as a berry and eat it raw with sugar and grease (Jensen and Powell 1979, McNeary 1976, and unpublished study of author).

Fireweed stalks (***khast'an***, *Epilobium angustifolium*) were stripped of their leaves, split and bent over. The pith was then stripped out and eaten. It is described as tasting like bananas.

Nodding onion, *Allium cernuum*, was gathered and eaten raw in the spring. It was called 'stink grass' (***tl'o ilhtsin***).

Columbine flower tips (*Aquilegia formosa* ***lesokh***) were bitten off and the nectar sucked by children for a sweet snack.

At the present time, only the various berries and "wild rhubarb" form an important part of the diet of Wet'suwet'en people. Many living adults remember collecting pine 'cambium'. The elders recall eating traditional vegetable foods such as ***diyi'n*** or hemlock 'cambium', though none has gathered these foods for decades.

Plants Used in Technology

Plants were used for construction of dwellings, boats and implements, for carving, cordage, and heating fuel, for smoking foods and for smoking hides to preserve and colour them. A discussion of some important plant uses follows. The discussion of plants used for technology does not include complete information on carving, construction, boats, or smoking.

Western red cedar bark, ***hët'il*** (*Thuja plicata* Donn. *ex* D. Don), Cupressaceae

Cedar bark was used for cord, and sometimes made into twined capes and dresses similar to those of the Gitksan. The cord was used to hang fish in the smoke house, to lash together fish traps, and in the construction of wooden bridges.

Whole cedar bark was used for durable roofing. This was peeled from the tree in May when the sap is rising by cutting around the tree with an axe near the base and again higher up. A stick was used as a spud to peel the whole bark off the wood. The bark strips were laid over the peak of the roof while still green and flexible. The bark was laid in two layers, the lower with the inner surface up, and the upper with the outer surface up, over the joints in the lower layer. This roofing was said to last for several years where spruce bark roofing would have to be replaced more frequently.

Western red cedar wood, ***simggin*** *(Thuja plicata)*, Cupressaceae

Cedar wood was used for bentwood boxes for storing food and goods, and for cradles. It was also split into planks for houses and carved into totem poles. The straight grain and ready splitting properties of cedar make possible splitting boards and planks without use of saws, a property widely exploited by Northwest Coast peoples.

Willow bark, ***k'ëltay*** *(Salix* spp., probably *S. lasiandra* and/or *S. scouleriana)*, Salicaceae

Willow bark was twined for cord especially for set lines and fish nets. Willow bark was twisted into twine. Untwined green willow bark is used for tying up fish in the smokehouse and lashing together shelters. (Fig. V-3) It was also used to lash beaver skin to a hoop of red-osier dogwood when the skin was being stretched and dried.

Willow, ***k'endliyh*** (*Salix* spp., probably *S. lasiandra* and/or *S. scouleriana)*, Salicaceae

Willow wood was used for snowshoes (***k'ëtlay 'ayh***) .

Alder bark, ***k'is*** *(Alnus* spp.), Betulaceae

Alder bark was used as a dye for birch bark baskets.

Lodgepole pine, ***cindu***; pine cones ***dikhlengwil*** *(Pinus contorta)*, Pinaceae

Pine wood was employed for snowshoes. Although not very strong, it was much lighter than maple.

Pine cones are used to smoke moosehide. They give a brown colour.

Douglas Maple ***'ayh*** *(Acer glabrum* (Torr.) var. *douglasii* (Hook.) Dippel), Aceraceae

This word means both maple and snowshoe. The most important use for maple was for manufacturing snowshoes. It is hard and strong wood, but heavy. Apparently ice skates were also fashioned from maple in the recent past. Maple wood was also sometimes used for other household implements where durability and hardness were desired, such as tumpline looms.

Spruce ***ts'o*** (*Picea engelmannii* x *glauca*), Pinaceae

Split spruce roots ***khay*** are used for sewing birchbark baskets. Spruce roots used to be used for making large cargo baskets. Such baskets were used to carry the remains of the dead back to the village if they died on the trapline or in a remote area. Thick spruce roots were also reportedly used for the construction of fish traps which were lashed together with cedar bark.

Spruce boughs ***ts'o 'il*** were used as thatch over the pole roof of winter lodges or small cabins. Spruce boughs can be used for bedding when camping.

Spruce poles were used for construction of winter lodges, cabins and caches. Winter lodges were A frame buildings about 2.5 m high constructed of spruce poles (Morice 1893).

Strips of freshly peeled spruce bark were used for roofing. The bark strips were laid over the roof in two overlapping layers and weighted down with poles to prevent their blowing off. Spruce bark was apparently also used for emergency canoes in the past.

Spruce poles are preferred for gaff poles to gaff salmon at Moricetown Falls. The gaff pole consists of a large hook which is lashed to the end of a long pole and secured with a leather strap. The fisherman holds the gaff pole down in the current and jerks sharply upward when a fish is felt. If a fish has been caught on the hook, the fisherman hauls the pole up out of the water and removes the fish. Young trees 5-6 cm diameter and some 9 m long are used. They will last 3 to 4 years. Cedar and subalpine fir are too brittle for this use, and they will float up rather than stay down in the current. Hemlock saplings are too heavy for this use.

Rotted spruce wood can be used for smoking hides. It gives a brown colour.

Rocky Mountain juniper (*Juniperus scopulorum* Sarg.), Cupressaceae

Juniper wood is very hard. It was formerly used to make a special knife for harvesting pine 'cambium'. Arrows were also made from it. The wood was boiled in grease for these uses to prevent cracking. Juniper is limited to certain xeric south facing slopes in the Bulkley Valley. A locality south of Telkwa was traditionally known for juniper.

Birch, birchbark; ***k'ay*** (*Betula papyrifera* Marsh.), Betulaceae

Some consultants call birch by the words for green tree ***dilï*** and birch wood ***dilï tsiz*** 'green firewood'. Birch bark was used for basketry and in pit cooking. For baskets, the bark must be collected from a living tree and used before it dries out and hardens. Birch baskets were used for food storage and carrying water, and carrying berries and other items (Fig. V-4). Torches were also made of rolled birchbark, and birchbark was used to carry fire from one camp to the next. Birch wood is used for carving masks, spoons and soup bowls. Birch wood is valued as firewood.

Black cottonwood, ***ts'iy*** (*Populus balsamifera* ssp.*trichocarpa* (Torr.&Gray. *ex* Hook.) Brayshaw), Salicaceae

The word for cottonwood and canoe are the same word. Canoes were traditionally dugouts constructed from cottonwood trunks. Similar canoes were made by the Gitksan and by the Carrier of Takla Lake. (The Gitksan word for cottonwood, although linguistically unrelated, means 'good for canoe').

Cottonwood wood was used in hide smoking to give a very pale colour to the hides. It was also used for smoking fish and meat.

Trembling aspen, 'poplar', ***t'ighis***; aspen wood ***t'ighis tsiz*** (*Populus tremuloides* Michx.), Salicaceae

Aspen wood was used for bentwood boxes and plates. The ash from aspen was used as a soap. Rotten aspen wood that is lying on the ground is used for smoking beaver meat, and aspen is the preferred wood for smoking salmon.

Red-osier dogwood, 'red willow', ***k'ëntsec*** (*Cornus stolonifera*), Cornaceae

The branches of red-osier are very flexible. Red-osier dogwood branches were used for the frames of temporary sweat huts. Larger branches were joined to form a circular frame for stretching beaver hides. Thin, smaller branches are used to form the rim of birchbark baskets.

Spreading dogbane, ***c'indeklh*** (*Apocynum androsimaefolium* L.), Apocynaceae

The fibre was spun and twined to make cord for rabbit snares.

Skunk cabbage, ***c'it'anco*** (*Lysichitum americanum*), Araceae

Skunk cabbage leaves were used to line the wooden rack when making berry cakes.

Thimbleberry (*Rubus parviflorus*), Rosaceae

Thimbleberry leaves are an alternative to skunk cabbage leaves for lining berry racks.

Fern fronds *Athyrium filix -femina* (L.) Roth and *Dryopteris expansa*, Polypodiaceae

Fern fronds were gathered to lay salmon on for curing after they were caught, before cleaning them and cutting them for drying in the smokehouse. The fish were covered over with a second layer of fern fronds.

Sphagnum, 'diaper moss' ***yin yil, yintl'akh yil*** (*Sphagnum* sp.), Sphagnaceae

A long, pale sphagnum moss was gathered from the muskeg and dried in trees or bushes. The preferred kind is about 18 to 20" long. It was used for diapers and for absorbing menstrual flow. Sufficient moss to last through the winter was gathered and dried in late summer. Urine soaked moss could be washed and reused, but fecal and menstrual blood soiled moss was considered unclean and discarded.

'Black tree moss' ***dikhghe*** (*Alectoria* or *Bryoria* spp.)

Before matches were introduced the "tree moss" was used for tinder in starting fires with a spark made by striking rocks together.

Discussion

As might be anticipated for people living in a heavily forested northern environment, many of the plants used by the Wet'suwet'en are forest trees and shrubs. Important medicines and foods, as well as plants used for technology and material culture, are derived from the stems of trees and large shrubs (Gottesfeld 1992a). Berries of many kinds, also largely derived from perennial shrubs, were the most important food plants. The fleshy roots and rhizomes of some perennial herbs were used, such as yellow pond lily and the cow parsnip for medicines, and the fern rhizome ***diyï'n*** as a carbohydrate source. Mosses and lichens were used for diapers and tinder, but no use for food or medicine has been recorded. Lichens may have been used for dye in the past. Fungi, with the exception of the cinder conk, are all lumped under one term, ***c'ebedzik*** The only reported use of fungi is the use of an unidentified woody polypore for cosmetics, and of cinder conk or "black birch burl" *Inonotus obliquus* for medicinal purposes and as a slow match. None of the many mushrooms in the region were utilised for food.

Wet'suwet'en plant uses reflect the availability to them of the different plants of their transitional environment. Like the Gitksan to the north and west, the Wet'suwet'en made use of western red cedar where available in the northwestern par . of their territory for plank long houses, totem poles, wooden storage boxes, and cedar bark cordage. In the interior parts of their territories, spruce poles and bark or branches were used for construction. Birchbark baskets, used across boreal North America, were more characteristic of Wet'suwet'en households than the bentwood cedar boxes ubiquitous on the North coast. Willow bark and sinew or rawhide, more widely available in Wet'suwet'en country than cedar, were the most important cordage materials. Hemlock 'cambium', though less important in Wet'suwet'en diet than in that of coastal peoples, was relished and gathered in the northwestern part of the territories, or obtained in trade from their neighbours. Pine 'cambium', readily available throughout Wet'suwet'en lands, was a more typical 'cambium' food than hemlock. Similarly, douglas maple, used by the Gitksan for snowshoes, was used by the Wet'suwet'en where available, but spruce or pine were used where maple was unavailable.

Cultural concepts involving health, healing and the spiritual world are shared by the Wet'suwet'en and neighbouring groups. Two important concepts shared with the Gitksan include purification and "getting lucky". As hunting and gathering peoples, both the Gitksan and the Wet'suwet'en were dependent on their success in hunting to obtain an important part of their food supply and hides and meat which brought prestige and paid debts when given away at potlatches. Preoccupation with hunting success led in both groups to ensuring the luck of the hunter by spiritual means. Plants such as devil's club, Indian hellebore and ***hadic***" were used in both groups in rituals to purify the hunters, their equipment and/or their families, and to promote good fortune (Gottesfeld and Anderson 1988, Jenness 1943). These practices, generally very private, continue at the present time in both groups of people in more traditional families. A larger number of people are aware that these plants "bring luck".

Many of the medicinal plants utilized by the Wet'suwet'en are used in similar ways by the Gitksan, which is not surprising due to the long period of exchange and interaction between these cultures and the similarity of the environment. However, certain plants are used more extensively among the Wet'suwet'en than the Gitksan. For example, the Wet'suwet'en make extensive use of black twinberry *Lonicera involucrata*, mountain-ash *Sorbus scopulina*, and red-osier dogwood *Cornus stolonifera* .

A number of medicinal plants used by the Wet'suwet'en are also used by the Central Carrier (Carrier Linguistic Committee 1973). Medicinal use of spruce and fir inner bark and pitch, pine tips, red-osier inner bark, devil's club inner bark, mountain-ash bark, soapberry stem bark, scouring rush, juniper, wild rose and Indian hellebore are shared with the Central Carrier.

Plants such as spruce, subalpine fir, Indian hellebore and devil's club

(Turner 1982) are found over much of northern B.C. and were used medicinally by all peoples of the region.

The long association of the Wet'suwet'en with the Gitksan in the Hazelton area has lead to considerable cultural diffusion and some linguistic borrowing. Although for most plants the names in Wet'suwet'en, an Athapaskan language, and Gitksan, a Tsimshian language, bear no resemblance to one another, some significant plant names are shared (see Chapter 6 for further discussion). Words for fireweed, yellow pond lily, cedar, cedar bark, pine 'cambium', cranberry, wild cherry, and spreading dogbane are among the shared plant words. Some of these are evidently Gitksan in origin. These include the name for the red cedar and for cedar bark, spreading dogbane, fireweed, and possibly the name for pine 'cambium'.

Summary

The Wet'suwet'en are transitional both in territory and way of life. Their lands span the transition between the coastal rainforests and the interior spruce forests. Their social structure, belief system, and way of life show the twin influences of their nomadic hunting Athapaskan ancestors of the boreal regions and the more sedentary fishing and gathering based cultures of the Northwest Coast. Plant names and uses reflect interaction with both the coastal Gitksan and interior Carriers. Gitksan-derived plant terms are loanwords across a major linguistic boundary, suggesting a long history of contact (Rigsby and Kari n.d.).

The present study documents the names and uses of fifty nine species of vascular plants, and three non-vascular taxa by the Wet'suwet'en in the historic period. Most plants used are plants of forest or woodland; many are woody perennials or trees. Despite the traditional reliance of Athapaskan-speaking hunting peoples on animal products, a diverse array of plant species was used for food, medicine and technology by the Wet'suwet'en.

Table V-1
Wet'suwet'en Plant Uses

Plant Species	Food	Beverage	Medicine	Technology
Abies lasiocarpa			√	√
Acer glabrum var. douglasii				√
Achillea millefolium			√	
Alectoria or Bryoria spp.	*			√
Allium cernuum	√			
Alnus spp.				√
Amelanchier alnifolium	√			√ #
Apocynum androsimaefolium				√
Aquilegia formosa	(√)			
Aralia nudicaulis			√	
Arctostaphylos uva-ursi	√			
Athyrium filix-femina				√
Betula papyrifera				√
Corylus cornuta	√			
Cornus canadensis	√			
Cornus stolonifera			√	√
Dryopteris expansa	√			(√)
Epilobium angustifolium	√			
Equisetum hyemale			√	
Fragaria virginiana	√			
Fritillaria camschatcensis	√			
Geum macrophyllum			√	
Heracleum lanatum	√		√	(√)
Inonotus obliquus			√	√
Juniperus communis			√	
Juniperus scopulorum				√
Ledum groenlandicum		√	√	
Lonicera involucrata			√	
Lysichiton americanum				√
Nuphar polysepalum			√	
Oplopanax horridum			√	
Picea engelmanii x glauca	(√)		√	√
Picea mariana			√	(√)
Pinus contorta	√		√	√
Plantago major			√	
Populus tremuloides				√
Populus trichocarpa			√	√
Prunus pennsylvanica			√	
Pyrus fuscus	√ ?		√	
Ribes oxyacanthoides	√			
Ribes sp	√			
Ribes triste?	√			
Rosa acicularis	√		√	

Table V-1, continued

Plant Species	**Food**	**Beverage**	**Medicine**	**Technology**
Rubus idaeus	√	√		
Rubus parviflorus	√			√
Rubus spectabilis	(√)			
Salix spp.				√
Sambucus racemosa			√	
Sedum divergens	√			
Shepherdia canadensis	√		√	
Sium suave?	√			
Sorbus scopulina			√	
Sphagnum sp.				√
Symphoricarpos albus			√	
Thuja plicata				√
Tsuga heterophylla	√			√
Urtica dioica			√	
Vaccinium caespitosum	√			
Vaccinium membranaceum	√			
Vaccinium oxycoccus	√			
Veratrum viride			√	
Viburnum edule	√		√	

* reported by Morice 1893

mentioned in Cove & MacDonald 1987

TABLE V-2
FOOD PLANTS

Root vegetables

chocolate lily ***c'inkalh*** *Fritillaria camschatcensis* (L.) Ker-Gawl

spiny wood fern ***deyï'n*** *Dryopteris expansa* (K.B Presl) Fraser-Jenkins & Jermy

"wild carrot" ***sasco*** identified as *Sium suave* Walt.(P. Kari, unpublished notes)

Green vegetables

cow parsnip stalks 'wild rhubarb' ***ggus*** *Heracleum lanatum* Michx.

fireweed ***khas t'an*** *Epilobium angustifolium* L.

wild onion 'stink grass' ***tl'o ilhtsin*** *Allium cernuum* Roth

stonecrop 'stone berries' ***tsë mï'*** *Sedum divergens* Wats.

Berries

highbush cranberry ***tsalhtsë*** *Viburnum edule* (Michx.) Raf.

lowbush or bog cranberry ***mï'o*** *Vaccinium oxycoccus* L.

kinnikinnik ***dinïh*** *Arctostaphylos uva-ursi*(L.) Spreng.

bunchberry ***dinïhyez*** or ***dinïh t'an*** *Cornus canadensis* L.

black huckleberry ***digï*** *Vaccinium membranaceum* Dougl.

low-bush blueberry ***yintimï'*** *Vaccinium caespitosum* Michx.

high-bush or oval leaf blueberry ***dïndze*** *Vaccinium ovalifolium* Smith

pin cherry ***smïts'ok*** *Prunus pennsylvanica* L.

red raspberry ***biyolhggok*** *Rubus idaeus* L.

thimbleberry ***dik dïnkay*** *Rubus parviflorus* Nutt.

soapberry ***niwis*** *Shepherdia canadensis* (L.) Nutt.

salmonberry ***misggile'n*** *Rubus spectabilis* Pursh

saskatoon 'close together' ***lhighah*** *Amelanchier alnifolia* Nutt.

strawberry ***yinti dilk'ï'n*** *Fragaria virginiana* Duchesne

'black currant' ***dilkw'akh mï'*** *Ribes* sp.

red currant ***k'iy ditigï*** *Ribes triste* Pall.

gooseberry ***c'indewizgï*** *Ribes oxyacanthoides* L.

rosehips ***tselhghil mï'*** *Rosa acicularis* Lindl.

'Cambium' foods

hemlock 'cambium' ***misdzu*** *Tsuga heterophylla* (Raf.) Sarg.
pine 'cambium' ***k'inïh*** *Pinus contorta* Dougl.
spruce 'cambium' *Picea engelmanni* x *glauca*

Teas

labrador tea ***lidï misgïk*** *Ledum groenlandicum* Oeder
raspberry leaves and stems *Rubus idaeus* L.

Flowers

columbine flowers ***lesokh*** *Aquilegia formosa* Fisch.

Nuts

hazel nut ***tsalik gg'a kun'*** *Corylus cornuta* Marsh.

Figure V-2 removed due to poor print quality.

Figure V-2. The late Madeline Alfred preparing medicine from devil's club.

Figure V-3 removed due to poor print quality.

Figure V-3. Bundle of prepared willow bark to be used to hang fish in the smoke house, Moricetown.

Figure V-4 removed due to poor print quality.

Figure V-4. Birchbark basket made by Jenny Naziel of Moricetown, B.C.

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[1] A version of this chapter has been submitted to the Journal of Ethnobiology.

[2] The following Wet'suwet'en people generously shared their time and knowledge: Edna Alfred, the late Madeline Alfred, Katherine Arsenault, Antoinette Austin, Charles Austin, Margaret Austin, Mary Ann Austin, Rita David, Mabel Forsythe, Adam Gagnon, Andrew George, Leonard George, Joe George, Florence Hall, Alfred Joseph, Cecilia Lapalme, Bazil Michell, Caroline Michell, Doris Michell, Josephine Michell, the late Alfred Mitchell, Charlotte Mitchell, Jenny Mitchell, Roy Morris, Lizette Naziel, Pat Namox, Lucy Namox, Elsie Tait, Sara Tait, Tommy Tait, Christina William, and Margaret Williams.

[3] Spellings of Wet'suwet'en words by Dr. Sharon Hargus using modified Hildebrandt system, 1989.

[4] Spellings of Gitksan words after Gottesfeld and Anderson 1988.

[5] Juniper 'berries' are the fleshy cones of the juniper plant.

[6] Although widely referred to as cambium in the ethnographic literature and in various ethnobotanical studies, the tissue which is collected and eaten is more than the cambium, strictly speaking. It appears to comprise secondary phloem. The term 'inner bark' is also applied to this food in more recent ethnobotanical studies. Inner bark can also include other tissues besides active phloem. I have chosen to retain 'cambium' because of its historic usage and because no botanical or English language term really specifies the tissue collected by North American native peoples.

[7] The term 'berry' is used here in its popular sense of small succulent fruits, not in its anatomical sense denoting a fruit of a specific structure. Not all fruits collected by the Wet'suwet'en are actually botanically berries.

[8] I employ the term root foods in the sense of garden vegetables, meaning underground food parts. The 'root' foods of the Wet'suwet'en were largely bulbs or rhizomes, not true roots.

[9] ***Hadic*** is the name of an unknown plant used for ritual and medicinal purposes by both the Gitksan and Wet'suwet'en. It appears to be a clubmoss (most likely *Lycopodium selago* L.), but efforts to positively identify the plant have been unsuccessful to date.

Classification and Nomenclature in Wet'suwet'en Ethnobotany-
a Preliminary Examination
Chapter 6

Introduction

The data for this analysis of plant classification and nomenclature were collected during five years of ethnobotanical and ethnomedical field work among the Wet'suwet'en, an Athapaskan speaking group of northwestern British Columbia. The Wet'suwet'en are traditional foragers in a largely forested environment transitional between the coastal rainforest and the boreal forest. Their traditional subsistence emphasized fishing for anadromous salmon, lake fishing, and hunting for large and small game, supplemented with collection of a wide variety of berries, and a few kinds of tree 'cambium', root vegetables and greens. The Wet'suwet'en presently live largely in two modern villages along the Bulkley River, and are integrated into the contemporary Canadian cash economy, although various foraging activities still take place.

The data were gathered in a series of unstructured interviews with elders regarding plant uses, identification and naming, and several field trips to gather medicinal plants. Plant information was elicited at times by bringing fresh specimens to elders and inquiring what specific plants were called. Information was also collected by reference to a looseleaf notebook of colour photos of local plants and plant parts such as berries, stems, petioles or rootstocks. Other plant data was volunteered spontaneously. Confirmation of identity of spontaneously described plants was by reference to fresh plant material collected to confirm postulated identifications, and to "case" specimens (Bye 1986) of known identity (e.g. a dried plant rhizome carried as a charm) or by freehand sketches and verbal descriptions, later verified by showing a plant or specimen to an elder to confirm the identification. Interviews were conducted in Wet'suwet'en with a bilingual translator, or in English, with use of Wet'suwet'en plant names and other botanical terms.

Classification

Ethnobiological classifications have been the subject of many papers and much theoretical debate. According to Berlin (1992; Berlin *et al.* 1973) ethnobiological taxonomies are hierarchical in organization, consisting of up to six different levels or ranks. The most inclusive is what he terms the "unique beginner" (e.g., 'plant'), unnamed in most cultures, ranging through "life form", "intermediate" taxa, folk generics, folk specifics, and folk varieties. Berlin emphasizes that folk generics are usually equivalent to biological species, and are the most salient and perceptually distinct basic "kinds" of plants or [illegible] ethnobiological classification. In some instances, the generics [illegible] down into folk specifics, which are recognized as being 'kind[illegible] generic. In relatively few instances, folk species are further [illegible] into superficially recognized but similar varieties. This usually occurs with distinctive cultivars or colour phases of cultivars, and does not typically occur with wild plant species. Not all cultures have all of the ethnobiological taxonomic ranks represented in their classifications. In particular, Berlin (1992), Waddy (1982), and Hunn and French (1984) have argued that foraging peoples tend to lack folk specifics and may have fewer recognized life form categories, or no life forms (Brown 1977). Intermediate level taxa are seen as being relatively uncommon and often linguistically unmarked (Berlin *et al.* 1973). Most generics are reported to be included in one or another life form, but many are not clustered within intermediate taxa. Similarly, few generics are reported to be further sub-divided.

It has been argued that a classification which usually develops only two levels is perhaps not most fruitfully conceptualized as "hierarchical" (Morris 1984; see also Randall 1985 and 1976 for a rejection of hierarchical taxonomy), but it is not my purpose to debate this theoretical point here. I have chosen to employ the terms used by Berlin (1992) for the different taxa of folk classifications, although my usage of "life form" does not conform entirely to his criteria, without accepting *a priori* Berlin's conclusions about the nature of ethnobiological classification. Alternative terms for ethnobiological taxa have been proposed by Bulmer (1968) and Atran (1990), but as Berlin's terms are those generally used in the literature, it seems most reasonable to retain them.

Most Wet'suwet'en generics seem to match well with scientific species.

In some instances, a Wet'suwet'en generic taxon may encompass more than one biological species. As is typical of most folk botanical classifications, relatively inconspicuous plants such as mosses, lichens and fungi (=fungal fruiting bodies) are underdifferentiated, with only a few Wet'suwet'en terms for the many kinds in the local biota.

The Folk Generic

Folk generics are the basic units of any ethnobotanical taxonomy (Berlin 1992). A folk generic is a "basic kind" usually denoted by a primary lexeme, a unitary term which is not further analysable, such as "pine" or "maple", or an analysable form which cannot meaningfully broken down, such as "dogwood" (unproductive primary lexeme). It may be further subdivided into folk species, which are recognized as kinds of the generic which differ in one or a few characters. These are usually named by secondary lexemes (Berlin 1992), such as 'white oak' (with 'white' as a descriptive modifier appended to the generic 'oak').

Because the focus of my study was on the utilisation of plant resources, I have not attempted to collect a complete inventory of all plants distinguished and named by the Wet'suwet'en. I have obtained 75 basic plant terms for folk generics or specifics (see Table VI-1), and three terms which are "empty" life form taxa (Turner 1987, Hunn 1982) that appear to be undifferentiated residual taxa (Hunn 1982) (discussed below under life forms and intermediate taxa). Seventy-one of these appear to be folk generics which are not further subdivided.

Most of the generics appear to correspond in their ranges to single biological species, but several may cover more than one scientific species (Fig. VI-1). ***K'is'*** appears to refer to both *Alnus incana* and *Alnus crispa*. ***Ts'o*** may refer to black spruce (*Picea mariana*) as well as the more common and widespread hybrid spruce *Picea engelmannii x glauca*. The shallow water aquatic plant *Calla palustris* appears to be grouped with yellow pond lily *Nuphar polysepalum*, a medicinal plant, as 'baby water lily' and similarly labelled with the term ***khëlht'ats***.

The only taxon which appears to be a folk generic with four named species is ***tl'o***, the term for 'grass'. The terms for nodding onion, sedge, cattail, and a species of grass are all called ***tl'o*** with a second term in

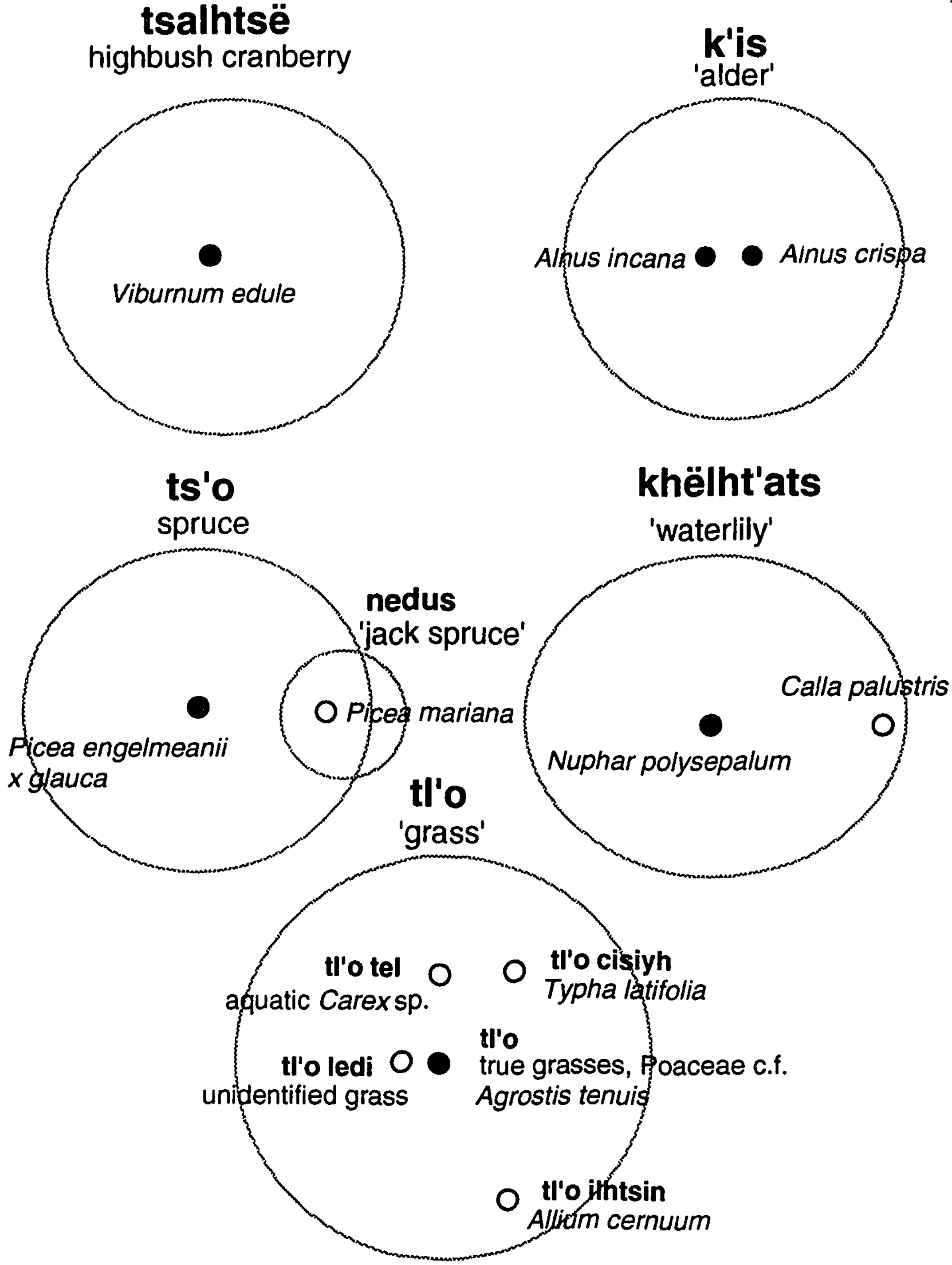

Figure VI-1 **Wet'suwet'en Generics**

binomial fashion (see Fig.VI-1).

Two other examples of possible folk specific taxa I prefer to treat as coordinate taxa (Hunn and French 1984). While the term for bunchberry (***dinihyez***, or 'small kinnikinnik') suggests that it is a species of ***dinih*** (kinnikinnik), I prefer to interpret it as two taxa at the same level of classification with a relationship indicated by a diminuitive, as has been reported in Sahaptin (Hunn and French 1984). Similarly, ***ts'o tsin***, 'balsam' or 'subalpine fir' may be treated as a type of ***ts'o***, spruce (*Picea* spp.), but I think they are seen as equivalently ranked taxa, and that the relationship is coordinate, not subordinate.

Although the 71 generics and specifics do not constitute a complete inventory of the flora, they do show the pattern reported for a number of other foraging peoples (Berlin 1992, Hunn and French 1984, Hunn and Randall 1984) with around 2% polytypic generics. This is not solely attributable to low levels of polytypic scientific genera in the local flora. Where there are several species in the local flora classified in the same genus in the scientific classification for which I have collected Wet'suwet'en names, the Wet'suwet'en terms all appear to be distinct (see species of *Rubus*, *Ribes*, *Vaccinium*, *Cornus* and *Juniperus* in Table VI-1).

Priscilla Kari (n.d.), working in 1978, collected Wet'suwet'en terms for an additional 18 taxa not reported here. Whether all of these should be considered generics or specifics is not immediately clear, since the identification of all forms was not listed, and several terms are potentially very general in their referrents (e.g. 'algae', 'lichen').

I attempted to elicit names of several plants which I had no indication were used by the Wet'suwet'en during 1992 field work. The consultants I asked were all elders of good language skills and broad familiarity with plants and plant uses. I was unable to obtain names for four plants, three of which are quite conspicuous and common. Two were flowering specimens of common herbs, Indian paintbrush *Castilleja miniata*, and a purple flowered aster *Aster ?ciliolatus*, and the third was a branch of a very common shrub, *Spiraea douglasii* or pink spirea, with flowers and fruits. Priscilla Kari does report a name for the *Spiraea*, though five elders I spoke to either did not recognize the plant, or did not know a name for it. Two elders commented that "in the old days" they would have had words for everything and would have had terms for the flowers, but they did not know any term for the aster and Indian paintbrush besides the general word for 'flower'.

Changes in lifestyle and language retention may affect the retention of botanical lexicon and knowledge of the indigenous classification system (Berlin 1992, Waddy 1982). The strong bias toward economic plants, and the poor awareness of non-economic plants evident in my research is probably affected by these factors, as well as by my research emphasis on plants as resources. The degree to which this emphasis on naming and classification of plants of potential utility would have been present in the aboriginal system prior to contact cannot be reconstructed at this point.

Research on other groups such the Sahaptin is suggestive that some groups do not recognize or name many species which are not utilised or otherwise particularly salient (Hunn 1982). Hunn (1982) comments that the Sahaptin only name approximately 10% of the vascular plant taxa found in their environment. Bulmer explores the relationship between obvious utility and plants and animals named by the Kalam of New Guinea:

> The recognition of both the objective and subjective importance of ecology to human communities throws light on the problem of classification and naming of apparently useless animals and plants. If one sees individual plant and animal categories solely in their direct relationships to man, there are many which appear irrelevant, neither utilised nor noxious. However if the relationships between different kinds of plants and animals are recognised as relevant, then a great range of additional forms will very usefully be indentified and classified....
>
> My final introductory point is that it is this ecological perspective which requires systems of classification to recognise basic categories, reflecting discontinuities in nature "in the round", multidimensionally, systematically relating morphological discontinuities with discontinuities in behaviour, as well as direct cultural significance (1974:12-13).

Major Plant Categories or "Life Forms"

Major plant categories in ethnobotanical classification have been called life forms (Atran 1985, 1990; Berlin *et al.* 1973; Berlin 1992; Brown 1977, 1984) Life forms are understood by these authors to be broad groupings of plant kinds based on morphological characters, designated by primary lexemes, and containing contrast sets of subordinate named generics. They are considered to partition the botanical domain without overlap, although not all generics appear to be affiliated with these broad groupings (unaffiliated generics of Berlin 1992). There has been considerable debate in the literature over the validity and universality of such plant groupings in cultural context (Randall 1976, 1985, Randall and Hunn 1984, Hunn 1982, Hunn and French 1984, Morris 1984, Taller de Tradicción Oral and Boucage 1987, Turner 1974, 1987) and what the nature of broad plant groupings is in various cultures whose ethnobotanical classification has been investigated.

Broad groupings of plant taxa in Wet'suwet'en are relatively difficult to identify without specialized elicitation sessions, as folk generics are the terms commonly employed. I will here provisionally employ the term "life form" for broad groupings of Wetsu'suwet'en plant taxa which I have inferred during my field work (Table VI-2), although the groups I report here do not uniformly conform to the definitions of life form given by Berlin (1992), Atran (1985, 1990) or Brown (1977) in that they may be based in part on utilitarian criteria, are not always mutually exclusive, and may be "empty", that is, contain few or no named subordinate generics. This is similar to the situation described by Turner (1974, 1987) for several other Indian groups in British Columbia.

The following list of broad taxa of "life form" rank, or general plant classes, must be considered preliminary until more detailed investigation is carried out. A class of large woody plants, ***dicin***, is recognized. These include plants which have woody stems and are usually approximately as tall as a person to forest canopy height. This includes both "trees" in the conventional English sense, and woody multiple stemmed shrubs. ***Dicin*** are utilised for firewood, construction, and bark resources for dye, cordage and medicines. (A common type of medicinal decoction of mixed barks is called ***dicin yu'*** 'wood medicine').

Other major plant categories are less clearly defined. Smaller shrubs, large herbs (including at least one fern) and low growing herbaceous or semi herbaceous perenniels can be referred to with the form ***–t'an***, which is glossed as 'plant' and derives from the word for 'leaf' (***c'i't'an***). Members of ***dicin*** cannot be referred to by this term. Fireweed, strawberries, thimbleberries, prickly rose bushes and Indian hellebore are all called ***–t'an***. I infer that there is a class of plants which I designate

c'i't'an or ***–t'an*** including all such plants, although I have not attempted to elicit such a classification in the field.

Herbs with conspicuous flowers are lumped as ***c'indek*** 'flower', and not subdivided by modern Wet'suwet'en. (An analogous situation is also found in Gitk[illegible] where flowers are called "***ma[illegible]galee***"). Forms with conspicuous flowers which have a use, however, are referred to by a specific name, such as red columbine (*Aquilegia formosa*)***lesokh***, or yarrow (*Achillea millaefolium*) ***bi'il yisonë***. The term ***c'indek*** or the bound form ***-dik*** also refers to the flower as a plant organ, e.g.: "You don't pick the leaves of ***lidï misgïk*** when the ***c'indek*** is on it." ***C'indek*** as a "life form" then is a residual category, or "empty" life form (Hunn 1982, Hunn and French 1984, Turner 1987). Clément (1990) records a similar class for the Montaignais, and Turner (1987), Hunn (1982), and Randall and Hunn (1984) have recorded the presence of such a group for various northwest North American groups.

The term for grass may also be applied at the life form level, and/or it may be an intermediate taxon or an unaffiliated folk generic with several folk species. If it is a "life-form", then it is essentially a monogeneric life form (*sensu* Atran 1985), containing one or perhaps two generics, but of distinctive morphology and role in the local "economy of nature", or an "empty" life form (*sensu* Turner 1987) because it lacks a contrast set of a number of named generics contained within it. A similar situation is described by Bale'e for the Ka'apor of Brazil (1989) and by Turner for the Lillooet of British Columbia (1987). Several different graminoid plants were shown to Wet'suwet'en elders to elicit names. *Agrostis tenuis*, red top, a true grass, was labelled ***tl'o***. Sedge (*Carex* sp.) was labelled ***tl'o tel*** or ***tl'o tel tlo***. A larger grass (as yet undetermined) was called ***tl'o ledi'***. The name of the large aquatic graminoid cattail (*Typha latifolia*) was not recalled by my informants, but the term collected by Priscilla Kari in 1978 for this plant was ***tl'o cisiyh***, indicating that it is another type of 'grass'. Another plant which appears to be classed as a 'grass' is nodding onion (*Allium cernuum*), which is called ***tl'o ilhtsin*** or 'stink grass'. It has linear grass-like leaves, but is somewhat succulent, has flowers, and a conspicuous smell. It is, incidentally, the only grass-like plant which was used by people for food.

Horsetail (*Equisetum* spp.) may be marginally included in the 'grass' life form. *Equisetum arvense* was unnamed by one informant, who said he guessed it could be called (in English) 'grass'. Two other informants called it ***khikh c'it'an*** ('gooseleaves'), or ***khikh dë'***.

There is a sense that 'grass' or ***tl'o*** may contain a connotation of uselessness, except for hay (and apparently 'stinkgrass', nodding onion). One elder contrasted a sedge specimen with other plants which had potential medicinal uses by saying, "That's just ***tl'o***." [e.g., useless, neither a medicine nor harmful] ((interview notes 7/31/92). Another elder, pondering the identity and proper name of an aster specimen said (in English): "It's not a 'wood', it's a 'grass'" (interview notes 7/23/92), suggesting that for him 'grass' [=herbaceous] contrasts with 'wood' [=woody, a shrub or tree].

When I directly asked one elder what term she would use for "all the low growing green plants I showed you" (including several graminoid specimens, horsetail, aster, and yarrow), she answered ***k'ay nïyi***. That means "new growth", she said (Gottesfeld field notes 7/28/92). I had just asked about the Wet'suwet'en term for "tree", and intended to inquire for a term for "herb" (=GRERB Brown 1977) as a contrast to "tree". However, since I never encountered such a term or concept spontaneously, I am hesitant to conclude that this term can be accepted as a general 'herb' life form concept or term.

Evidence for "berries" (***mï'*** or ***nit'ay***) as a "life form" or major plant category is suggested by the spontaneous listings in interviews of a number of plants which bear edible berries. Such forms include trees or large shrubs, smaller shrubs, and perenniels which grow low to the ground (including the succulent *Sedum divergens* whose leaves are classed as a berry). As Turner (1987) found in her Thompson and Lillooet material, this classification cross cuts other 'life form' taxa in that some members are "double indexed" (see Table VI-3). For example, saskatoons were listed spontaneously as 'large woody plant' ***dicin*** as well as 'berries'. This may be because saskatoons were formerly prized for their hard straight wood for arrow shafts, an important pre-contact trade item, as well as being one of the most important berries for food. For other berries, such as rose hips, strawberries or thimbleberries, when the focus is on the plant, as opposed to the fruit, they are referred to as ***-t'an***.

In addition, some forms of conspicuous berry bearing plants are perhaps peripherally included as 'berries', because although they have berries, the fruit is not edible (black twinberry *Lonicera involucrata* and common snowberry *Symphoricarpos albus*). These plants may be linguistically coded for non-edibility by the use of animal terms in their Wet'suwet'en names. These plants appear peripheral to ***mï'*** or ***nit'ay*** and are sort of "pseudo" berries, classed primarily as ***dicin***.

A "berry" taxon is reported by Turner for a number of northwest North American Indian languages (1987:72) and by Randall and Hunn (1984:340) for Sahaptin. Clément (1990) also reports a similar edible fruit taxon for the Montaignais of northeastern North America.

Two "empty" life forms round out the classification of plants (*sensu lato*) by the Wet'suwet'en. These are a term for moss, ***yin***, and a term for fungus ***c'ebedzik***. Moss was collected for diapers, and this moss is called ***yin yil***, or ***yin tla yil*** ['white moss']. Its pale colour and length are the distinguishing features. Moss in general is simply ***yin***, a term which apparently also can designate 'swamp' [muskeg?]. Fungi, including mushrooms and bracket fungi, are called by the term ***c'ebedzik*** (– 'ear').Cinder conk, a bracket fungus of unusual form (*Inonotus obliquus*), is called ***tleyhtsë*** or ***dic'ah c'ists'o'***. Whether this is considered a type of ***c'ebedzik*** is not clear.

Empty classes denoting "moss" and "mushroom" are also found among the Gitksan, and may be characteristic of other groups in similar climatic regimes (Turner 1987:77). Clément (1990) describes a broad Montaignais bryoid taxon with numerous named types from the Boreal forest region of northeastern North America. The set of "life form" terms derived from Northwest peoples differs from the basic list discussed by Brown (1977) and others, perhaps, as Turner (1987) has pointed out, for ecological reasons[2]. In their environment, mosses and fungal fruiting bodies are prominent and perceptually salient, whereas vines, for example, are rare and not prominent in the landscape. Similarly, the prominence of berry bearing plants and their economic and cultural importance should perhaps not make it surprising that they should be recognized by a higher order taxon.

Atran (1985, 1990) recognizes that life forms have ecological relevance, and, indeed are still retained in scientific ecology. He comments that life forms occupy distinctive roles in "the economy of nature". However, some of his and Brown's (1977) comments regarding the fundamental nature of life forms, their perceptual salience and universal occurrence do not fit the Wet'suwet'en and some other cultures very well, as I will discuss below. Atran maintains that life forms are natural, rather than artificial categories, and, most importantly, that they:

> appear to partition the conceptual categories of living kinds... into a contrastive lexical field. The system of lexical markings at the life form level constitutes a *fundamentum divisionis*, that is, a logical partitioning of the category into features that are "positive and opposed" ... The opposition may be along a single perceptible dimension (e.g. size, stem habit, mode of locomotion, mode of reproduction) or simultaneously along several dimensions...
>
> Generics, however, do not form a contrastive semantic field....the partitioning of the local flora and fauna into generic groupings thus represents a *fundamentum relationis*, rather than *divisionis*. That is a relational segregation of organisma into well-formed configurations (Atran 1985:307-308).

According to Brown (1977), the first life form which will be recognized in a culture is "tree" ('large, upright woody plant') and it will be contrasted implicitly or explicitly with a term for herb (in the botanical sense) or "herb + grass" (GRERB) as Brown uses the term. I found that the word for "tree" is non-obvious in Wet'suwet'en. The word ***dicin*** which I finally learned could be translated as "tree", I had originally heard glossed as "stick" (not "wood" or firewood, as Brown 1977 indicates is frequent in other languages). ***Dicin*** applies to all woody stemmed plants with reasonably stout stems which are more than about waist high. As it includes both multiple stemmed and single stemmed forms, it includes many forms which would be distinguished as shrubs in English and other classification systems. Forms with thin or weak stems which are about waist high are included with "plants" ***-t'an,*** herbaceous forms such as wild strawberry or fireweed. ***-t'an*** is partially equivalent to Brown's GRERB class as it includes low growing and non-woody plants in apparent opposition to 'sticks' ***dicin***, but in contrast to his GRERB form actually includes neither grasses ***(tl'o)*** nor flowering herbs (***c'indek***), but does include a variety of smaller shrubs. That a cognitive opposition between woody and herbaceous forms on the order proposed by Brown may occur for Wet'suwet'en speakers is suggested by one interview. An elder, thinking aloud about what to call the problematic aster specimen, said (in English), "It isn't a wood, it's a grass..." (interview notes 7/23/92).

Intermediate Taxa

Without detailed systematic investigation of Wet'suwet'en plant classification, the existence of intermediate level taxa cannot be discussed in detail. Several possible intermediate level taxa may be present in Wet'suwet'en plant classification (Fig. VI-2). Prickly plants or "thistles" ***whis*** are spoken of as a group. These include devil's club (*Oplopanax horridum*)(the prototype ***whisco***, or simply ***whis***), prickly rose (*Rosa acicularis*), stinging nettle (*Urtica dioica*), the introduced weedy Canada thistle (*Cirsium arvense*), and perhaps ***whis mi'***, tentatively identified as *Ribes lacustre*. "We call all those thistles, rosebush, and so on. They're all ***whis***. The devil's club is ***whisco***. That is big ***whis***, big thorns." (interview notes 10/29/86). These plants are referred to in conversation as types of ***whis***, e.g. "The ***whis*** with the pink flower...***tselhghïl*** [prickly rose]." (interview notes 4/19/88), or "There is a ***whis*** that makes you itch. It's a green 'grass' on the hillside [stinging nettles, ***holhts'ic***]." (interview notes 10/14/87). Such a 'spiny' group is reported by Turner (1989) for the Nitinaht (Turner *et al.* 1983), Lillooet and for the Chilcotin, other British Columbia Indian groups. The Chilcotin use a cognate (***kwes***) of the Wet'suwet'en term to designate this group, which for them includes a species of prickly pear (*Opuntia*) but does not include devil's club (Turner 1989:98).

"Grass" ***tl'o***, discussed above, may be an intermediate taxon rather than a "life form". I have here diagrammed it (Fig. VI-2) as including ***tl'o***, the focal generic, and ***khikh c'it'an***, "horsetail", as a second generic.

A third potential intermediate taxon is "willow". People take care to distinguish several shrubs with generally similar ecological habitats and habit, including alders (*Alnus incana* and *A.crispa*), willows (*Salix* spp.), "red willow", or red-osier dogwood (*Cornus stolonifera*) and perhaps mountain-ash (*Sorbus scopulina*). Alder and willow as names are

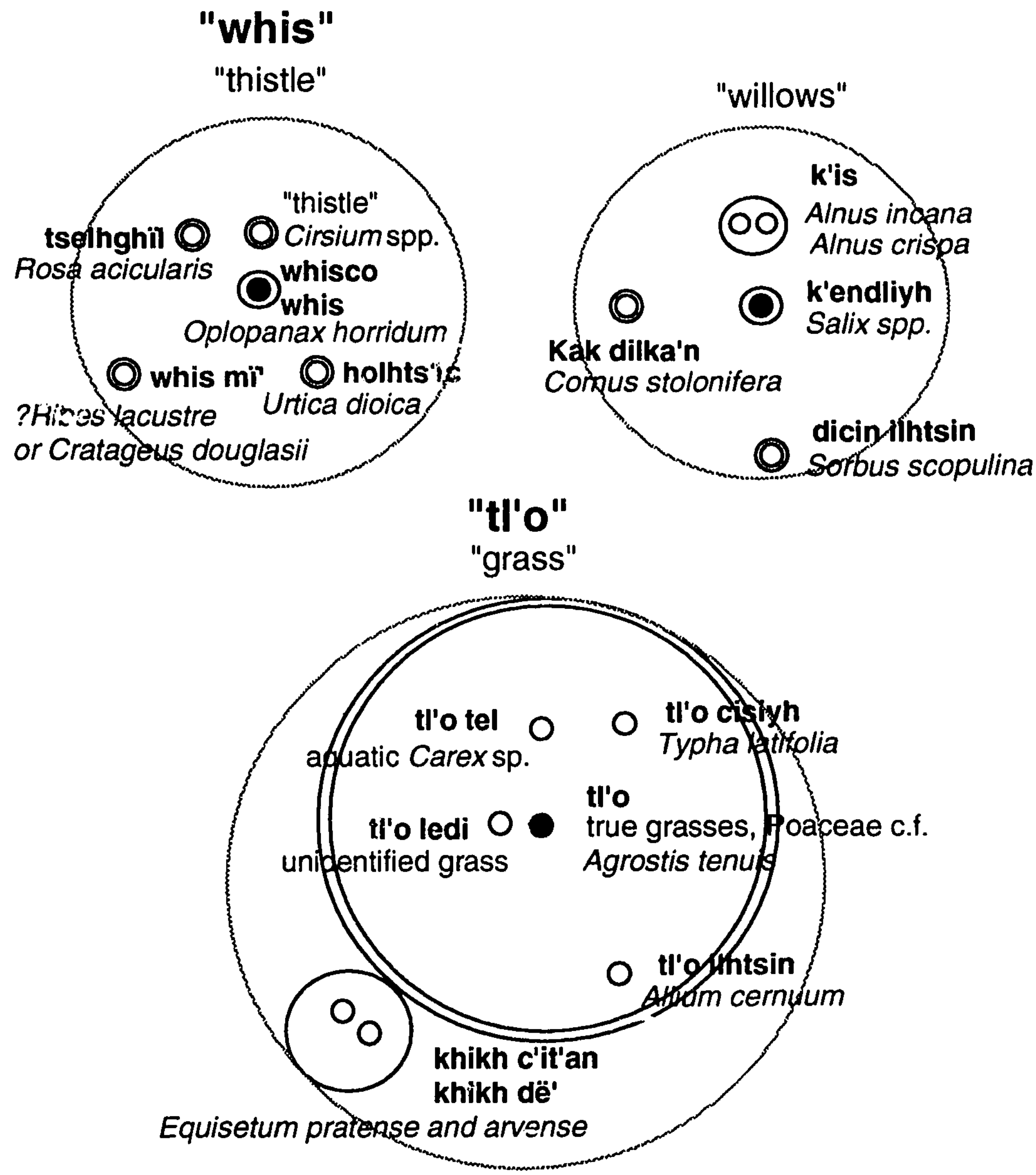

Figure VI-2 **Wet'suwet'en Intermediate Taxa**

- prototypic generic
- other generics
- scientific species

confused in English in terms of the species they refer to. Alder (*Alnus* spp.)***k'is*** is distinguished by its inner bark which turns red when peeled, and was used as a dye. Willow (*Salix* spp.) inner bark ***këltay*** remains white and is strong. This was used for cordage. When red-osier (*Cornus stolonifera*) is discussed for medicine, it is generally referred to as ***kak dilk'i'n*** (referring to its red colour). It may also be called ***k'ëntsec***, which is similar to or identical to the term for a willow bush (***k'endliyh***), when discussing its use for basketry. One elder also took care to contrast mountain-ash (*Sorbus scopulina*), from "willow" by bark characters. This is another plant whose bark is medicinal. It differs from "willow" by the glossiness of the bark, and by its strong, distinctive smell. This may be a functional grouping in that all of these shrubs of similar stature are utilised for bark resources in the dormant season when they are leafless. As their properties and uses are not interchangeable, it is necessary to carefully observe and contrast their stem and bark characters to avoid collecting the wrong type of bark.

Other possible intermediate groupings include a 'kinnikinnik and relatives' group, containing kinnikinnik (***dinih***) and bunchberry, and possibly 'wintergreens' (*Pyrola* spp., *Orthilia secunda* and *Chimaphila* spp. These are relatively similar low growing ground plants which retain green leaves all year, though they contrast in that only the first two produce edible fruits. At least bunchberry seems to be named in coordinate fashion to kinnikinnik, and Priscilla Kari's word list suggests that a species of *Pyrola* (not determined) is also called ***dinih yez***. Turner (1989:76) has found evidence of a kinnikinnik and relatives grouping including kinnikinnik, wintergreens, false box, and twinflower among the Thompson. The Gitksan may also have such a group. Kinnikinnik is called ***sk̲an timi'it*** in Gitksan. A wintergreen, *Orthilia secunda*, was identified by one elder as ***his sk̲an timi'it*** 'resembling kinnikinnik' (interview notes 9/8/87).

The last proposed intermediate taxon is a possible "poisonous plants" grouping. Two plants were spontaneously volunteered after a discussion of edible plants, as poisonous plants: ***dinize kos*** (*Delphinium glauca* or possibly water hemlock) and ***honcakyu*** (identity unknown). The false hellebore plant, ***konye*** , is always mentioned as poisonous as well, and might be affiliated with such a grouping.

More systematic data collection would clarify the existence and membership of these and other intermediate taxa among the Wet'suwet'en. Turner (1989) finds evidence of a large number of intermediate plant groupings based on a variety of morphological and utilitarian criteria. The Wet'suwet'en intermediate taxa proposed in the present study are based on similar habit, possession of spines or stinging hairs, and possibly on recognition of human toxicity. Turner's data (1989) suggests there might be a number of such intermediate plant groupings, which would serve to order the plant domain for Wet'suwet'en native speakers as the groupings she has documented do for a variety of other Indian groups in British Columbia.

Discussion: Utilitarian Factors

Brown (1977, 1985), Berlin and his colleagues (1973 and 1992), and Atran (1985, 1990) consistently argue for divorcing ethnobiological taxonomy from utilitarian characteristics of biological species, and argue that "general purpose" (more or less purely morphological or perceptually based classifications of biota) taxonomies can be meaningfully elucidated in human cultures which are separate from various "special purpose" classifications such as the uses of biological species for food, medicine or in symbolic systems. Other authors have argued that, while these "general purpose" taxonomies may be elicited, these classifications of the biological world may not reflect what is culturally relevant or significant (Randall 1976, 1985; Morris 1984, Hunn 1982).

> ... although we can accept that there is no necessary one-to-one relationship between utility and nomenclature, nevertheless it is important to recognize that functional criteria are intrinsically linked to taxonomic ordering. As I have tried to indicate above, many Chewa life-form categories cannot be understood in purely morphological terms, and functional categories ... also have a taxonomic relevance. Ethnoscientists have recognised that cultural significance has salience in the differentiations of folk generics...and they have recognized that functional categories exist, although these are seen rather misleadingly as non-taxonomic groupings (cf. Hays 1979:257). But a true understanding of the nature of folk classifications, both in a culturally specific context and in terms of the evolution–the 'encoding sequence'–of life form categories demands that we incorporate into the analysis functional criteria. As anthropologists we should be concerned with systematically exploring the relationship between folk classifications and other aspects of cultural life. To view folk taxonomies simply

> as taxonomies, abstracted from utilitarian, ecological and cultural concerns, limits our understanding of how human groups related [sic] to the natural world (Morris 1984:58-59).

> ...Brown arbitrarily restricts his [life form] analysis to a small set of folk biological concepts prejudged to be universal....Consequently, we are left in ignorance of the welter of utilitarian and ecologically defined suprageneric taxa which most peoples rely on to organize their knowledge of the natural world....Sahaptin conversation is full of reference to such general classes of plants as *xnit* 'foods which are dug' and *tmaanit* 'foods which are picked' (Hunn 1982:839).

The argument has involved both the presumed actual structures involved in storage and retrieval of relevant information regarding plant identity, and issues such as what is legitimately a taxonomy (c.f Wierzbicka 1984), versus other types of classification.

> This intrusion of practical considerations into the referential meaning of life forms is also anomolous from the taxonomic perspective in that it divides species that exhibit strong morphological resemblences while uniting others that are morphologically dissimilar (Hunn 1982:838).

Issues such as transitivity (Waddy 1982, Randall 1976, 1985), and whether classification and perception of 'living kinds' differ in a fundamental way from other cultural artifacts (Atran 1985, 1990) are also involved.

> ...Atran argues that functional attributes cease to be of taxonomic importance. It is possible to make this statement true trivially by definition: taxonomies involve the classification of living kinds, which are defined exclusively by their *perceptual form* (cf Wierzbicka 1984:36). Therefore, use is of no taxonomic importance. The problem with this approach, however, is that no evidence is offered to show that taxonomies, so defined, are of any behavioral importance in everyday discourse or thought (Randall 1987:144).

> Berlin suggests that a life-form generally contains a fairly large number of named subdivisions. However, the internal differentiation of a taxon may not correlate with the salience that taxon has in local thinking....
> A second difficulty with the concept of "life form" is that some taxonomic categories of this general order do not in fact coincide neatly with obviously distinctive groups of fauna or flora...Here the polysemous nature of terms applied in many languages to certain taxa which would appear to contitute legitimate "life forms"...suggests that these taxa may be defined as much by cultural evaluation (technological utilisation, dietary and culinary status, economic and ritual significance) as by their objective biological characteristics (Bulmer 1974:23).

In contrast, Atran (1990) suggests that children spontaneously form natural object concepts including life forms and generics when learning language by a special cognitive process, not by learning the potential uses of plants and animals. Therefore he believes that ethnobiological classification is fundamentally separate from utilitarian factors.

My experience suggests that in families which engage directly in subsistence activities, children learn the economic and utility aspects of plants as soon as they become aware of the plant world at all. I know that my own daughter began to learn about edible and poisonous plants as soon as she was mobile. Sentences such as these might be spoken to toddlers as part of this type of learning: "Yes, you can pick that berry. That's a raspberry. No don't pick those [baneberries, an attractive red berry in the buttercup family]. Those are poison." Or, "That's a toadstool. Don't touch it." Or, "Pick the puffballs. Leave those other ones alone. Just the puffballs that are white inside. These [coloured ones] are no good."

Similarly, Wet'suwet'en children would be told which berries to pick (and which to avoid) in the normal course of growing up, and they are encouraged to pick berries when young.

Johns (1990) suggests that there is a time period after weaning when young children are particularly receptive to learning new foods, and are most likely to sample different plants in their environment. This leads to a peak in accidental poisonings of young toddlers, but might also make children of this age very impressionable regarding the potential edibility of plants in the environment if they are in contact with the plant world and are among adults who regularly harvest plants for food. Therefore, at the point in a child's life where he/she is learning the names of things in his/her environment, he/she will also be learning the uses of plants.

It is true that not all types of use are likely to be learned equally early, nor, indeed, by all members of a given society (cf. the study of Tzeltal children's ethnobotanical knowledge by Stross 1973, cited in Berlin 1992). Medicinal uses of plants may be learned much later, and may involve specialisation of skills and knowledge. Important edible and poisonous plants, however, are likely to be learned by children, concurrently with their use or avoidance, as soon as they are mobile and can talk.

Therefore, I argue that utility of plants may well be incorporated into classification schemes for plants, and that "foods" or "economic plants" may not be separated from the basic taxonomy for plants. There is evidence from several authors (Turner 1987, Hunn 1982, Hunn and French 1984, Gottesfeld, unpublished notes) that this is a general factor in plant taxonomies of northwest North America. This is particularly prominant at the "life form" level, where both Turner (1987), and Randall and Hunn (1984) have argued for the existence of a berry/edible fruit "life form". My own evidence suggests the existence of such a taxon in Wet'suwet'en (discussed here) and in Gitksan of northwest British Columbia (Gottesfeld, unpublished notes). Clément (1990) also describes a similar "life form" system for the Montaignais in northeastern Canada. Further afield, Morris (1984) argues that for the Chewa of Malawi, neither plant nor animal major groupings can be defined on morphological features alone, but are not comprehensible without awareness of cultural values and utilitarian factors.

Even some of the data presented by Brown (1987) support the importance of utilitarian factors and ecological and cultural differences in conception in the definition of major plant groupings. The Zuni he interprets to have but one legitimate life form, 'tree'. Their 'grass' taxon is "empty" in the sense of Turner (1974, 1987), containing no contrast sets at the generic level; their 'herb' taxon implies medicinal plants and so has a utilitarian component; while their "bush" taxon implies clumped plants which are deciduous, so is more restricted in reference than Brown's focal "bush" life form (Brown 1977:323).

Some features of naming of edible or cultivated plants versus non-utilised or wild plants by Amazonian peoples can also be interpreted as coding utility within the plant taxonomy. The Ka'apor label folk generics which are wild or unutilized forms with an animal name coupled to the name of a cultivated form (Balée 1989). Sometimes these are cultivated and wild species of the same scientific genera, though not seen as folk species of a folk generic; other times the plants are not related in the scientific taxonomy. In addition, as with a number of cultures (cf. Hunn 1982), traditionally cultivated plants *are not included in the life forms*, whereas even related non-cultivated forms of the same scientific genus are classified within life form terms, clearly showing a utilitarian component (in a negative sense) to "life form" terms for the Ka'apor (Balée 1989).

A feature of Northwest taxonomies I have dealt with which intrigues me is the direct coding of utility in some tree species. In Gitksan, the names of many tree species mean "good for________." The name for the cottonwood (*Populus balsamifera* ssp. *trichocarpa*) is ***am mal*** [4] which means "good for canoe". The name for western red cedar is either ***sim gan*** (real wood or tree) or ***am hadatl'*** (good for cedarbark). In Wet'suwet'en, the cottonwood is simply called ***ts'iy***, 'canoe', and maple (*Acer glabrum* var. *douglasii*) ***'ayh*** 'snowshoe'. Turner (1987) reports several such examples from Lillooet including 'digging stick plant' for ocean spray (*Holodiscus discolor*) and 'bitter cherry bark' for bitter cherry (*Prunus emarginata*).

Indirect coding of utility comparable to the Ka'apor example may be seen in the names for black twinberry (*Lonicera involucrata*) and snowberry (*Symphoricarpos albus*) (named for their colours and habit in English). The names in Wet'suwet'en are ***sis mi' cin*** and ***c'itsit mi' cin***, literally, 'bear berry bush', and 'grouse berry bush'. Neither of these fruits is considered edible, though they are used for medicine; their names set them apart from edible fruits by the inclusion of the animal name. That is, these are not for people. These are the bear's berries, or the grouse's berries. In Gitksan, black twinberry is called 'raven's berry' ***skan maya gaak*** and is not eaten either (Gottesfeld unpublished notes).

Incorporation of economic or utilitarian factors into basic classification may be less true of animals (e.g. mammals and birds) which are animate actors and often treated as "persons" in the cosmology of traditional peoples, although Morris (1984) and Randall (1987) suggest that even with animal groupings, utility may be important. Perhaps because of their intrinsic nature as mobile creatures, and perhaps because of our own primate nature, they have different perceptual salience to us and may be classified and named in a different way by most cultures. Many of Berlin's (1992) arguments against the incorporation of utilitarian factors in basic ethnobiological classification revolve around his discussions of ethnozoological classification and nomenclature, and therefore may not be pertinent to classification of plants.

Shallowness of hierarchy

The uneven development of life form taxa with "empty" residual classes, and overlapping membership, coupled with the irregular presence of intermediate taxa and the rarity of folk specifics creates a shallow and weakly developed hierarchic structure in Wet'suwet'en ethnobotanical classification. This situation has been reported for other folk biological classification systems such as the Sahaptin (Hunn and French 1984). Turner, describing the overall ethnobotanical classification systems of the Thompson and Lillooet Indians of British Columbia was moved to remark:

> A number of the major categories are at least partially defined by utilitarian, rather than solely morphological features. These categories are not necessarily mutually exclusive. Most are residual, having a few highly salient named terminal taxa and many recognizably distinct, but unnamed, members. Most of the named taxa have, or had in the past, a high level of cultural significance, particularly as foods [technological] materials or medicines (1987:77).

Had she confined her analysis to taxa which did not overlap and were based only on morphological and perceptual differences, she would have missed much of the structuring of the botanical domain by speakers of these languages. Although loose hierarchy is apparent in the taxonomies of these groups, the structure is much more fluid and less systematic than the classic hierarchical structure idealized by Berlin *et al.* (1973). In a later paper investigating intermediate level groupings, Turner comments:

> Hunn (1982), Randall (1976) and other researchers...have presented data that contradict or at least render less certain the contentions of Berlin and his colleagues that ranked, hierarchical folk biological classifications systems based on perception of overall morphological similarities are universal and are the only valid framework for folk taxonomies. Classes based on utilitarian features, and relationships through affiliation, association and "sphere of influence" rather than stringent hierarchical inclusion are perceived by many researchers to play a significant role in folk biotaxonomies. ...data presented in this study supports the views of Hunn (1976, 1982) and others that relationships based on affiliation and utility are important components of plant classification systems (1989:71).

Morris suggests that even in the original studies of Berlin and his colleagues, the degree of hierarchy in the ethnobotanical classifications studied was not great:

> But folk taxonomic hierarchies are relatively shallow and the term hierarchy is almost a misnomer when one considers, for instance, that about 20% of Tseltal plant categories are unaffiliated to any life-form taxa, and some 85% of genera are monotypic (1984:53).

In Wet'suwet'en ethnobotanical classification, hierarchy is weakly developed, and relationships between taxa based on inclusive relationships is poorly developed. Only one folk generic with several named subordinate species has been described to date. The postulated major life forms may overlap, as ***mï'*** with ***di***[illegible] and ***-t'an***. Intermediate groups appear to exist, but their relationship [illegible] form taxa is not yet clear. Prototypy seems applicable to three of the postulated five intermediate groups described. The "coordination" model of Hunn and French (1984) may better describe the ethnobotanical classification of the Wet'suwet'en than hierchical relations, in that folk generics may be seen to form clusters or groups based on affiliation rather than inclusion.

Nomenclature

The majority of generics and life form terms are unanalyzable primary lexemes. Examples include words like ***ts'o*** 'spruce', ***tl'o*** 'grass', ***cindu*** 'pine', and ***konye*** 'Indian hellebore'. Other generics are descriptive like ***lhighah*** 'close together' for saskatoons which have berries in clusters, or ***dicin ilhtsin*** 'stink wood' for mountain-ash which has a very characteristic bitter almond odor when the bark is cut. Verbal forms, a stem plus verb, also form names in Athapaskan languages. ***Holhts'ic*** 'nettles', literally, 'it pricks" (Morice 1932), is an example of a verbal plant name. Some terms are descriptive phrases such as ***cinic hikh***"wood torn down", a synonym for mountain-ash, or ***yinti dilk'i'n*** "red on the ground" for wild strawberries.

A small group of plant names are polysemous with the objects made from or derived from the tree, such as ***'ayh*** 'snowshoes' for Douglas maple, ***ts'iy*** 'canoe' for the cottonwood, and ***k'iy*** 'birchbark' (important for basketry and other uses) for the birch tree.

Another distinctive group of plant names contain animal names. ***Sis mi' cin*** and ***c'itsit mi' cin***, black twinberry and snowberry, are berry bearing shrubs whose fruits are not eaten, but their barks are used for medicine. I speculate that the animal names included in their names may signal that these berries are not edible. Turner (1975) reports that the Nuxalkmc (Bella Coola) of northwest B.C. call devil's club 'grizzly bear's highbush cranberry'. It likewise is a shrub which bears prominent berries which are not edible, but whose bark is used for medicine. The Gitksan also have a couple of berry names for non-edible berries which contain the names of animals[6]. ***Skan maya gaak*** 'raven's berry plant' is the Gitksan term for black twinberry, used for medicine, while ***maya smex*** ('bear's berry') has been applied to Queen's cup or beadlily, *Clintonia uniflora*, which is regarded as poisonous (Gottesfeld unpublished field notes 1992). The leaves of the yellow pond lily and the introduced weed *Plantago lanceolata*, broad-leaved plantain, are called ***dilkw'akh nilhdic*** 'frog blanket'. Both are medicinal plants with similar clusters of round leaves (though of vastly different size and habitat!).

Animal names are used by other groups to indicate the status of plants. The Ka'apor of Brazil contrast wild forms from cultivated forms by analogic use of animal names ecologically associated with the wild species coupled with the name of a cultivated taxon (usually not closely related to the species being named) (Balée 1989). The Chewa of Malawi use animal names to signal the inedible or dubious status of mushrooms (Morris 1984).

Finally, about 11% of the plant generic and specific names collected are loanwords from Gitksan, a Tsimshian language spoken by the Gitksan who live immediately north and west of the Wet'suwet'en, and with whom the Wet'suwet'en have had long contact (Mills n.d.)[7]. Wet'suwet'en plant names which are apparently Gitksan in origin include the name for the red cedar and for cedar bark, and possibly the name for pine 'cambium' (Table VI-4). It is tempting to speculate that the names for these plants, and/or perhaps the uses, [illegible] learned from the Gitksan. This might be expected for the red cedar, which does not grow in areas occupied by Athapaskan speakers except for the now extinct Tsetsaut and the northwestern corner of the territory of the Wet'suwet'en, while it is very abundant in the territory occupied by Tsimshian speakers, and by the Gitksan.

The situation with pine 'cambium' could be the reverse situation, with the Gitksan having learned of the use and harvesting of the edible 'cambium' from the upriver dwelling Wet'suwet'en when they migrated into the area in the distant past. The Carrier word for pine 'cambium' or "sap" ***k'unih'*** is a cognate of the Wet'suwet'en ***k'inïh.*** The Gitksan word is ***gan hix*** or ***ganix***, obviously the same form. There is no Coast Tsimshian term for pine 'cambium' as it is not a harvestable food source on the coast. However, the situation may be less clear than that, as discussed below, and the name borrowing could be from Gitksan to Wet'suwet'en as with the term for fireweed

Although ***khëlht'ats***, the Wet'suwet'en word for yellow pond lily, is the same word as the Gitksan ***gahldaats***, the direction of borrowing is probably from Wet'suwet'en. The Central Carrier word for the yellow pond lily, ***khe'ht'az***, and the Dena'ina name for yellow pond lily rootstock, ***qalt'ats'a***", are also cognates of the Wet'suwet'en term, suggesting that this term has a general Athabaskan root. The fact that the Coast Tsimshian name, ***onxt***, " is not a cognate of the Gitksan name also corroborates this interpretation.

A similar situation is found with the name for fireweed, where the Gitksan word ***haast***, the Wet'suwet'en word, ***khas*** or ***khas t'an***, and the Carrier word ***khas*** are all the same word. The Niska'a and Tsimshian names, ***haast***, however, are also cognates (Rigsby and Kari n.d.), where the names in Tenaina are completely different, suggesting in this case the origin of the term in Tsimshian languages. This hypothesis is supported by Bruce Rigsby (personal communication) who also believes that this term originates in the Tsimshian languages.

The language of origin of some shared words for plants or plant parts is not immediately obvious. The Wet'suwet'en word for hemlock 'cambium' is ***misdzu***, which could be related to the Gitksan terms ***maas*** (bark) and ***xsuu'uu*** (hemlock 'cambium'). All Wet'suwet'en speakers who discussed hemlock 'cambium' as a food mentioned that it was learned about or obtained in trade from Gitksan or Tsimshian people. One elder stated that the name ***misdzu*** was from the Skeena language. The Carrier term for hemlock tree reported by Morice (1932) is also ***mesdzu***". However, ***musdzo,*** an obviously related term, is the word for the inner bark of all kinds of trees in Central Carrier, which may indicate that this word is not derived from Gitksan. Two Wet'suwet'en speakers referred to spruce bark as ***ts'amisdzu***, which would suggest some use of ***misdzu*** as a general term for tree inner bark by the Wet'suwet'en as well.

The shared plant type word ***mi'*** 'berry' is also obscure in its origins. It appears that the word ***mi'*** for berries is used widely in both the Gitksan and Wet'suwet'en languages, and is also used in the Niska'a dialect (a Tsimshian language spoken to the west of the Gitksan area) (McNeary n.d.). The Central Carrier dialect, which is spoken to the east of the study area, uses the related word ***mai*** for berries (Antoine *et al.* 1974). Words with ***mi'*** in Wet'suwet'en have ***mai*** in Central Carrier. ***Maa'y*** is also a word for berry in Gitksan, Niska'a and Tsimshian. Gillian Story hypothesizes that the word may derive from Tsimshianic, because the initial /m/ is not likely from a Proto Athapaskan root (personal communication 1992). Wet'suwet'en has another unrelated word as a general term for berry, ***nit'ay***, 'it ripens' (Gillian Story, personal communication 1992), which is clearly Athapaskan in origin (Jim Kari personal communication).

The origin of the word ***gan*** to mean wood or tree is also obscure. One could easily infer a Tsimshianic origin as this term is widely distributed in Gitksan, Niska'a and Coast Tsimshian. The only occurrences of this form in Wet'suwet'en I have discovered where this meaning is pertinent are in the terms for red cedar [***simggin***] and pine cambium [***k'inïh***], where both words are obvious cognates of the Gitksan [***sim gan*** and ***gan hix***], and a personal name ***Hlo'omgan***, translated as timber avalanche, which was stated to be of the Skeena language. However, the term for "stick" in Wet'suwet'en is **dicin** and this word, or the "***-cin***" portion of it, occurs in a number of plant names. It is possible that this root could be related to the Gitksan ***gan***. If key terms like ***gan hix*** in Gitksan are derived from ***k'inïh***, then ***gan*** may also be derived from ***-cin.*** Alternatively, both ***-cin*** and ***dicin*** could be derived from Tsimshianic languages via Gitksan. This area needs further research. The word for "wood" in Wet'suwet'en is ***tsiz***, as it is in Central Carrier. This is obviously unrelated to the Gitksan ***gan*** 'wood'.

Synonymy occurs for Wet'suwet'en plant taxa, but the meaning of this is not clear. Nine generics in total were labelled by more than one term. For two of these, the speaker was bilingual in Wet'suwet'en and Gitksan, and may have inadvertantly adopted the Gitksan stems for two plants, while adding Wet'suwet'en endings. These forms were stable for this informant, because they were first collected by Priscilla Kari in 1978 and repeated to me in 1992. A certain number of generic taxa were consistently referred to by more than one name, especially red-osier dogwood, *Cornus stolonifera* (two distinct terms and several variants of the first term), mountain-ash *Sorbus scopulina* (three terms encountered), bunchberry *Cornus canadensis* (three terms collected), birch (two unrelated terms used) and cinder conk (two unrelated terms used) . The names for horsetail, diaper moss and strawberries appear to be conceptually related, and are perhaps better treated as variants of the same name. Similarly, devil's club can be called ***whis***, an an unmarked prototype of the "***whis***" taxon, or can be distinguished as ***whisco***, 'big thorn'.

Conclusions

Although my studies have not been exhaustive, plants named by the Wet'suwet'en appear to be primarily those of high utility, and/or ecological and perceptual salience. I have collected the names of 75 taxa which cover the mid to low elevation flora of the Bulkley River drainage, where the Wet'suwet'en with whom I have worked primarily have lived and carried out traditional hunting, trapping, fishing, berry picking and other subsistence activities. Alpine plants have not been investigated in any depth, partly for logistical reasons, and partly because the alpine zone does not appear to have been an important locus of traditional Wet'suwet'en subsistence activities involving plants, although certain seasonal hunting (see Chapters 2 and 3) did take place in the alpine. There are certainly more than 75 vascular, fungal and moss biological species found in the Bulkley Valley and surrounding area. Not all of these appear to have been named by the Wet'suwet'en, although many types of low salience and economic importance are probably subsumed in 'grass' and 'flower' . Some, at least by modern Wet'suwet'en, are simply unnamed. This is similar to the pattern reported for other foraging peoples such as the Sahaptin (Hunn 1982) of the Columbia Plateau, who name 213 vascular taxa of the approximately 2000 vascular plant species which occur in their traditional territory, or approximately 10%.

Plants which are named include all tree species (in the English sense), most large shrubs, plants which produce edible fruit, plants which are used for medicine, plants which are eaten, plants which have technological uses, and poisonous plants. Underdifferentiation is characteristic of vascular plant groups like grasses, sedges and rushes, small herbaceous plants, and wildflowers. Mosses and fungi are also underdifferentiated, having generally low salience and utility, and are subsumed in two "empty" life forms. One folk taxon of moss ***yin tla yil***, or simply ***yin***, 'diaper moss', is differentiated because of its functional importance. This utilitarian taxon may include diverse moss species including several "feather mosses" of the forest floor along with a pale type of moss, probably a sphagnum, which grows in "swamps". Fungi in general are lumped as ***c'ebedzik***. A single type of technological and medicinal use is called either ***dic'ah c'i...*** '...burl' or ***tl'eyhtsë***, 'fire carrying fungus'. Whether it is considered a ***...bedzik*** has not been determined. Similarly, the position of ... 'black tree moss', a conspicuous arboreal hairlike lichen used as ti...r, with reference to more inclusive classes has not been determined.

Major plant classes or "life forms" include utilitarian factors in their definition. Most conspicuously this applies to the 'berry' group, but it is a factor in other groupings such as ***dicin*** 'stick' or 'tree' as well. Wet'suwet'en classification is similar to the classifications of the Thompson and Lillooet (Turner 1987) and other Northwest North American Indian groups. Wet'suwet'en classification contains taxa which seem primarily morphological, and some which are strongly utilitarian. "Empty" or monogeneric "life forms" are found among the major plant categories, i.e. 'grass', 'moss', 'mushroom', and 'flower'. Hierarchical organization is shallow, and higher level taxa are not mutually exclusive, but may cross cut one another, a situation also reported by Hunn (1982), Randall and Hunn (1984) and Turner (1987, 1989).

My findings regarding Wet'suwet'en plant nomenclature and classification may be influenced by selective loss of detail of less salient or economically important plants as a corollary of extensive changes in life style and culture contact in the past 100 years. Berlin (1992) and Waddy (1982) suggest that the low level of specific taxa could be caused by this type of cultural erosion, though Hunn argues cogently that this is unlikely for the Sahaptin (1982). Memory ethnography introduces some biases; elders sometimes report they don't know, or can't remember the name of a specific plant, or what plant was used for a particular purpose, that their grandmother would have known. It is possible, for example, that some conspicuous shrubs of no known utility such as *Spirea* were named in the past, and that some of the 'wildflowers' once had specific names. However, Morris (1984) in a traditional Malawian population reports that conspicuous flowers without uses are neither named nor apparently recognized, so this may not be an artifact of information loss. Sometimes errors in plant reference can be detected which derive from learning of plant names and uses only from hearsay, without having had the experience of gathering the plants in question. Such inaccuracies cannot be corrected if no elders remain who have been shown the correct plants or gathered them themselves.

Nomenclature patterns of the Wet'suwet'en seem consistent with other foraging peoples in the high proportion of names which are primary lexemes, and the low level of folk specific differentiation. This is true even when congeners in the scientific taxonomy are found in the local flora such as the species of *Rubus* or the two species of *Picea*. Names may be unanalysable, descriptive, named with reference to other taxa (coordinate), or loanwords. This last class is not frequently described for other groups between indigenous languages.

The significant number of plant terms shared with the neighbouring Tsimshian speaking Gitksan is noteworthy and appears to relate to the particular culture history of the Wet'suwet'en. Most terms appear to have been borrowed into Wet'suwet'en from Gitksan, but at least one term appears to have gone in the opposite direction. No clear picture emerges of the distribution and ecology of plants whose names are borrowed, except for cedar/cedarbark, red elderberry and crabapple, which have geographic distributions which center on the coast. Another aspect of this linguistic borrowing is the presence of bilingual informants and Wet'suwet'en people with recent Gitksan ancestry, who I hypothesize may add new loanword forms. ***Scanistles***, ***milks***, ***gale'endik*** and ***misko'o t'an*** are terms I have collected whose occurrence is complicated by these factors.

The significance of loanwords in Wet'suwet'en is unclear. As mentioned in Chapter 2, loanwords include plant and animal terms, chiefly titles, and terms pertaining to the clan system, regalia and feasthall. Turner (1974) reports a similar occurrence of loanwords of Bella Bella origin in Bella Coola for plant names (Nuxal , and Rigsby and Kari (1987) and Turner (1974) document botanical loanwords in northwestern British Columbia between Tsimshian, Haida, and Tlingit. As plant foods were trade items among these groups and also prominent in the feasthall, it is possible that the occurrence of plant loanwords reflects the shared heritage of trade and mutual feasting in the Northwest Coast area.

Table VI-1

Wet'suwet'en Plant Taxa

Plant Species	English Name	Wet'suwet'en Name †	Life form
Abies [illegible]	subalpine fir	ts'o tsin	dicin
Acer [illegible] var. douglasii	Douglas maple	'ayh	dicin
Achillea millefolium	yarrow	bi'il yesone	
Agrostis tenuis	red top	tl'o	tl'o?
Alectoria or Bryoria spp.	"black tree moss"	dikhgho	
Allium cernuum	nodding onion	tl'o ilhtsin	tl'o?
Alnus spp	alder	k'is	dicin
Amelanchier alnifolium	saskatoon berry	lhighah	dicin, mi'
Apocynum androsimaefolium	spreading dogbane	lekh, c'indeklh	
Aquilegia formosa	red columbine	lesokh	
Aralia nudicaulis	wild sarsparilla	scanistles	
Arctostaphylos uva-ursi	kinnikinik	dinïh	mi'
Arnica cordifolia	heart-leaved arnica	dïtnic kwi'n	
Betula papyrifera	paper birch	k'iy, dilï	dicin
Carex sp.	sedge	tl'ogh t'el, tl'o t'el tlo	tl'o?
Cicuta douglasii? or Delphinium glauca? #	?water hemlock	dinize cos	
Cornus canadensis	bunchberry	dinih yez, cin'iyht'an	-t'an, mi'
Cornus stolonifera	red osier dogwood	kak dilk'i'n, wikak dilk'a'n, k'öntsoc	dicin
Corylus cornuta	beaked hazelnut	tsalik gg'a kun'	dicin
Crataegus douglasii ? # or Ribes lacustre?	black hawthorne	whis mi'	dicin, mi'
Dryopteris expansa	spiny woodfern	diyï'n	
Epilobium angustifolium	fireweed	khas t'an	-t'an
Equisetum arvense/pratense	horsetail	khikh de', khikh ci'dan	?tl'o
Equisetum hyemale	scouring rush	lawzi	
Fragaria virginiana	wild strawberry	yinti dilk'i'n	-t'an, mi'
Fritillaria camschatcensis	chocolate lily	c'inkalh	
Geum macrophyllum	large-leaved avens	ilk'it bin	
Heracleum lanatum	cow parsnip	[illegible]us	
Inonotus obliquus	cinder conk	[illegible]'ah c'ists'o', tl'eyh[illegible]	
Juniperus communis	common juniper	[illegible]san	
Juniperus scopulorum	Rocky mountain juniper	[name not recalled]	dicin
Lathrys nevadensis	peavine	[illegible]dis	
Ledum groenlandicum	Labrador tea	[illegible]	
Lonicera involucrata	black twinberry	sis mï' cin	dicin, mi'?
Lycopodium selago?	?fir clubmoss	hadic	
Lysichiton americanum	skunk cabbage	c'it'an co	
Nuphar polysepalum	yellow pond lily	khëlht'ats, dilkw'akh nelhdic (leaves)	
Oplopanax horridum	devil's club	whis, whis co	
Picea engelmanii x glauca	spruce	ts'o	dicin
Picea mariana	black spruce	nedus*, ts'o, ts'o diz	dicin
Pinus contorta	lodgepole pine	cindu	dicin
Plantago major	broad-leaved plantain	dilkw'akh nelhdic	
Poaceae, indet.	grass (not determined)	tl'o ledi	tl'o?
Populus tremuloides	trembling aspen	t'ighis	dicin
Populus trichocarpa	black cottonwood	ts'iy	dicin
Prunus ?virginiana	'red cherry', chokecherry	snou'	dicin, mi'
Prunus pennsylvanica	bird cherry	smïts'ok	dicin, mi'
Pyrus fuscus	Pacific crabapple	milks	dicin, mi'
Ribes oxyacanthoides	northern gooseberry	c'indewizgï	mi'
Ribes triste?	'wild red currant'	k'iy ditigï	mi'
Ribes?lacustre	'wild black currant'	dilkw'akh mi'	mi'
Rosa acicularis	prickly rose	tselhghïl	-t'an, mi'
Rubus idaeus	red raspberry	biyolhggok	mi'
Rubus parviflorus	thimbleberry	dik dïnkay	-t'an, mi'
Rubus spectabilis	salmonberry	misggile'n	mi'
Salix spp.	willow	k'endliyh	dicin
Sambucus racemosa	red elderberry	luts dicin	dicin
Sedum divergens	stonecrop	tsë mï'	mi'
Shepherdia canadensis	soapberry	niwis	mi'
Sium suave? #	water parsnip?	sas co	
Sorbus scopulina	mountain ash	dicin ilhtsin, honca ts'iy cin	dicin
Sphagnum sp.	sphagnum moss	yintl'akh yil, yin yil	yin?
Symphoricarpos albus	snowberry	c'itsit mï' , c'itsit mï' cin	dicin, mi'?
Thuja plicata	western red cedar	singgin, het'el	dicin
Tsuga heterophylla	western hemlock	misdzu	dicin

Appendix VI-1, cont.

Plant Species	English Name	Wet'suwet'en Name †	Life form
Typha latifolia	cattail	tl'ogh cisiyh*	tl'o?
Urtica dioica	stinging nettle	holhts'ic	
Vaccinium caespitosum	low-bush blueberry	yintimī'	mi'
Vaccinium membranaceum	black huckleberry	digï	mi'
Vaccinium ovalifolium	high-bush blueberry	dïndze	mi'
Vaccinium oxycoccus	bog cranberry	mī'o	mi'
Veratrum viride	Indian hellebore	konye	–t'an
Viburnum edule	highbush cranberry	tsalhtsë	mi'
unidentified fern? from swamp		dimuh t'an	–t'an
fern	lady fern, spiny woodfern	[name not collected]	
Fungi, general	mushroom, fungus	c'ebedzik	c'ebedzik
	'flower', wildflower	c'indek	c'indek
Mosses, general	moss	yin	yin

† orthography using modified Hildebrandt system; mostly after Sharon Hargus
*name from Hagwilget-Moricetown Carrier Plant List, Priscilla Kari, 1978
ID from Hagwilget-Moricetown Carrier Plant List, Prisculla Kari 1978

Table VI-2
Wet'suwet'en Major Plant Categories

Wet'suwet'en Plant Category	Approximate English Gloss	"Empty"
Dicin	'tree', large woody plant	no
C'i't'an, -t'an	'plant', small shrubs and herbs	no
Mï' or ***nit'ay***	'berry', shrubs or low plants with berries; focussed on edible fruits [not exclusive of ***dicin*** or ***-t'an***]	no
C'indek	'flower', herbs with conspicuous flowers	yes
?***Tl'o***	'grass', graminoid plants	yes
Yin	'moss', includes true mosses	yes
C'ebedzik	'mushroom', fruiting bodies of fungi including 'mushrooms' and bracket fungi	yes

Table VI-3
Wet'suwet'en 'Berries'

English name/ Scientific Name	Wet'suwet'en Name	Other "Life Form"*
Saskatoon	***lhighah***	***dicin***
Amelanchier alnifolia		
Kinnikinnik	***dinïh***	
Arctostaphylos uva-ursi		
Bunchberry	***dinïh yez, cin'ïyht'an***	***–t'an***
Cornus canadensis		
'Thornberry'	***whis mi'***	
Cratageus douglasii ? or		
Ribes lacustre ?		
Wild strawberry	***yinti dilk'i'n***	***–t'an***
Fragaria vi[illegible]iana		
'Wild cherry', [illegible]rd cherry	***smïts'ok***	***dicin***
Prunus pensylvanica		
'Wild red cherry'	***snou***	***dicin***
Chokecherry?		
Prunus virginiana ?		
Pacific crabapple	***milks***	***dicin***
[illegible]s fuscus		
[illegible]ern gooseberry	***c'indewizgï***	
[illegible] oxyacanthoides		
?Swamp gooseberry	***dilkw'akh mi'***	
Ribes lacustre ?		
'Wild red currant'	***k'ïy ditigï***	
Ribes triste ?		
Prickly rose	***tselhghïl***	***–t'an***
Rosa acicularis		
Red raspberry	***bïyolhggok***	
Rubus idaeus		

Berries, continued

Thimbleberry	***dik dïnkay***	***–t'an***
Rubus parviflorus	***mïsk'o't'an***	
Red elderberry	***luts dicin***	***dicin***
Sambucus racemosa		
'stoneberry', stonecrop	***tsë mï'***	
Sedum divergens		
Soapberry	***niwis***	
Shepherdia canadensis		
'Low bush blueberry'	***yintimï***	
Vaccinium caespitosum		
Black huckleberry	***digï***	
Vaccinium membranaceum		
'Highbush blueberry'	***dïndze***	
Oval-leaved blueberry		
Vaccinium ovalifolium		
Bog cranberry	***mï'o***	
Vaccinium oxycoccum		
Highbush cranberry	***tsalhtsë***	
Viburnum edule		
'Bearberry'#	***sis mï' cin***	***dicin***
Black twinberry		
Lonicera involucrata		
'Grouseberry'#	***c'itsit mï' cin***	***dicin***
Common snowberry		
Symphoricarpos albus		

* other "life form" listed only where the use of the "life form" term with the berry name has been recorded; this information was not specifically elicited in the field

marginal members of ***mi'*** or perhaps contrasted from true ***mi'*** by animal names; have fruits which are considered inedible with stems which are used for medicinal bark collection

Table VI-4

Wet'suwet'en Botanical Terms Shared with Gitksan

English name/ *Latin Name*	Wet'suwet'en Name	Gitksan Name	Term Origin
Bird cherry *Prunus pensylvanica*	***smï ts'ok***	***smi ts'ook***	G
Bog cranberry *Vaccinium oxycoccus*	***mi' o***	***mi'oot***	?
'Red wild cherry' *Prunus virginiana?*	***snou'***	***snau***	G
Fir clubmoss? *Lycopodium selago?*	***hadic***	***haadak***	?
Pacific crabapple *Pyrus fusca*	***milks***	***milkst***	G
Red elderberry *Sambucus racemosa*	***luts dicin***	***s<u>k</u>an loots***	G
Spreading Dogbane *Apocynum androsimaefolium*	***c'ind'eklh***	***s<u>k</u>an lekx***	G
Yellow pond lily *Nuphar polysepalum*	***khëlh t'ats***	***gahldaats***	W
Western redcedar *Thuja plicata*	***simggin***	***sim gan***	G
Wild sarsparilla *Aralia nudicaulis*	***scanistles****		G
Cedar bark	***het'el***	***hadat'l***	G
Pine cambium	***k'inïh***	***gan hix*** or ***ganix***	G

Botanical nomenclature after Hulten (1968).

Term not collected among the Wet'suwet'en by the author; included in Jenness 1943.

* Term not collected in Gitksan; Wet'suwet'en consultant stated the term to be in the "Hazelton language" (field notes, July 1992) and the root ***s<u>k</u>an*** is a Gitksan term meaning "plant".

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[1] Spellings of Wet'suwet'en words by Dr. Sharon Hargus using modified Hildebrandt system.

[2] Atran (1985:300) comments that:

> ...occasionally mushrooms, as for the Brou, and possibly mosses, as in the case of the Batak of Sumatra, also assume life-form status. This may owe more to the distinctive role they are perceived to play in the economy of nature than to their readily visible external morphology (i.e. habitus), for the non-flowering plants, (exclusive of the ferns, perhaps) may be generally construed as "residual" categories with no clearly defined morphological aspect. ...Ray's (1682) *Musci*...those small and often plants hidden plants that lack phenomenal resolution for human beings.

The last comment perhaps accounts for the fact that the "moss" and "mushroom" life forms are often "empty" or mono-generic, as they are for the Wet'suwet'en.

[3] The Haida medicine/leaf taxon Turner (1987) discusses represents another example of an 'herb' taxon which implies medicinal plants.

[4] Spellings of Gitksan words after Gottesfeld and Anderson (1988), Bruce Rigsby, unpublished notes, and Gottesfeld, unpublished notes.

[5] The term ***mi' ganaa'w***, 'frog-berry' apparently for the edible cloudberry *Rubus chamaemorus*, may indicate that this is not a universal association.

[6] The word for Labrador tea, ***lidï misgïk***, seems to be a loanword from French (***lidi*** is from *le té*) and Cree(***misgïk*** is derived from the root 'muskeg'). This suggests that its use as a beverage may have been learned from early French and Métis fur traders, possibly through the Babines or Stuart Lake Carrier.

[7] Spellings of Central Carrier words after Antoine *et al.* (1974).

[8] Spelling from Kari (1987).

[9] Spelling from Dunn (1978).

[10] Spelling from Morice (1932).

A Review of Human Nutrient Requirements
Chapter 7

Introduction

This chapter is a general review of human nutrition to provide background for the discussion of the role of plant foods in the traditional Wet'suwet'en diet (Chapter 8).

Essential Nutrients

The need for macronutrients in the human diet is usually approached in terms of minimum protein requirements, and requirements for overall food energy (kilocalories or kilojoules). The requirement for essential fatty acids is also recognized. No specific recommendation for carbohydrate intake has been proposed. Average protein and energy by sex and age are presented in Table VII-1, a synopsis of nutrient requirements compiled from Health and Welfare Canada (1990) and other sources (J. Anderson 1990, National Academy of Sciences 1974, Speth and Spielmann 1983). I have chosen to present only requirements for nutrients which are represented by the nutrient analyses of native foods which will be presented in Chapter 8, to facilitate comparison between nutrient requirements and nutrient availability.

Most people consume moderate to large amounts of carbohydrates as part of their ordinary diet; Health and Welfare Canada (1983) reports that most human populations consume 40 to 80% of their energy intake as carbohydrates. Health and Welfare Canada discusses the issue of a minimum requirement for carbohydrates in the diet:

> A lower limit of intake [of carbohydrates] has been argued on two grounds but neither is absolute. First, glucose is an essential energy substrate for the central nervous system, adrenal cortex and blood cells. These tissues utilize 100-150 g of glucose per day, but some can be provided by gluconeogenesis from amino acids, and furthermore, with time the brain can adapt to the use of ketones rather than glucose as an energy source. Ketosis and ketotic diets are not desirable, however, and ketosis can be prevented by intakes of carbohydrate of about 100 g/day (Health and Welfare Canada 1983:29).

Inuit and Subarctic hunting populations stand out as populations which derive the majority of their food energy from animal sources. There has been some research on northern diets (Berkes and Farkas 1978, Draper

Table VII-1 Recommended Daily Nutrient Intakes

Age group and sex	protein	n-3 PUFA	n-6 PUFA	carbohy	KCAL	fibre	Ca	P	Na	Mg	Fe	Zn	Cu	Mn †	thiamin	riboflav.	niacin	Vit C	carotene	folate	Vit. E
	g	g	g	g		g*	mg	mg	gƒ	mg	mg	mg	mg		mg	mg	NE	mg•	RE	µg	tocopherol
4–6 years, male & female	19	1.0	6.0		1800		600	400	1.1-3.3	65	9	5			0.7	0.9	13	25	500	70	5
10-12 male	34	1.4	8.0		2500		900	700	1.1-3.3	130	8	9			1.0	1.3	18	25	800	120.0	8
10–12 female	36	1.2	7.0		2200		1100	800	1.1-3.3	135	8	9			0.9	1.1	16	25	800	130	7
16-18 male	58	1.8	11.0		3200		900	1000	1.1-3.3	230	10	12			1.3	1.6	23	40	1000	220	10
16-18 female	47	1.2	7.0		2100		700	850	1.1-3.3	200	12	[illegible]			0.8	1.1	15	30	800	190	7
25-49 male	64	1.5	9.0		2700	20-35	800	1000	1.1-3.3	250	9	12	1.6		1.1	1.4	19	40	1000	230	9
25-49 female	51	1.1	7.0		1900	20-35	700	850	1.1-3.3	200	13	9			0.8	1.0	14	30	800	185	6
50-74 male	63	1.3	8.0		2300	20-35	800	1000	1.1-3.3	250	9	12	1.6		0.8	1.2	16	40	1000	230	6
50-74 female	54	1.1	7.0		1800	20-35	800	850	1.1-3.3	210	8	9			0.8	1.0	14	30	800	195	5
3rd trimester pregnancy	75	1.7	9.2		2400		1200	1050	1.1-3.3	245	23	15			0.9	1.3	16	40	800	385	8
lactatating women	71	1.4	7.3		2600		1200	1050	1.1-3.3	265	13	15			1.0	1.4	17	30	1200	305	9

Recommended nutrient intake values from Health and Welfare Canada 1990

pregnant and lactating women figured as 25-49 female + additional increments for pregnancy or lactation

`PUFA = polyunsaturated fatty acid

* fibre allowance from J. Anderson1990

† no RNI; deficiency not known in man

ƒ National Academy of Science 1976 cited in Hazell 1985

• Vit. C recommendations x2 for smokers

1977), and some investigation of the consequences of heavy dependence on animal products. Speth and Spielmann (1983) discuss need for carbohydrate and/or fat in the diet to maintain health and make possible the utilization of protein. Their work suggests that at least a minimal inclusion of carbohydrates in the diet significantly enhances health. Fat can also be consumed along with lean meat, and the Inuit manage to subsist with very low carbohydrate contributions to their diet, at least in some areas (Draper 1977).

In the absence of carbohydrates or fats to provide energy, protein must be broken down to synthesize glucose. The metabolic cost of generating the glucose necessary to maintain basal metabolic rate (specific dynamic action) is much higher when protein is the energy source than when carbohydrates and fats are. Under these circumstances 30% of the calories taken in may be expended for specific dynamic action (Speth and Spielmann 1983) compared to 6% for carbohydrates or 6-12% for fats. Prolonged dependence on protein for food energy without fat or carbohydrates leads to toxicity problems from excess protein intake and deficiencies of essential fatty acids and vitamins. In Great Plains and Subarctic Indian populations, there are reports of starvation on a lean meat diet. Speth and Spielmann (1983) quote Stefansson (1944) regarding "rabbit starvation", a condition which results when people are forced to subsist entirely on the extremely lean carcasses of wild rabbits:

> If you are transferred suddenly from a diet normal in fat to one consisting wholly of rabbit you eat bigger and bigger meals for the first few days until at the end of about a week you are eating in pounds three or four times as much as you were at the beginning of the week. By that time you are showing both signs of starvation and protein poisoning. You eat numerous meals; you feel hungry at the end of each; you are in discomfort through distention of the stomach with much food and you begin to feel a vague restlessness. Diarrhoea will start in from a week to 10 days and will not be relieved unless you secure fat. Death will result after several weeks((Stefansson 1944:234), cited in Speth and Spielmann 1983:3).

In these northern environments where such a large proportion of the diet consists of meat and fish, the importance of plant foods may be far out of proportion to their actual quantitative contribution to the diet. Speth and Spielmann (1983) emphasize the superior "protein sparing" effects of carbohydrate consumption versus fat consumption under conditions of marginal energy intake. Corroborating the significance of plant foods in

Arctic conditions, research among the Inuit and Yupik Eskimos suggests that plant foods were actively sought and prepared, providing the diet with essential vitamins, fibre and variety (Draper 1977, Jones 1983, Nickerson *et al.* 1973). In addition, faced with severe limitations on plant food availability during much of the year, stomach contents of game species were often consumed as a sort of condiment or delicacy, thus taking advantage of the abilities of prey species to procure and digest plant foods to enhance the plant component of the diet (Nickerson *et al.* 1973, Balikci 1970:46).

Though not really a nutrient, dietary fibre has recently been recognized as necessary for health. Dietary fibre is derived from plants. It consists of several classes of complex carbohydrates, largely derived from cell wall components (Spiller and Amen 1975, Van Soest and McQueen 1973). Cellulose, most hemicellulose, and lignans are insoluble dietary fibre (J. Anderson 1990). Pectins, gums and mucilages are the principal soluble forms of dietary fibre (J. Anderson 1990). Dietary fibre has been shown to be necessary to maintain bowel health (Burkitt 1973). Its primary action is to increase fecal bulk and decrease transit time (Burkitt 1973, Spiller and Amen 1975), although soluble fibre may act to delay gastric emptying (Nabhan 1991, Stahl 1989). The effects of decreased transit time are primarily in production of a bulkier, softer stool, decreasing strain on the colon and preventing development of diverticulitis (Spiller and Amen 1975). This more rapid passage may also have effects in reducing production of potentially carcinogenic substances by bacterial fermentation of bile acids in the colon (Burkitt 1973, Spiller and Amen 1975) which may have a role in colon cancer. Too rapid a passage can make digestion of foods inefficient, leading to decreased utilisation of food nutrients (Spiller and Amen 1975, Stahl 1989).

Dietary fibre intake apparently influences other conditions like blood cholesterol levels and diabetes as well (J. Anderson 1990, Fukagawa *et al.* 1990, Groen 1972, Spiller and Amen 1973, Trowell 1972). 37 grams of dietary fibre / day is reported to protect against coronary heart disease (J. Anderson 1990). In high levels, dietary fibre influences absorption of various nutrients and may contribute to poor mineral nutrition in populations with marginal intakes (Bender 1987, Kelsay *et al.* 1988), although populations with high fibre intake usually also have high phytate intake from grains. Phytates are known to influence mineral absorption, particularly of calcium, zinc and iron (Bender 1987, Hallberg *et al.* 1989).

Fatty acids are essential nutrients as well as providing food energy. Requirements for essential fatty acids have recently been established (Health and Welfare 1990). Two distinct families of polyunsaturated fatty acids which cannot be synthesized by animals are required in the human diet: the n-6 or ω-6 polyunsaturated fatty acids including linoleic acid, and the n-3 or ω-3 fatty acids. These two classes of fatty acids are not interconvertable in the body. They are important components of membranes and serve as precursors to compounds called eicosanoids, which include prostaglandins, thromboxanes, and leukotrienes (Health and Welfare 1990:40). ω-6 fatty acids are obtained from plant sources and are also present in animal foods in small amounts (Apavoo *et al.* 1991, Hepman *et al.* 1986). The ω-3 fatty acids are particularly prominent in seafoods, especially those with a chain length of 20 carbon atoms or longer (Nettleton 1991, Kuhnlein *et al.* 1991).

Linoleic acid is required in the diet of infants for normal growth and development. Deficiency symptoms can be prevented at intakes of 1% of food energy as linoleic acid (Health and Welfare Canada 1990:40). ω-3 fatty acids (docosahexaenoic acid, 22:6 n-3) are concentrated in the photoreceptor membranes of the retina and are present in substantial amounts in the brain. 22:6 n-3 accumulates in the human brain during the last trimester of pregnancy and the first 18 months after birth. The ω-6 and ω-3 fatty acids compete as substrates for enzymes involved in their metabolism. For this reason, ratios between 4:1 and 10:1 ω-6 to ω-3 fatty acids are suggested for good nutrition, especially during pregnancy and lactation, and in the diet of infants (Health and Welfare Canada 1990:41).

Dietary fat is also implicated in the etiology of cardiovascular disease, particularly in terms of the association between dietary fat, serum cholesterol levels, and coronary heart disease (Health and Welfare Canada 1990:41). Linoleic acid reduces serum cholesterol levels, while saturated fats such as palmitic and lauric acid raise it. Fish oils, of the ω-3 family of polyunsaturated fats, do not depress serum cholesterol, but produce a marked reduction in serum triglycerols in patients with high triglyceride levels. VLDL also decreases with intake of ω-3 fatty acids, but LDL may increase. Eicosapentanoic acid, an n-3 fatty acid, may reduce risk of thrombosis relative to n-6 arachidonic acid, which can also be synthesized in the body from linoleic acid. The thromboxane synthesized from eicosapentanoic acid lacks the platelet-aggregating and vasoconstrictive effects of the thromboxane synthesized from arachidonic acid (Health and Welfare Canada 1990).

Micronutrients-Minerals

Twenty one different minerals are now known to be required for human nutrition. These can be divided into six major minerals (Na, K, Mg, Ca, P and Cl), and fifteen trace elements (As, Co, Cr, Cu, F, Fe, I, Mn, Mo, Ni, Se, Si, Sn, V and Zn) (Hazell 1985). Figure VII-1 summarizes important aspects of the nutritional availability of these minerals and the probability of deficiency. Minerals have a range of functions in the body, including major structural components (e.g. calcium); electrolytes influencing the function of the nervous system and the acidity of blood (sodium and potassium); phosphorous, vital for cellular energy transactions; and the remainder of the trace minerals, required in small amounts for compounds such as metalloenzymes. Copper, cobalt (as cobolamine, B12) and iron, needed for hemoglobin for oxygen transport are trace minerals not required in large amounts, but which serve vital functions (Hazell 1985). Cobolamine (B12) is discussed further under B vitamins in the following section. Many other trace minerals have been identified in recent years. For many of these the requirements are so low that atmospheric dust may be sufficient to supply them, and deficiency states have not been encountered (Hazell 1985). I will discuss calcium, phosphorous and iron requirements in more detail.

Calcium and phosphorous are major structural components of the body, and are required in relatively large amounts. Phosphorous is ubiquitous in foods, so dietary deficiency of phosphorous is not known. Calcium is more restricted in its occurrence and particularly in its availability as it often occurs in organic complexes from which it cannot be absorbed during digestion (Hazell 1985). Phytate, common in grains, and oxylate are particularly problematic in terms of availability of calcium from plant

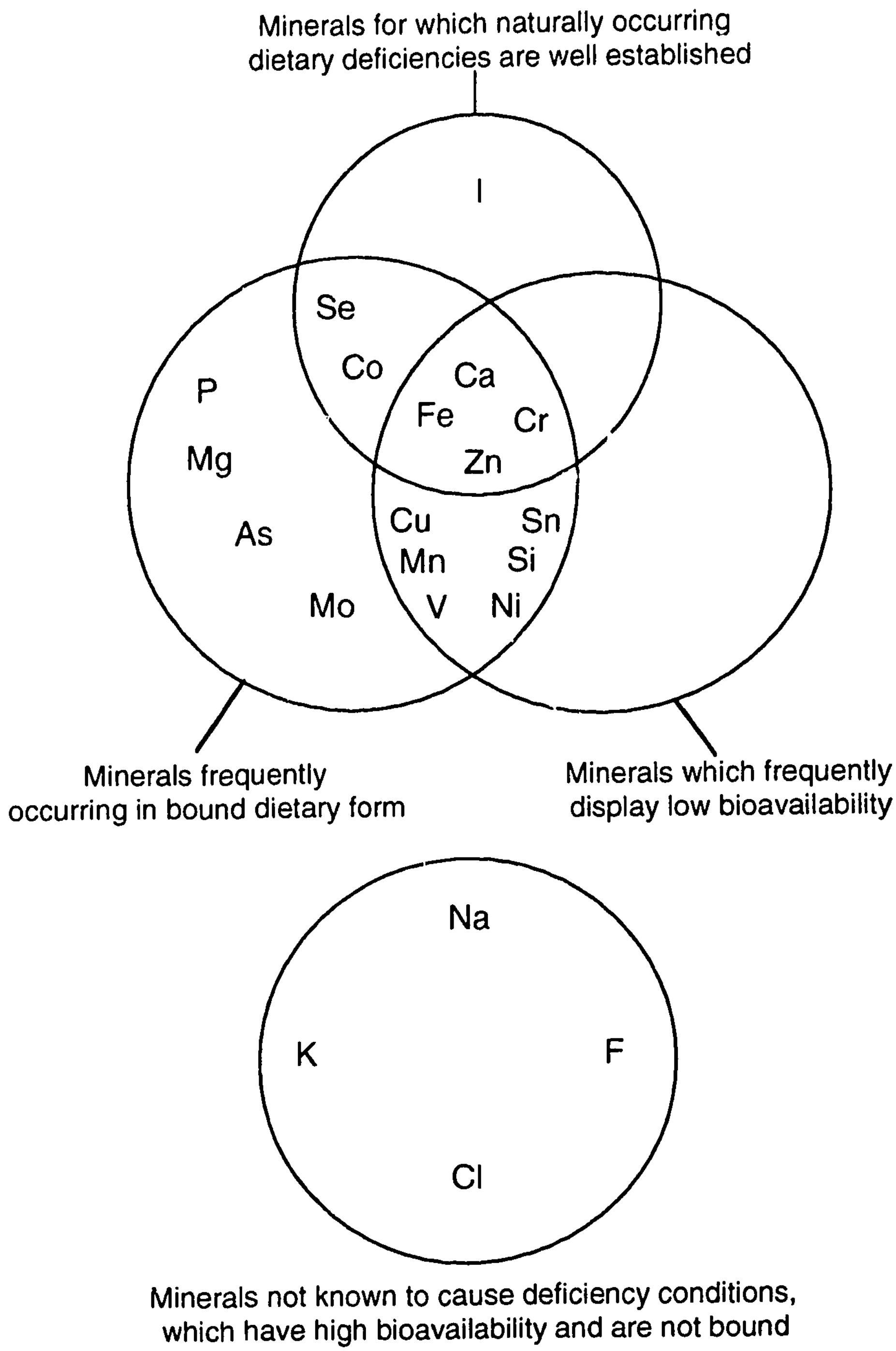

Figure VII-1 Nutritional Availability of Minerals (after Hazell 1985) sources (Allen 1982). Calcium uptake from dairy products is enhanced by a macrophosphopeptide formed during the digestion of caseine, and also by caseine phosphopeptide (Hazell 1985). There is some literature which suggests that ratios of calcium to phosphorous may be important in calcium utilisation (Draper 1977, Hazell 1985). Ratios of 1:1 are considered optimal; ratios below 1:2 are considered undesirable by some workers (Hazell 1985). Allen (1982) discusses the interactions of phosphorous and calcium in more detail. Protein enhances calcium absorption, which may be a factor in the better utilisation of calcium from animal sources (Hazell 1985). Calcium associated with pectin substances high in uronic acid is of low availability since human digestive enzymes cannot release it. Bacterial fermentation in the colon makes a small portion of this bound calcium available for absorption (Hazell 1985).

Iron is required for hemoglobin synthesis for oxygen transport. It is not required in large amounts, but it frequently occurs in bound dietary form and may be of low bioavailability. The occurrence of iron deficiency anemia is widespread and well documented. Availability of iron varies depending on the source. Heme iron, derived from meats, has high availability. Meats may also contain a substance which promotes absorption of iron (Monson *et al.* 1978). In contrast, iron from dairy products and vegetable sources (non-heme iron) may be poorly absorbed. Vitamin C promotes absorption of non-heme iron. Phytate, cellulose, lignan, pectin, oxalate and tannin inhibit iron absorption from plant sources (Hazell 1985).

Micronutrients-Vitamins

Vitamin C (ascorbic acid) is required for formation of collagen. Deficiency of Vitamin C leads to scurvy (Health and Welfare Canada 1983). Other functions for Vitamin C are less well understood, but it is involved in metabolism of tyrosine, synthesis of serotonin and conversion of dopamine to norepinephrine, iron absorption and transfer to ferritin, and folic acid metabolism (Health and Welfare 1983). It may also be involved in immune response and may block nitrosamine formation (potent carcinogens) in the gut (Health and Welfare Canada 1983). As it is a water soluble vitamin, the body does not store vitamin C, but must replenish supplies by dietary intake.

The B vitamins include thiamin, riboflavin, niacin, B6, folic acid and

B12 (cobolamine). The B vitamins are enzymes important in cellular metabolism. They are water soluble and required on a continuing basis for health. Thiamin is involved in the carboxylic acid cycle, a fundamental part of the cellular reactions which yield energy from glucose. It is also involved as a catalyst with the interconversion of sugars with 3 to 7 carbon molecules. Requirements for thiamin are thus linked to energy expenditure. Dietary deficiencies of thiamin (beriberi) characterize populations reliant on unenriched polished rice. Thiamin is stated to decline quickly in conditions of starvation or semi-starvation (Health and Welfare Canada 1983). Riboflavin is a constituent of flavoproteins, which function as enzymes in tissue respiration, and in oxidation of substrates. Deficiency of riboflavin is characterized by soreness of tongue and lips and dermatitis (Health and Welfare Canada 1983:81). Niacin (nicotinamide) is also involved in tissue respiration and forms part of the coenzymes nicotinamide adenine dinucleotide (NAD) and NADP. Niacin defficiency (pellagra) is characterized by dermatitis, mucous membrane inflammation, and dementia (Health and Welfare 1983:84).

The active form of vitamin B6, pyridoxal 5-phosphate is a coenzyme in reactions involving amino acids, carbohydrates and unsaturated fatty acids (Health and Welfare 1983). B6 is widely distributed in foods including meat, fish, and poultry. Primary B6 deficiency in humans is rare (Health and Welfare Canada 1983). Folacin, or folate, is a group of coenzymes and their precursors which function in purine and DNA synthesis and many other biochemical reactions. Clinical deficiency of folacin relates to deficiency of a coenzyme involved in DNA synthesis (Health and Welfare 1983). Folacin is stored in the liver, and is retained in red blood cells. Red blood cell levels will fall after about four months if a person is maintained on a folacin free diet, and megaloblastic anemia will develop shortly afterwards (Health and Welfare 1983:94). The last B vitamin, B12 or cobolamine, is almost entirely produced by bacterial synthesis. Dietary sources are tissue stores of B12 in animal foods; strict vegetarians may have very low intakes. Some bacteria in the human colon synthesize B12, which, however, is unavailable for absorption by the host human. There are also small amounts synthesized in the small intestine, and this may be available for absorption by the host. Lack of B12 has a number of serious side effects including nervous system disorders arising from demyelination of nerves, megaloblastic anemia, and changes in epithelial cells (Health and Welfare Canada 1983:101). Primary deficiency in B12 does not arise in non-vegetarians (Health and Welfare Canada 1983).

Vitamin A (retinol) is available in animal products as retinol. In plants ß carotene is the form which is found. Vitamin A is a fat soluble vitamin, so it is not required on a continuous basis. In high amounts Vitamin A can be toxic because it is stored rather than excreted. Vitamin A is involved in vision, bone growth, the maintenance of epithelial tissue, and reproduction (Heath and Welfare 1983). Prolonged Vitamin A deficiency is characterized by a dry keratic condition of the eyes called xeropthalmia, especially prevalent in children (Health and Welfare Canada 1983). It is involved in the manufacture of the visual pigment rhodopsin. Vitamin A deficiency leads to night blindness, among other symptoms.

Vitamin E is a fat soluble vitamin. α and γ tocopherol are the active forms of the vitamin. Vitamin E requirements appear to vary depending on the concentration of polyunsaturated fatty acids in the diet. The metabolic role of vitamin E is as an antioxidant (Health and Welfare Canada 1983:57). For usual mixed diets of North America, a ratio of .4 mg of α tocopherol per gram of polyunsaturated fatty acid intake has been found satisfactory (Health and Welfare Canada 1983:57). The recommended intakes of vitamin E can be met by a normal mixed diet, and deficiency signs have generally not been been found in adults (Health and Welfare Canada 1983). Indigenous populations in Canada do not appear to be deficient in Vitamin E either (Desai and Lee 1971, 1974a, 1974b).

Population Considerations

Recommended Nutrient Intakes or Daily Allowances of nutrients are derived from modern western populations eating agricultural crops and living an urban or modern lifestyle. There are some problems with extrapolating to other populations and conditions. For example, energy and/or fat needs of highly active hunter-gatherers, especially those living under cold climatic conditions, may be far in excess of those characterizing the populations on which the RNI's and RDA's are based. Shephard

(1978:51) estimated that caribou hunting required 3600 kcal per 24 hour period, 600 kcal above the RNI for energy for a 25-49 year old male. Sedentary Inuit men were estimated to require 3150 calories per day and women 2500 calories (400 calories higher than the Canadian RNI) (Berkes and Farkas 1978). High fat tolerance is also characteristic of Inuit people . Apparently the body fat of Inuit consuming a traditional diet is biochemically different from fat synthesized from surplus carbohydrate (Draper 1977). This may be relevant to the low prevalence of heart disease among the Inuit despite high fat intake (Kuhnlein *et al.* 1991).

Calcium needs based on modern European and North American populations may be overestimated; it is certain that much of the world's population does not meet the 800 mg recommended daily intake of the US and Canada (Allen 1982, E. Anderson 1990). Most of the world does not consume high amounts of dairy products, which are the best dietary sources of calcium. The FAO/WHO Committee on Calcium Requirements has suggested that 400-500 mg/day may be a more realistic estimate of adult calcium requirements. (Allen 1982). Apparently the efficiency of calcium absorption increases when intakes are low. However, assessing the real consequences of long term low calcium intake is difficult, because the only method of monitoring long term calcium status is bone demineralization. Significant bone demineralization must occur before calcium loss is detectable (Allen 1982). In addition, vitamin D status and ratio of calcium to phosphorous may be important in calcium utilization (E. Anderson 1990; Health and Welfare Canada 1983; although see Allen 1982), as well as disease conditions, pregnancy, and lactation (Allen 1982). Others have suggested that even the 800 mg per day level may actually be too low given the prevalence of osteoporosis in older women (Allen 1982).

There may be metabolic or biochemical changes in different populations who are adapted to diets different from those characteristic of Europe and North America. Schaefer *et al.* (1972) found that oral glucose tolerance curves of Inuit people differed from those of southern Canadians, showing a diabetes like sharp rise in blood sugar following oral glucose challenge. When he preceded the oral glucose dose with protein feeding, insulin response and bloods sugar levels were more normal. Schaefer *et al.* concluded that for the Inuit they studied that amino acids elicited insulin secretion more effectively than blood sugars, suggesting a real metabolic difference which would have arisen from population adaptation to prolonged dependence on a high protein-low carbohydrate diet. Other sources have found sucrose intolerance among Inuit from Greenland and Alaskan Eskimos (Draper 1977). Northern native people may have different requirements for protein than southern populations (Berkes and Farkas 1978), also presumably as a result of adaptation to a diet high in protein.

Biochemical adaptation is also suggested by the responses to glucose of the O'odham and Australian Aborigine populations reported by Nabhan (1990) and Thorburn *et al.* (1987). The carbohydrate sources to which these populations were adapted consisted of complex mucilages and were derived from sources high in soluble fibre (Nabhan 1990). Such carbohydrates have a low glycaemic index and provide slow release of glucose into the bloodstream (Brand *et al.* 1990). Simple sugars and carbohydrates which are quickly digested were not a substantial part of the pre-modern diet, leading to differences in metabolism of carbohydrates and insulin secretion responses (Nabhan 1990, 1991).

Effects of Cultural Practices on Dietary Quality of Food

Cultural practices effect diet quality. Harvesting may be carried out in a manner to minimize potential toxicity or enhance nutritional value. Young leaves may be low in secondary compounds concentrated in older leaves, or simply lower in fibre. Cow parsnip (*Heracleum lanatum*) is picked young and peeled to reduce furanocoumarins (Kuhnlein and Turner 1986), toxic compounds which react with DNA in the presence of ultraviolet light (Camm *et al.* 1976), by North American native peoples. 'Cambium' foods must be harvested when the phloem is actively dividing and translocating sugars, and before it becomes woody and indigestible. Pine, hemlock and cottonwood 'cambiums' were harvested by Northwest Coast peoples during a short annual optimal period to maximize digestible carbohydrates and minimize indigestible cellulose, and lignans, tannins and resins (Gottesfeld 1992). Such toxic factors are found in scotch pine inner bark, particularly late in the growing season (Airaksinen *et al.* 1986).

Food storage and preparation techniques may modify basic constituents of food or remove toxins. Cooking may enhance digestibility of nutrients in foods (Stahl 1984, 1989). Cooked starches are more digestible than raw starches (Stahl 1984). Cooking, particularly with moist heat, inactivates some of the toxic compounds like lectins, tannins, and trypsin inhibitors found in otherwise nutritious foods such as grain legumes (beans, peas and other pulses) (Boag n.d., Stahl 1989). Pre-soaking of grain legumes before cooking and discarding the soaking water removes oligosaccharides, compounds which produce flatulence and can produce diarrhoea and nausea (Boag n.d.). Leaching, and grinding and leaching techniques, have also been traditional preparation techniques of foods to remove toxins, as was done by California Indians to remove tannins from acorns which were a staple of their diet (Stahl 1989). Johns and Kubo (1988) have reviewed traditional methods of detoxification of plant foods. Major techniques include heating, dissolution, fermentation, adsorption, drying, physical processing, and pH change. Johns' own research gives examples of ways that *Solanum* species were detoxified by Andean Indians to render them safe for consumption, including consumption of special clays (geophagy) (Johns 1986).

On the Northwest Coast, a staple root crop, camas, was traditionally pit cooked for prolonged periods. This processing technique converts a large percentage of the inulin contained in camas to fructose (Konlande and Robson 1972) Inulin is not digestible by humans, whereas fructose is readily assimilated. The traditional processing converts a non-food into a food. Red elderberries, another common food on the Northwest Coast, were never eaten raw. Edible plant books typically warn that they are poisonous, but many cultural groups on the Northwest Coast utilized them in large amounts. Possibly the cooking of the fruit minimizes toxicity. Red elderberries are often consumed mixed with other fruits. This may also act to minimize possible toxicity.

Antinutrients

Antinutrients also effect nutrition and dietary quality. Antinutrients include enzyme inhibitors (against trypsin, chymotrypsin and amylase), which prevent digestion of proteins or starches. Antivitamins (such as thiaminase) and mineral binding agents, including phytates, oxalates and goitrogens (glucosinalates) (Bender 1987), lectins (Grant 1989), toxic amino acids (D'Mello 1989), polyphenols (Griffith 1989), and saponins (Stahl 1984, D'Mello 1989) are also found in foods. Alkaloids (Stahl 1984, Morgan and Coxon 1987) and other secondary metabolites may also effect potential nutritional quality. Phytates have already been mentioned in connection with their influence on mineral nutrition. Saponins have been extensively investigated in soya beans and alfalfa in terms of their hemolytic properties (D'Mello 1989). Negative effects of ingestion on humans remain undocumented, and small amounts of saponins in foodstuffs are apparently tolerated (Stahl 1984). Most published research applies to crop plants, particularly legumes, crucifers, and grains (D'Mello 1989, Ory 1981, Stahl 1984, Watson 1987), which gives little information on potential antinutrient content of wild plant foods.

Soapberries, a widely (but sparingly) consumed food in western North America, have high levels of saponins (Turner 1981). Polyphenols and tanins are found in pine inner bark (Airaksinen *et al.* 1986) and probably are present in some level in 'cambium' foods derived from conifers. Phytates may be present in some northwestern wild foods because they are widely distributed in fruits and vegetables.

Summary

General nutrient requirements of human beings include macronutrients, proteins, carbohydrates and fats, and micronutrients, a variety of vitamins and minerals. Macronutrients provide food energy. In addition, essential amino acids and essential fatty acids are required by the body for cellular metabolism. Although no lower limit for carbohydrate intake has been established, a minimal inclusion of carbohydrate in the diet significantly enhances health. Dietary fibre, while not strictly a nutrient, is also required for health. Micronutrients have a variety of functions relating to their use as building blocks in synthesis of particular molecules or as enzymes and co-enzymes. Various factors affect the absorption and use of vitamins and minerals. Water soluble vitamins such as the B vitamins and vitamin C are required on a continuing basis for health since they are not stored in the body. Some minerals such as calcium and iron my occur vary in their bioavailability depending on the source. Iron and calcium are both absorbed better from animal sources than plant sources.

Population differences in nutrient requirements may exist as part of the adaptation of specific populations to particular environments and ways of life. Requirements for protein, for example, may be higher among northern Native groups in the subarctic, for example, and fat tolerance may be high among the Inuit. Differences in metabolism of carbohydrates have been suggested to underlie prevailing high rates of diabetes in some indigenous populations whose traditional diets were low in refined, easily digested carbohydrates when they have switched to modern diets high in these foods.

Various factors may influence the availability of nutrients in various potential foodstuffs. Antinutrients are substances which can interfere with uptake of nutrients of digestion of foods containing them. Most of the literature deals with the presence of antinutrients in crop plants, but antinutrients and various toxic substances also limit use of wild plants. Cultural practices such as special preparation techniques, including cooking, may reduce toxicity of potential foods and enhance digestion of their nutrients.

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The Role of Plant Foods in Traditional Wet'suwet'en Nutrition[1]

Chapter 8

Introduction

The significance of plant foods in northern hunting, fishing or marine mammal dependent groups is often underestimated (Norton *et al.* 1981), with ethnographers noting in passing that the people ate "some berries" along with their meat and fish (e.g. VanStone 1974:26; McKennan 1959:36, Hunn 1981:126,127). I have collected information on utilisation of plants for food and medicine by the Wet'suwet'en, an Athapaskan speaking group who live in the drainage of the Bulkley River and adjacent Fraser River headwaters in Northwest British Columbia. The Wet'suwet'en fished for salmon in the summer and hunted, trapped and fished in lakes in the winter and early spring. Animal foods, especially salmon, big game and beaver are recognized as important dietary staples. In addition, a diverse array of plants were collected or eaten casually (Gottesfeld 1991, Chapter 5).

The purpose of this chapter is to examine the contribution of plants to the Wet'suwet'en diet by reviewing their nutrient content in context of general requirements for human nutrition and the total traditional diet of the Wet'suwet'en. I present data on nutrient composition of foods in the traditional diet, including discussion of limitations of the available nutrient data, to elucidate the role of plant foods in traditional nutrition.

The Traditional Wet'suwet'en Diet

In order to understand the role of plant foods in the traditional Wet'suwet'en diet, one must look at a reconstruction of the total diet. Only then can one evaluate what needs were being met by animal products, and what needs could be met by plant products. The Wet'suwet'en diet is similar to other inner coast groups and interior groups of Northwest North America with access to anadromous salmon species. Fish, both salmon and steelhead, and trout and whitefish, were extremely important in the diet for much of the year. Big game species such as bear, mountain goat, deer, and caribou or moose, also contributed heavily to the diet, particularly in the late summer/fall through late winter period. Small game species such as rabbits, porcupine, beaver and marmot (groundhog), along with grouse, ptarmigan and migratory waterfowl such as swans made supplemental contributions to the diet. Plant foods included a wide variety of berries, eaten fresh, and preserved in quantity for the winter; a few root foods such as chocolate lily bulbs and spiny woodfern rhizomes; a few green vegetables consumed in spring, and tree 'cambiums', principally lodgepole pine and western hemlock. These were consumed fresh in season (for a short period in mid to late spring) and stored for winter consumption. In addition, oolachan grease (derived from the smelt *Thalichthys pacificus*), smoked oolachans, and seaweed were obtained by trade from the Coast, and consumed in variable amounts by different segments of the population, at least in Proto-historic times.

Unfortunately, quantitative data is lacking for the traditional diet with respect to frequency of consumption of foods and portion sizes. Therefore, I have attempted a qualitative assessment of the precontact diet, emphasising availability of known food items on a seasonal basis, including use of fresh versus dried or stored foods (Fig. VIII-1). The frequency with which these items were consumed cannot be reconstructed at this point.

Although a quantitative assessment of dietary quality is not possible for the reasons outlined above, a qualitative assessment of the nutrient density of various available foods and the probability that a good diet could be achieved with these foods can be investigated. I have referred to various published sources for data on the nutrient content of foods in the traditional Wet'suwet'en diet, or similar foods eaten by other Native peoples (Drury 1985, Health and Welfare Canada 1985, Keely 1980, Kuhnlein 1989, 1990, Kuhnlein *et al.* 1982, Watt and Merrill 1963). I have then compared these values to published adult male recommended nutrient intakes (RNI's) of various nutrients to derive percent RNI figures for various nutrients (Health and Welfare Canada 1990). I have presented the results in tabular form, including only the richer sources for particular nutrients from the list of nutrient values.

Dietary Adequacy of Traditional Diet

A general review of the Wet'suwet'en diet (see Fig. VIII-1 and Table VIII-1; Tables VIII-2–10) indicates that the bulk of calories, fats, proteins,

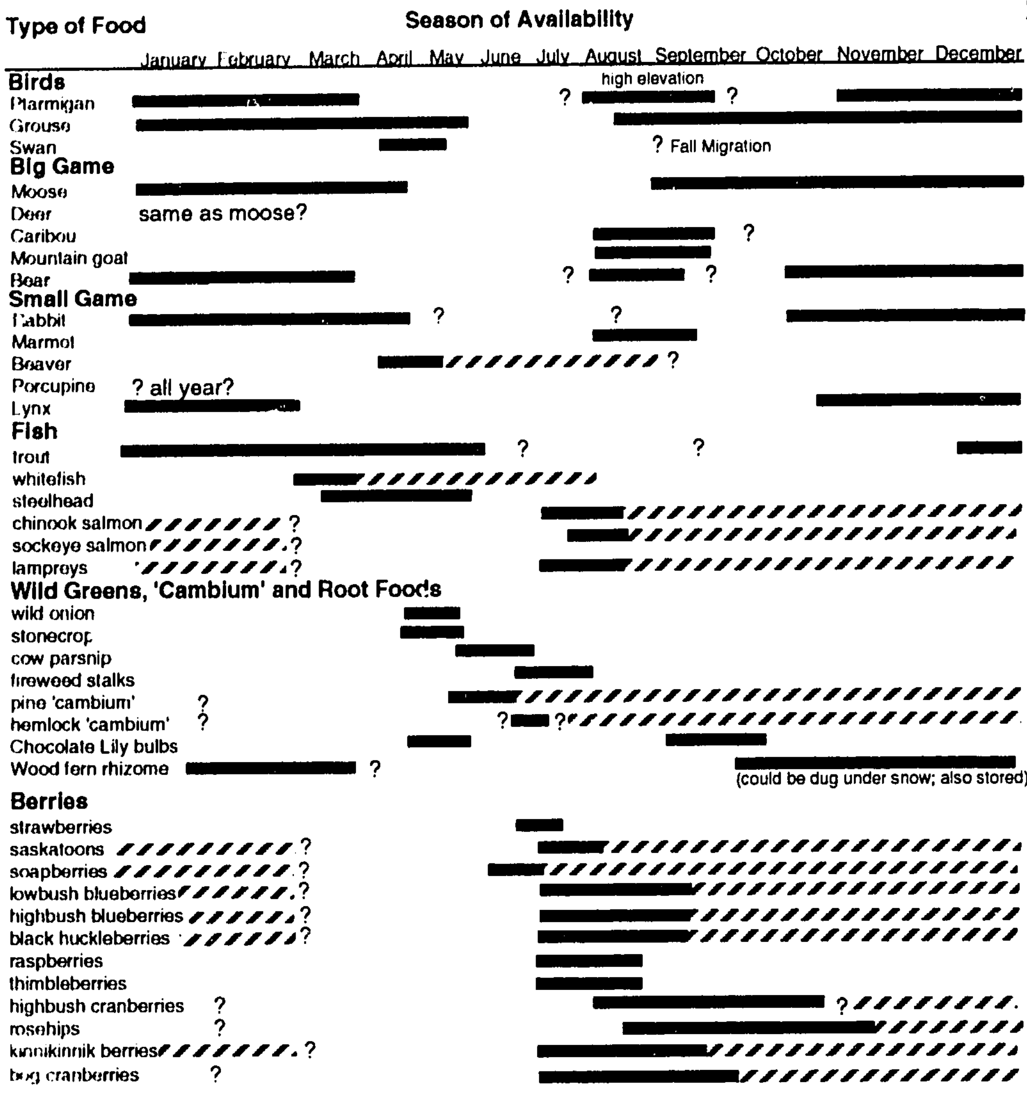

Figure VIII-1 Reconstruction of Traditional Wet'suwet'en Diet

available fresh

stored or dried

Table VIII-1

Analyses per 100 g fresh food

Food Type	moisture g	protein g	fat g	carbohydr. g	KCAL	kJ	fibre g*
Berries (Kuhnlein 1989)							
• *Amelanchier alnifolia*	76	0.7	1.2	21.4	90	375	6.4
• *Arctostaphylos uva-ursi*	75	0.7	1.1	22.4	92	385	14.8
+ *Cornus canadensis*	81	0.7	0.8	16.6	52	217	5.2
Crataegus douglasii	84	0.3	1.4	14.9	52	217	2.6
x *Fragaria vesca*	85	0.6	0.9	12.5	54	227	2.9
Malus fuscus (Kuhn. 1990)	79	1.2	1.6	17.7	82	343	6.0
x *Rosa nutkana (no seeds)*	79	1.6	0.6	17.6	74	308	4.4
+ *Rubus idaeus*	83	0.6	0.8	15.8	65	273	4.5
+ *Rubus parviflorus*	74	1.7	1.2	23.0	99	412	11.9
Rubus spectabilis	88	1.4	0.8	9.9	47	195	2.6
Sambucus racemosa (cooked)	78	2.9	4.8	13.9	100	418	8.2
• *Shepherdia canadensis*	81	1.8	0.7	16.6	72	300	5.3
Vaccinium alaskaense	82	0.9	0.6	16.2	66	276	2.8
• *Vaccinium membranaceum*	86	0.6	0.5	13.1	54	224	2.0
+ *Vaccinium ovalifolium*	87	1.1	0.5	11.3	49	203	3.3
Vaccinium parvifolium	87	0.8	0.5	12.0	50	209	3.9
• *Viburnum edule*	89	0.1	0.4	9.4	39	161	3.8
Roots, Greens & Vegetables (Kuhnlein 1990)							
• *Dryopteris expansa (steamed)*	68	2.5	1.0	27.3	126	525	3.7
+ *Epilobium angustifolium*	92	0.3	0.4	6.4	27	113	0.8
• *Fritillaria camschatcensis(raw)*	74	2.9	0.3	21.8	98	411	1.9
• *Heracleum lanatum*	95	0.2	0.3	4.0	17	71	0.9
Populus trichocarpa 'cambium'	92	0.2	0.5	6.3	27	112	1.5
(Keely 1980)							
• *Tsuga heterophylla 'cambium'*	70.8	2.3	0.6	25.9	103	432	–
(Gottesfeld unpublished)							
• *Pinus contorta 'cambium'*	88.3	0.8	0.6	9.9	48	202	1.1
Berries (Drury 1985)							
+ *V. alaskaense & V. ovalifolium*	88.7	0.7	0.0	10.4	44	184	–
V. parvifolium	90.7	0.4	0.1	8.7	37	155	–
Rubus spectabilis	88.6	1.0	0.1	10	44	184	–
Animal Foods (Drury 1985)							
• dry smoked sockeye salmon	20.3	57.2	14.4	3.2	371	1552	–
herring eggs, raw	83.8	9.6	1.0	4.4	56	234	–
• venison (deer) raw	73.7	21.5	3.4	0.2	117	490	–
(Kuhnlein et. al 1982)							
+ ooligan grease	0.2	>0.01	>99.0	n.d.	[900]	[3766]	0
(Health & Welfare,Can. 1985)							
• Caribou, cooked	-	37.8	1.1	0	174	728	0
• beaver, cooked	-	28.9	13.3	0	248	1036.7	0
• groundhog, cooked	-	28.9	10.0	0	216	902	0
• Moose, cooked	-	34.4	3.3	0	176	734	0
• Rabbit/Hare, wild, cooked	-	28.9	10.0	0	216	902	0
+ Liver, deer (cooked)		26.4	11.0	6	227	948	0
• Ptarmigan, raw	-	25.6	1.1	0	116	483	0
• Lake trout, broiled or baked	-	23.1	14.3	tr.	213	893	0
• Whitefish, broiled	-	23.1	11.0	tr.	194	812	0
(Watt & Merrill 1963)							
• chinook salmon, raw	64.2	19.1	15.6	0	222	929	0

* indicates believed to be present in measurable amount, but no good value available

tr = trace; n.d. = none detected;- indicates analysis not performed

•= important traditional food; + known to be used; x=related species used

Table VIII-1, cont.

Analyses per 100 g fresh food

Food Type	Ca mg	P mg	Na mg	Mg mg	Fe mg	Zn mg	Cu mg	Mn mg
Berries (Kuhnlein 1989)								
• *Amelanchier alnifolia*	69	40	0.6	26	0.5	0.4	0.4	2.2
• *Arctostaphylos uva-ursi*	37	35	0.5	17	0.7	0.5	1.3	0.2
+ *Cornus canadensis*	52	19	0.4	12	0.6	0.1	0.1	0.1
Crataegus douglasii	31	12	6.9	12	0.5	0.2	0.3	0.2
x *Fragaria vesca*	64	35	0.6	54	0.4	0.2	0.8	0.8
Malus fuscus (Kuhn. 1990)	29	33	21.2	28	0.6	0.2	0.5	0.3
x *Rosa nutkana (no seeds)*	77	37	1.8	26	0.3	0.2	n.d.	0.9
+ *Rubus idaeus*	36	38	0.4	17	0.7	0.4	0.6	0.4
+ *Rubus parviflorus*	89	62	0.8	44	0.7	0.4	0.2	1.8
Rubus spectabilis	15	24	2.6	16	0.6	0.2	0.5	0.7
Sambucus racemosa (cooked)	89	77	1.9	40	1.0	0.7	0.5	0.6
• *Shepherdia canadensis*	16	21	0.5	8	0.5	1.4	0.3	0.2
Vaccinium alaskaense	24	21	1.0	9	0.5	0.2	0.3	0.1
• *Vaccinium membranaceum*	14	17	0.4	8	0.2	0.1	0.1	2.5
+ *Vaccinium ovalifolium*	16	21	0.9	9	0.4	0.2	0.6	1.3
Vaccinium parvifolium	22	16	0.8	7	0.3	0.2	0.4	4.5
• *Viburnum edule*	24	23	0.6	11	0.3	0.1	0.1	0.1
Roots, Greens & Vegetables (Kuhnlein 1990)								
• *Dryopteris expansa (steamed)*	56	63	1.4	44	0.8	1.5	1.5	3.19
+ *Epilobium angustifolium*	32	31	0.6	20	0.5	0.7	0.7	0.18
• *Fritillaria camschatcensis(raw)*	10	61	18.4	23	2.2	0.7	0.2	0.44
• *Heracleum lanatum*	29	16	0.7	11	0.2	0.4	0.1	0.06
Populus trichocarpa 'cambium'	10	39	–	8	0.3	0.4	0.4	0.07
(Keely 1980)								
• *Tsuga heterophylla 'cambium'*	202	–	–	11.6	2.54	1.57	–	–
(Gottesfeld unpublished)								
Pinus contorta 'cambium'	–	–	–	–	–	–	–	–
Berries (Drury 1985)								
+ *V. alaskaense & V. ovalifolium*	15	–	–	–	1.1	–	–	–
V. parvifolium	15	–	–	–	0.3	–	–	–
Rubus spectabilis	14	–	–	–	0.6	–	–	–
Animal Foods (Drury 1985)								
• dry smoked sockeye salmon	136	–	–	–	1.9	–	–	–
herring eggs, raw	19	–	–	–	2.7	–	–	–
• venison (deer) raw	7	–	–	–	2.9	–	–	–
(Kuhnlein et. al 1982)								
+ ooligan grease	7	9	n.d.	tr.	tr.	tr.	n.d.	n.d.
(Health & Welfare,Can. 1985)								
• Caribou, cooked	19	–	–	–	3.44	–	–	–
• beaver, cooked	21	–	–	–	1.44	–	–	–
• groundhog, cooked	21	–	–	–	1.11	–	–	–
• Moose, cooked	10	–	–	–	3.33	–	–	–
• Rabbit/Hare, wild, cooked	21	–	–	–	1.56	–	–	–
+ Liver, deer (cooked)	11	–	–	–	8.8	–	–	–
• Ptarmigan, raw	351	–	–	–	*	–	–	–
• Lake trout, broiled or baked	50	–	–	–	5.0	–	–	–
• Whitefish, broiled	31	–	–	–	1.1	–	–	–
(Watt & Merrill 1963)								
• chinook salmon, raw	*	301	45	–	*	–	–	–

* indicates believed to be present in measurable amount, but no good value available

tr = trace; n.d. = none detected;- indicates analysis not performed

•= important traditional food; + known to be used; x=related species used

Table VIII-1 cont.

Food Type	Analyses per 100 g fresh food						Vit. E
	thiamine µg	riboflav. µg	niacin mg	ascorbate mg	carotene RE	folate µg	tocopherol
Berries (Kuhnlein 1989)							
• *Amelanchier alnifolia*	<4	1	0.3	10.9	0.5	–	–
• *Arctostaphylos uva-ursi*	–	–	–	–	–	–	–
+ *Cornus canadensis*	8	25	0.5	2.1	3.5	10.5	–
Crataegus douglasii	–	–	–	9.5	8.1	–	–
x *Fragaria vesca*	6	26	<.3	23.8	–	–	–
Malus fuscus (Kuhn. 1990)	31	13	1.9	–	–	–	–
x *Rosa nutkana (no seeds)*	–	–	–	413.8	18.0	–	–
+ *Rubus idaeus*	13	1	0.4	30.7	0.6	61.8	–
+ *Rubus parviflorus*	31	<1	<.6	63.6	–	–	–
Rubus spectabilis	40	1	0.5	14.4	31.4	16.5	–
Sambucus racemosa (cooked	–	–	–	30.9	2.2	–	–
• *Shepherdia canadensis*	7	100	0.2	165.6	–	–	–
Vaccinium alaskaense	17	1	0.4	3.3	2	4.9	–
• *Vaccinium membranaceum*	–	–	–	6.6	0.5	–	–
+ *Vaccinium ovalifolium*	4	1	0.4	6.2	0.7	7.4	–
Vaccinium parvifolium	20	8	0.5	6.2	0.2	2.8	–
• *Viburnum edule*	–	–	–	13.4	5.8	–	–
Roots, Greens & Vegetables (Kuhnlein 1990)							
• *Dryopteris expansa (steamed*	–	–	–	–	–	–	–
+ *Epilobium angustifolium*	–	–	–	–	3.9	–	–
• *Fritillaria camschatcensis(raw*	35	36	0.2	29.0	0.3	36.5	–
• *Heracleum lanatum*	2	12	0.3	3.5	0.5	16.1	–
Populus trichocarpa 'cambium	–	–	–	–	–	68.6	–
(Keely 1980)							
• *Tsuga heterophylla 'cambium*	–	–	–	–	–	–	
(Gottesfeld unpublished)							
Pinus contorta 'cambium'	–	–	–	–	–	–	–
Berries (Drury 1985)	mg	mg			Vit. A RE		
+ *V. alaskaense & V. ovalifolium*	0.03	0.10	0.40	2.2	16		–
V. parvifolium	0.01	0.03	0.30	2.8	8		–
Rubus spectabilis	0.04	0.07	0.10	2.4	155		–
Animal Foods (Drury 1985)							
• dry smoked sockeye salmon	0.14	0.60	20.20	0	82		*
herring eggs, raw	0.10	0.12	1.80	0.6	6		–
• venison (deer) raw	0.20	0.36	6.60	0	0		–
(Kuhnlein et. al 1982)							–
+ ooligan grease	0	0	0	0	1985		22
(Health & Welfare,Can. 1985)			NE				
• Caribou, cooked	0.11	0.63	11.56	0	7	–	–
• beaver, cooked	0.08	0.38	16.67	0	0	–	–
• groundhog, cooked	0.04	0.07	13.89	0	0	–	–
• Moose, cooked	0.03	0.32	11.11	0	52	–	–
• Rabbit/Hare, wild, cooked	0.06	0.07	17.00	0	0	–	–
+ Liver, deer (cooked)	0.25	4.40	13.20	26	15875	–	–
• Ptarmigan, raw	0.71	2.33	*	6.7	tr.	–	–
• Lake trout, broiled or baked	0.12	0.26	5.72	3.3	95	–	–
• Whitefish, broiled	0.12	0.06	7.04	0	106	–	–
(Watt & Merrill 1963)							
• chinook salmon, raw	0.1	0.23	*	*	94	–	*

*believed to be present in measurable amount NE=1mg niacin or 60 mg tryptophan

tr = trace; n.d. = none detected;- indicates analysis not performed

•= important traditional food; + known to be used; x=related species used

Table VIII-2

Nutrient: Source	Fibre/100 g portion % RNI
kinnikinnik berries	43-87%
thimbleberries	33-56%
red elderberries	24-41%
saskatoons	20-32%
crabapple	17-30%
soapberries	15-27%
bunchberries	15-26%
raspberries	13-23%
rose hips	13-22%
red huckleberries	11-20%
highbush cranberries	11-19%
fern rhizomes	10-19%

[figures expressed as % of 20 grams fibre and % of 35 grams fibre]

Table VIII-3

Nutrient: Source	Vitamin C (ascorbate)/100 g portion % adult male RNI
rose hips	1035%
soapberries	414%
thimbleberries	159%
red elderberries	77%
raspberries	77%
strawberries	60%
chocolate lily bulbs	73%
salmonberries	36%
highbush cranberries	34%

Table VIII-4

Nutrient: Source	Vitamin A (RE)/100 g portion % adult male RNI
deer liver	1443%
oolachan grease	199%
salmonberries	16% Drury 1985
raw chinook salmon	9%
dry sockeye salmon	8%
moose, cooked	5%
salmonberries	3% Kuhnlein 1989
rose hips	2%

Table VIII-5

Nutrient Source	Folate/100 g portion % adult male RNI	% pregnant female RNI
cottonwood cambium	31%	18%
raspberries	28%	16%
chocolate lily bulbs	17%	9%
salmonberries	8%	4%
cow parsnip	7%	4%
highbush blueberries	3%	2%

Table VIII-6

Nutrient Source	Thiamin/100 g portion % adult male RNI
ptarmigan	65%
venison, raw	18%
dried sockeye salmon	13%
herring eggs, raw	9%
caribou, cooked	10%
beaver, cooked	7%
rabbit/hare, cooked	5%
groundhog, cooked	4%
salmonberries	4%
chocolate lily bulbs	3%
moose, cooked	3%
thimbleberries	3%
wild crabapple	3%

Table VIII-7

Nutrient: Source	Riboflavin/100 g portion % adult male RNI
ptarmigan	166%
caribou, cooked	45%
dried sockeye salmon	43%
beaver, cooked	27%
venison (deer) raw	26%
moose	23%
herring eggs (raw)	9%
highbush blueberries	7%
soapberries	7%
salmonberries	5%

Table VIII-8

Nutrient: Source	Calcium/100 g portion % adult male RNI
ptarmigan	44%
hemlock cambium	25%
dried sockeye	17%
thimbleberry	11%
red elderberries	11%
rose hips	10%
saskatoons	9%
fern rootstocks	7%

Table VIII-9

Nutrient: Source	Iron/100 g portion % adult male RNI	% adult female RNI
caribou, cooked	38%	26%
moose, cooked	37%	26%
hemlock 'cambium'	28%	20%
chocolate lily bulbs	24%	17%
rabbit/hare, cooked	17%	12%
beaver, cooked	16%	11%
groundhog, cooked	12%	9%
highbush blueberries	12%	8%
red elderberries	11%	8%
fern rhizomes	9%	6%

Table VIII-10

Nutrient: Source	Magnesium/100 g portion % adult male RNI
strawberries	22%
thimbleberries	18%
fern rhizomes	18%
red elderberries	16%
wild crabapples	11%
rose hips	10%
saskatoons	10%
chocolate lily bulbs	9%
fireweed stalks	8%

iron, thiamin, niacin, riboflavin, calcium and iron were derived from animal foods, including mammals, birds and fish. Plant foods provided carbohydrates, fibre, Vitamin C and folate. Plant foods also contributed to dietary Vitamin A, thiamin, riboflavin, iron, magnesium, zinc, copper, and manganese. Plant contributions to niacin were less than 10% of the contribution made by animal foods on a per 100 gram basis. Relative plant food contributions to folate, magnesium, zinc, copper and manganese cannot be assessed with the available food composition data, because these analyses were not performed for the animal foods. Plant foods were of moderate importance in terms of calories consumed, generally ranking half or less the energy content of a comparable weight of meat.

A number of foods known to have been important in Wet'suwet'en diet (Fig. VIII-1) are not represented in the tables of food composition or are incompletely analysed. These include fresh or smoked bear meat, smoked lamprey, rendered bear grease, sockeye oil, fresh and dried salmon roe, whitefish roe, low bush blueberries, stonecrop (*Sedum divergens*), and pine 'cambium'. Salmon roe might be important as a source of vitamin A, fatty acids and energy, especially in spring. Sockeye oil might also be a significant source of vitamin A, but there is no data available on its Vitamin A content. Bear meat was probably a good source of iron. Low bush blueberries and *Sedum* probably provided fibre, minerals and vitamins. Pine 'cambium' may have provided minerals such as calcium and magnesium and vitamins such as folate in addition to fibre and carbohydrate.

I have attempted to clarify the contribution of pine 'cambium' by collecting a composite sample for analysis in spring of 1992. The proximate composition of fresh 'cambium' from *Pinus contorta* was 88.3 g moisture, 0.75 g protein, 0.6 g fat, and 9.9 g carbohydrate/ 100 gram portion[2]. 1.1 g of dietary fibre was also present, and the energy yield was 48 kcal, comparable to fruits such as blueberries or salmonberries. Insufficient material was collected for analyses of other nutrients; I plan to collect more edible 'cambium' for further analysis in spring of 1993.

As pine and hemlock 'cambiums' were collected as sweeteners, it would be useful to learn if the sugars they contain can be digested, and under what circumstances. Anecdotal evidence indicates that consumption of large quantities of pine 'cambium' by an individual unaccustomed to eating it will cause diarrhoea and flatulence (Alfred Joseph, personal communication). This suggests that habituation and enzyme induction may be necessary to fully utilise the sugars in pine 'cambium'[3].

It would be desirable to learn more about the carbohydrate, mineral and vitamin composition of lodgepole pine 'cambium', and investigate possible antinutritional substances, such as polyphenolics.

Careful consideration of both nutrient values/100 gram portion and the probably frequency of consumption and normal portion size is necessary to gain an accurate picture of the potential of various foods to meet nutritional needs. Soapberries (*Shepherdia canadensis*) are good sources of fibre, zinc, riboflavin and ascorbate (vitamin C). However, a 100 gram portion of soapberries would be a much larger dose than a normal serving. Soapberries contain saponins (Turner 1981), which can be hemolytic in quantity (D'Mello 1989). The saponin content in soapberries is exploited in one of their most widespread forms of consumption, a froth called "Indian ice cream", which is eaten at feasts and as a treat at other times as well. The actual amount of soapberries consumed ordinarily would be on the order of a tablespoon, far less than 100 grams. This is the medicinal dosage for soapberries as well. Perhaps the high vitamin content explains in part the widespread use of soapberries as a food, despite a strongly bitter taste that most non-Indians find unpalatable, and potentially harmful saponin content.

Review of the Published Nutrient Data

Protein and food energy (Table VIII-1, Figure VIII-2) are predominantly provided by animal foods. None of the plant foods analysed is a significant protein source. Animal foods provide from 100-300 kcal/100 g, with the exception of herring eggs (only 57 kcal) and dry sockeye salmon (357 kcal because of its low water content). The best sources of food energy among the plant foods are fern rootstock, chocolate lily bulbs, hemlock 'cambium', kinnikinik berries, saskatoons, and red elderberries. Their energy content ranges from 126 kcal to 90 kcal/ 100 grams. All of these were

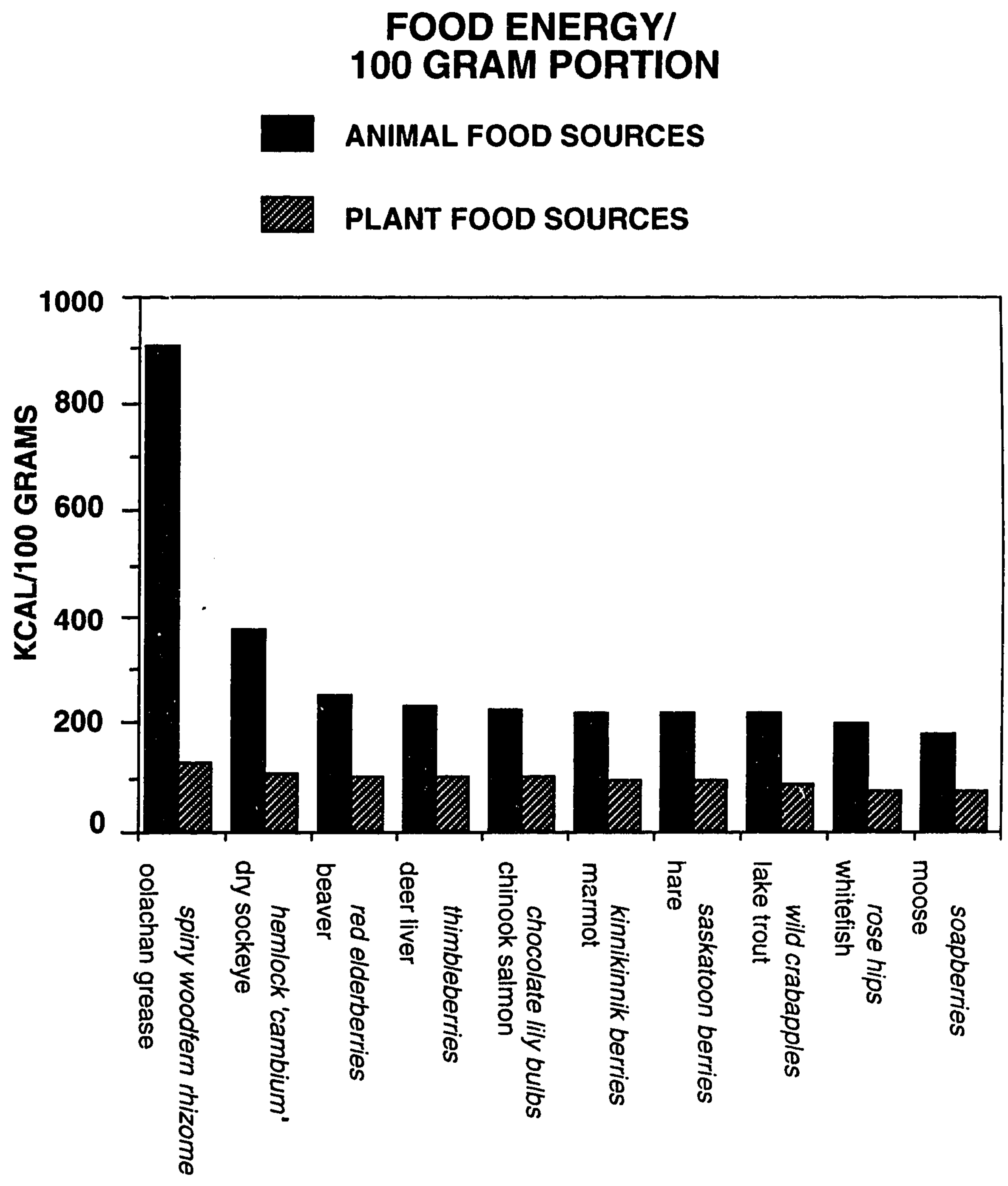

Figure VIII-2

important storage foods with the exception of red elderberries, rarely consumed by the Wet'suwet'en.

In Tables VIII-2–VIII-10 the most important sources of nutrients from the published data are ranked on a percentage RNI basis. Sources of fibre (Table VIII-2) are all of plant origin by definition. Although not strictly speaking a nutrient, fibre intake is required for good health. Low intakes of fibre are associated with bowel disease, heart disease and diabetes (Burkitt 1973, Trowell 1973, J. Anderson 1990). The recommended daily intake of fibre is derived from J. Anderson (1990). He gives a range of recommended values without providing any specific guidelines. Therefore, I have presented the percentages in Table VIII-2 as a range as well. Kinnikinik berries (*Arctostaphylos uva-ursi*) are the best source of dietary fibre. They were also an important winter storage food in the past, although little used now. 100 grams of kinnikinik berries provides from 40-87% of the suggested daily intake of 20-30 grams of fibre. Thimbleberries were eaten casually in season, but not stored, and so would contribute little fibre to the diet on an annual basis. Red elderberry and red huckleberry were rarely eaten by the Wet'suwet'en, as they were more coastal in distribution. Saskatoons were consumed in quantity and stored for winter. Rose hips and cranberries were gathered and consumed in winter, but I do not know what portion of winter diet they formed. Raspberries may have been eaten in quantity fresh, but were not stored. Fern rhizomes, though providing only 10-19% of the RNI of fibre, were apparently eaten throughout the winter and may thus have been a significant fibre source.

Rosehips are far and away the best source of vitamin C, providing more than ten times the RNI/100 gram portion. Unfortunately, I lack information about the quantity of rosehips consumed in the traditional diet, so I cannot say if they actually contributed a major proportion of dietary Vitamin C. Soapberries also have high levels of vitamin C providing more than four times the RNI per 100 grams. Soapberries were an important food and were stored for winter, but were consumed in small quantities as discussed above. This would limit the vitamin C contribution of soapberries to the annual diet. Thimbleberries, raspberries and strawberries are very seasonal in their availability as they were not stored. Red elderberries and salmonberries were rarely consumed because they are primarily coastal species. Chocolate lily bulbs are also seasonal, but were eaten in both spring and fall, making their potential contribution greater. High bush cranberries may have contributed to winter Vitamin C stores, although once again I lack data on amounts stored and consumed over the winter season.

By far the richest source of vitamin A is deer liver, at more than 140 times the recommended daily intake per 100 gram portion. Moose, mountain goat and caribou liver are probably quite similar, though not listed in the tables, as beef liver is also very close to deer liver in vitamin A levels. Liver is only available from freshly killed animals, and constitutes a small proportion of the weight of a fresh carcass, so it would not constitute a frequent diet item. However, as vitamin A is stored, occasional consumption of a very rich source such as liver might be sufficient to meet vitamin A needs. The other rich source of Vitamin A is oolachan grease, which was obtained by trade from the coast. Oolachan grease does keep, and may have been a more constant component of the diet when available. Locally rendered sockeye oil may also have had a significant vitamin A content, but there is no published data to quantify its potential contribution. Other available sources of vitamin A do not seem sufficient to meet vitamin A needs. Salmonberries were not a significant vitamin A source because of their scarcity and perishability. Salmon, consumed frequently, does contain vitamin A, but at 8-9%, more than a kilogram of fish would have to be consumed to meet vitamin A needs. (One kilogram of dry sockeye would be a prodigious amount, as it has a moisture content of less than 10%!). Moose contains vitamin A as well, but more than 2 kilograms of moosemeat would have to be consumed to meet the RNI from this source. Rosehips are the only vegetable source of any note, and at only 2% of the RNI, their role was at best supplemental.

Folate is present in both animal and plant foods, although the low number of folate analyses in the literature makes the determination of folate sources problematic. No good sources of folate are apparent from the nutrient data on traditional foods. The best listed source, cottonwood 'cambium', is not consumed by the Wet'suwet'en, but is eaten by the neighbouring Haisla (Gottesfeld 1992). Whether pine or hemlock 'cambium' are similarly high in folate can only be a matter of speculation until more complete analyses of these foods are available. Other sources such as raspberries and cow parsnip, are very seasonal, and so could not have met yearly dietary folate requirements. Chocolate lily bulbs, a moderate source of folate at 17% of the RNI, are available for limited periods in spring and fall. Some groups cooked and dried these bulbs (Turner and Kuhnlein 1983), including, apparently, the Gitksan (People of Ksan 1980), but I have no record of this practice for the Wet'suwet'en. Highbush blueberries were consumed in fair quantities, although their low folate concentration, only 3% of the RNI, does not make them a very good dietary source. Animal sources cannot be ranked as folate sources because folate values for these foods have not been included in food composition tables. Health and Welfare Canada (1990:116) suggests that liver is a good dietary folate source. Folate from sources such as liver may have provided the bulk of dietary folate in the aboriginal diet, as traditional vegetable foods have relatively low levels.

Thiamin was supplied in moderate amounts by animal foods, although only ptarmigan is a notably rich source. I have been unable to determine whether grouse, probably utilized more often than ptarmigan, is similarly rich in thiamin. Prevailing forms of cooking (boiling meat or fish to make soups and stews) would conserve B vitamins, because the broth is consumed along the the meat or fish. Plant sources of thiamin are not significant.

Local meats are richer sources of riboflavin. Ptarmigan provides more than the RNI per 100 grams. Other sources range from 44% (caribou) to 23% (moose). The plant sources are only supplemental.

Calcium levels in ptarmigan are good, with 100 grams providing 44% of the RNI. The next best source is hemlock cambium at 25%, but the calcium from this source is likely of much lower bioavailability (see discussion). Dried sockeye calcium would be of good bioavailability. Thimbleberries would not be a significant source of calcium on an annual basis because of their short season of availability. Elderberries are too uncommon to make a significant contribution. Rosehips, saskatoons and fern rootstocks could have played a supplemental role as calcium sources, but bioavailability from these sources is not known.

Iron supplies from caribou or moosemeat is moderately high at 38-37% of the male RNI, but only 26% of the female RNI. Hemlock cambium and chocolate lily bulbs have a substantial iron content as well, but bioavailability from vegetable sources is much lower than heme iron from meat (Hazell 1985; Monson *et al.* 1978). Beaver and groundhog are moderate sources. Highbush blueberry, elderberry and fern rootstock are moderate sources of iron also at 10-14% of the RNI. Again, bioavailability of iron from these sources is unknown. Looking at nutrient density/ 100 grams, dietary iron does not seem to present a problem for men (265 grams of moose or caribou would meet the daily requirement) but could be more of a problem for women. However, dietary iron would be much lower during periods of reliance on fish or small game for the bulk of daily protein and food energy. Reference to Figure VIII-1 would suggest that there were significant periods of the year when protein and energy were derived from these sources. More information on the relative consumption of these different sources of protein, and energy would be required to determine if iron consumption were adequate or marginal in the aboriginal diet.

Examination of Table VIII-10 indicates several relatively high plant sources of magnesium. In the absence of comparable data on the animal foods, one cannot assess the importance of these sources in the diet, or the adequacy of the diet for magnesium. Strawberries are the richest source at 22% of the RNI; their short season and relatively low yields would minimize their actual contribution to annual magnesium intake. Thimbleberries, at 18% are likewise of short season. Fern rootstocks, also at 18%, might be a significant annual source of magnesium, because of the prolonged period of consumption. Rose hips, saskatoons and chocolate lily bulbs were probably consumed in sufficient quantities to be a significant dietary source, but their magnesium content is only 10-11% of the RNI, suggesting a supplemental role in magnesium balance.

Seasonal Aspects of Dietary Quality and Plant Food Importance

There are some uncertainties in my reconstruction of seasonal availability of animal foods, as my field research has emphasized uses of plants, but Figure VIII-1 is adequate to examine the types of foods available by season to reconstruct times when particular foods may have made important contributions to the seasonal nutrient balance. Late winter and early spring stand out as times when availability of carbohydrate foods was likely low, and available wild game was probably of low fat. Game condition is poor at this season, and stored foods such as berries, grease, and dry fish might be running low. Nutritional stress due to low intake of vitamins, low overall calorie intake, and high ratios of protein to fats and carbohydrates (Speth and Spielmann 1983) may have been problems at this season, at least in some years. A food especially mentioned as being consumed at this critical time of year is the rhizome of spiny woodfern, *Dryopteris expansa*. It provides 27.3 grams of carbohydrate per 100 grams edible portion, and 126 kcal (525 kJ). It stores well, and is available in case of need by shovelling the snow off of the patch and digging the rootstocks in late winter (Morice 1893; Madeline Alfred, personal communication).

The importance of beaver as a spring food source may reflect these needs for fat and calories as much as the historic period economic incentive for beaver trapping for cash. Proto-historic period trade for coastal products such as oolachan grease might also be explained by the shortage of food at this season. Oolachan grease is rendered during a short period in April. Interior groups made the difficult journey to the coast annually through late winter snowpacks to obtain grease and dried oolachans (People of Ksan 1980:89). Oolachan grease, in addition, is one of the richest sources of vitamin A available to Wet'suwet'en and neighbouring peoples (TableVIII-4).

The seasonal utilization of the various green vegetables in early spring may also reflect seasonal stress in nutrients levels such as Vitamin C, fibre, Vitamin A. Analysis of chocolate lily bulbs (*Fritillaria camschatcensis*), gathered in May, indicates relatively high vitamin C values, and also high values of folate. The local species of wild onion, *Allium cernuum*, has not been analysed for vitamin content, but wild chives, *Allium schoenoprasum*, contain 32 mg of vitamin C per 100 grams fresh weight (Kuhnlein and Turner 1991), indicating that the seasonal preference for eating wild onion might be related to restoring vitamin C levels.

Limitations of Available Nutrient Data

Available nutrient analyses are not from the same climatic and edaphic area as my study area, which could cause variation in vitamin and mineral content, and even possibly in carbohydrates. Published analyses from different climatic regions may differ for the same species. In Table VIII-1 there is a noticeable discrepancy between the Vitamin A content of salmonberries reported by Drury (1985) from Sitka Alaska, and Kuhnlein (1989) from southwest British Columbia, resulting in salmonberry appearing twice with different rankings in Table 4, sources of Vitamin A. The figures for vitamin C content of red huckleberry (*Vaccinium parvifolium*) are even more divergent, with Keely *et al.* (1982) reporting 37 mg/ 100 g portion for Washington State berries, while Kuhnlein (1989) found only 6.2 mg and Drury found a mere 2.8 mg Vitamin C per 100 gram portion of huckleberries. Published values are not always available for important species, or may represent raw foods or non-traditional preparation techniques, with unknown influence on the nutrient values obtained.

Analytical techniques and units of reporting may also differ between different investigators, especially if older studies are consulted. The comprehensive studies of Yanovsky and Kingsbury (1938) are difficult to compare with more recent data, for example.

Limitations of the available nutrient data include lack of analyses for iodine, folate, copper, magnesium, manganese and vitamin E for many foods. Methodologies for elucidating the carotene contribution to vitamin A and analyses for folate have been problematic, making reliable analysis of foods for these nutrients difficult (Watt & Merrill 1963; Health and Welfare Canada 1983:95).

Older studies report fibre content as crude fibre, which is now known to seriously underestimate dietary fibre (Van Soest and McQueen 1973). This makes comparison with newer data difficult, and hampers understanding of the potential contributions of various foods to dietary fibre.

Another potentially important aspect of fibre and dietary carbohydrate intake is the influence of soluble fibre (pectins and hemicellulose) on blood sugar levels and insulin (J. Anderson 1990). This has been related to the occurrence of high rates of diabetes in modern native populations (Nabhan 1991, Brand *et al.* 1990). Unfortunately, outside of a few pioneering studies in the Southwest USA (Brand *et al.* 1990), little is known about the different components of the carbohydrate fraction of North American native foods.

Discussion

Overall dietary quality of traditional Wet'suwet'en diet (outside of infrequent periods of famine) was probably good. Protein, calories, essential fatty acids, and B vitamins, probably posed no problems. The relatively high fish, fish roe and fish oil consumption would provide beneficial levels of omega-3 fatty acids (Hepburn *et al.* 1986), although linoleic acid levels might be low. Appavoo *et al.* (1991) found a higher ratio of n-6:n-3 fatty acids in the diet of the Sahtú Dene than the North American average. The Wet'suwet'en diet may have resembled that of the Sahtú Dene.

Data from relatively traditional modern native populations suggests that iron deficiencies for children and women, and calcium, vitamin A and folate deficiencies may be problems (Desai and Lee 1971, Kuhnlein 1984, Wein *et al.* 1991). In addition, in Subarctic populations, chronic low levels of Vitamin C and borderline scurvy have been reported (Desai and Lee 1974a, Berkes and Farkas 1978).

My own analyses suggest that vitamin A and folate could have been in low supply in traditional diet. Liver and oolachan grease are the known rich sources of vitamin A in traditional diet. Frequency of liver consumption and its distribution in the population remain unknown, and some consultants feel that trade with the Niska'a or Haisla of the Coast to obtain oolachan grease may be recent. Barring liver or oolachan grease, salmon, moosemeat, and rosehips are indicated by the nutrient data as possible sources. Other possible sources of vitamin A are salmon oil and salmon roe, although I have been unable to obtain data on Vitamin A content for these foods.

Relatively high folate values are reported in only two traditional foods known to have been used by the Wet'suwet'en, raspberries and chocolate lily bulbs, both of short seasonal availability. It is suggestive that cottonwood 'cambium' (not used by the Wet'suwet'en) is recorded as a good source of folate, but extrapolation of this value to pine and hemlock 'cambiums', both derived from conifers, is not warranted without specific chemical investigation. Unfortunately, folate analyses are difficult to do and hard to interpret, and efforts to obtain values from pine 'cambium' have not yet been successful (Gottesfeld, in progress). A clearer picture of folate nutrition in the pre-contact diet will be obtained by including values from animal foods in the analysis.

Vitamin C levels seem adequate, at least in fresh fruits and berries, which were eaten in large amounts. Vitamin C content of stored foods late in winter is not known, but could be significantly lower than fresh values. Drury speculated that low vitamin C values in her samples might be a result of prolonged storage in a freezer (1985). However, Benson *et al.* (1973) found no decline in vitamin C in huckleberries (*Vaccinium* spp., not specified) in extended frozen storage. Norton *et al.* (1984) also reported that vitamin C was as high or higher in dried berries as in fresh berries, though none of the species they analyse are species used by the Wet'suwet'en. The only season of the year when Vitamin C shortage might be anticipated is late winter/early spring. Although I have not included analyses for teas and medicines, teas containing conifer needles and infusions of Labrador tea contain significant vitamin C (Berkes and Farkas 1978; implied from vitamin C levels of dried labrador tea leaves reported by Kuhnlein 1990). Spring 'tonic' medicines with these and other potentially nutritionally significant components were frequently employed at this time, often on a daily basis (Gottesfeld unpublished field notes).

Calcium levels could have been marginal before the introduction of dairy products. Foods like fish head soup, and dry fish consumed with the bones such as dried oolachans would have been important dietary sources. Health and Welfare Canada (1985) report 142 mg of calcium per 150 ml serving of fish head soup. Salmon heads were traditionally preserved in the smokehouse, extending their availability beyond the summer fishing season. Ptarmigan are reported to have high values of calcium. The total contribution of ptarmigan (which are quite small birds) to the diet is not known, but was probably not large. Keely (1980) reports very high values of calcium in hemlock 'cambium'. This could have been significant, if hemlock cambium from Northwestern British Columbia (growing on soils with low calcium levels) also contains significant calcium, as hemlock was a dietary staple of the Gitksan and coastal groups and utilized by the Wet'suwet'en as well. However, the availability of this calcium is unknown; it could be closely associated with the pectins in the cell walls and thus of low bioavailability (Hazell 1985). Among other foods, only rose hips is a potentially significant source of calcium which is not highly seasonal in its availability.

The apparent low to inadequate calcium intake of the traditional diet may be overestimated by standards based on modern European and North American populations. It is certain that much of the world's population does not meet the 800 mg recommended daily intake of the US and Canada (Allen 1982, E. Anderson 1990). The FAO/WHO Committee on Calcium requirements has suggested that 400-500 mg/day may be a more realistic estimate of adult calcium requirements (Allen 1982). If adult calcium requirements were only 400 mg per day, then 100 g of hemlock cambium would provide 50% of the calcium requirement, and 100 g of dried sockeye 34%.

Deficiencies or low iron levels are reported in modern native children and adult women (Desai and Lee 1971, Kuhnlein 1984, Wein *et al.* 1991), especially coastal populations which may derive much of their protein from fish, shellfish, and birds. Modern Wet'suwet'en probably have iron intakes more similar to the Anaham people of Interior British Columbia reported by Desai and Lee (1971), which is low for children and adult women, but better than the coastal Ahousat also included in the study. Iron intake from the traditional diet was probably adequate for Wet'suwet'en men, but could have been a problem for adult women. Salmon, trout, whitefish, beaver, groundhog and rabbits, which accounted for a substantial portion of

Wet'suwet'en protein intake, are relatively low in iron compared to moose or caribou. Proportions of these various protein foods consumed in the year would have a major effect on total dietary iron.

Hemlock 'cambium' may also have been a significant dietary source of iron, but availability of non-heme iron is significantly lower than heme iron from animals (Hazell 1985, Monson *et al.* 1978). Availability of iron from vegetable sources is enhanced by vitamin C intake and decreased by fibre and phytates (Monson *et al.* 1978, Hazell 1985). Phytate binding is possible, because phytate has been reported in grain, seeds, roots and tubers (Hallberg *et al.* 1989), but I am not aware of any investigation of the occurrence of phytates in native North American foods. Fibre could also influence absorption from hemlock cambium.

Pubescent girls could have been iron deficient due to restriction of diet in the year following menarche to dry meat, fish, and berries (Gottesfeld 1991, Murdoch unpublished); dietary iron would depend on how much dry moose, bear or deer meat, as opposed to fish or beaver, might be available for consumption. If pubescent girls were allowed to consume dried cambium this could have been an additional source of iron.

The Wet'suwet'en were able to find sources of food in their environment which gave them a diet of good quality and provided essential nutrients. The mere presence of potentially nutritious species in an environment does not guarantee use. Knowledge of how and when to harvest potential foods, and how to prepare or preserve them are involved in whether a given species is utilized by a group for food. (Other factors which I will not discuss here include diet breadth and optimal foraging models, see chapter 2). Many species of plants contain toxic compounds. Detoxification techniques (Johns 1990; Johns and Kubo 1988; Stahl 1984, 1989) are employed by many groups to make available otherwise nutritious plant foods which contain harmful levels of toxins. Harvesting may also be carried out in a manner to minimize potential toxicity or enhance nutritional value. Cow parsnip (*Heracleum lanatum*) is picked young by northwest North American native groups and peeled to reduce furanocoumarins (Kuhnlein and Turner 1986), toxic compounds which react with DNA in the presence of ultraviolet light (Camm *et al.* 1976). Pine 'cambium' and hemlock 'cambium' were harvested by the Wet'suwet'en and neighbouring Gitksan during a short annual optimal period in the spring which maximizes digestible carbohydrates and minimizes indigestible cellulose, and lignans, tannins and resins. These toxic factors are found in Scotch pine inner bark, particularly late in the growing season (Airaksinen *et al.* 1986); almost certainly they also occur in lodgepole pine inner bark, and probably that of hemlock as well. Cooking techniques may also alter the digestibility or toxicity of foods and make available important food resources. The traditional methods of cooking camas (a liliaceous bulb from *Camassia quamash* and *C. leichtlinii* widely used as a food in the Northwest U.S. and southwest British Columbia) convert its indigestible inulin to fructose, making it a nutritious carbohydrate source (Konland and Robinson 1972). Pit cooking of *Dryopteris* rhizomes or chocolate lily (*Fritillaria*) bulbs could have enhanced digestibility or nutrient content of these foods, although studies of the digestibility of their carbohydrates are lacking.

Inuit and Subarctic hunting populations stand out as populations which derive the majority of their food energy from animal sources. The Wet'suwet'en are also heavily dependant on animal foods, but plants have always been a significant component of diet as well. There has been some investigation of the consequences of heavy dependence on animal products. Speth and Spielmann (1983) discuss need for carbohydrate and/or fat in the diet to maintain health and make possible the utilization of protein. They emphasize the superior "protein sparing" effects of carbohydrate consumption versus fat consumption under conditions of marginal energy intake. Their work suggests that at least a minimal inclusion of carbohydrates in the diet significantly enhances health. In northern environments where such a large proportion of the diet consists of meat and fish, the importance of plant foods may be far out of proportion to their actual quantitative contribution to the diet.

Fat can also be consumed along with lean meat. Depending on the types of fats and their constituent fatty acids, this contribution to food energy can be accomplished without elevation of risk of ischaemic heart disease (Kuhnlein *et al* 1991, Harris and Connor 1980) if marine mammals, fish and shellfish constitute important sources of dietary fats.

The Wetsuwet'en consumed large amounts of salmon flesh, roe and rendered sockeye oil, whitefish, trout (including lake trout), and, at least in proto historic times, oolachans and oolachan grease along with various mammal and bird species. It is probable that their intake of ω-3 fatty acids was relatively high, although lower than coastal dwellers, and may have contributed to low rates of cardiovascular disease in the past.

There may be metabolic or biochemical changes in different populations who are adapted to diets different from those characteristic of Europe and North America. (Brand *et al.* 1990, Draper 1977, Nabhan 1990, Schaefer *et al.* 1972, Thorburn *et al.* 1987). Northern native people may have different requirements for protein than southern populations (Berkes and Farkas 1978), also presumably as a result of adaptation to a diet high in protein.

Whether low levels of easily digested sugars in the traditional diet of the Wet'suwet'en would be a factor in the present relatively high levels of obesity and diabetes is difficult to say without a better understanding of the carbohydrate sources in the traditional diet, and of relative intakes of carbohydrate versus fat and protein. Studies of the O'odham of Arizona and Sonora, and Australian Aborigines, have suggested that the complex mucilages which were the dominant carbohydrates in their traditional diets had a hypoglycaemic effect (Nabhan 1990, Thorburn*et al.* 1987) and that dietary shift to a "western" diet is a significant factor in the very high prevalence of adult onset diabetes in these populations today. In contrast, the berries which form the bulk of dietary plant foods for the Wet'suwet'en contain fructose and sucrose, which are quickly broken down in the body. The nature of the fibre and carbohydrate components of tree 'cambium' is less well understood, but possibly may have provided more complex carbohydrate to the diet.

The Modern Wet'suwet'en Diet

Contemporary Wet'suwet'en people who live in Northwest British Columbia consume a mixture of traditional foods and foods purchased from the grocery store. Market foods are similar to those eaten by other Canadians, including items such as hamburger, pork chops, potatos, rice, pasta, bread, margarine, cookies, coffee, tea, and fruit drinks. Traditional foods still consumed include chinook salmon (fresh, frozen, canned and, more rarely, smoked), sockeye salmon (fresh, canned or smoked), trout, moose, bear, grouse, saskatoons, blueberries and huckleberries, soapberries, wild strawberries, wild raspberries (fresh, canned or made into jam), and cow parsnip stalks. Smoked beaver and smoked bear meat are still consumed in potlatches. In addition, labrador tea is collected and brewed by some. New "traditional" foods like fried bannock, introduced during the fur trade, are also frequently consumed.

Conclusions

The bulk of calories, protein, minerals and B vitamins in the traditional Wet'suwet'en diet probably were derived from animal foods, particularly salmonid fish, game mammals such as caribou or moose and deer, and small game including rabbits, marmots, grouse and ptarmigan, and waterfowl. Availability of animal foods was year round, although salmon was consumed more heavily in the summer and fall than late winter and spring.

Plant foods were important in the traditional diet of the Wet'suwet'en people as well, although harvested and consumed in lower quantities than animal foods. Plant foods were consumed throughout most or all of the year, although some foods such as strawberries were only available fresh for a short season. Large quantities of certain plant foods, notably berries and fern rhizomes, were collected and stored for winter consumption. Critical contributions by plant foods included vitamin C, folate, fibre, and carbohydrate to balance the consumption of protein in meat. Plant foods also made significant contributions to several other nutrients, including iron, calcium and magnesium. The most important plant foods in terms of quantity and annual contribution to nutrition were various berries which were eaten both fresh and stored for winter, especially huckleberries and saskatoons. The spiny woodfern rhizome may have been important for its supply of food energy in late winter, when other food sources were running low or difficult to obtain. Green vegetables and chocolate lily bulbs harvested in spring were important seasonally in restoring vitamin C levels and supplementing the supply of lean meat in late winter and spring. Conifer needle teas, Labrador tea, and various spring tonic medicines also probably contributed to vitamin C at this season.

Cultural practices enhanced the nutrient value of some foods and minimized toxicity. This is especially significant for cow parsnip and pine 'cambium', which can only be harvested for short periods in the year. Cultural practices also made possible winter storage of plant foods, compensating for the short period of harvest for most foods. Data presented by Benson *et al.* (1971) and Norton *et al.* (1984) suggest that vitamin levels of traditionally stored foods may remain high, confirming the nutritional significance of stored foods.

Traditional foods retain the potential to contribute to dietary quality among contemporary Wet'suwet'en, with animal foods contributing protein and ω-3 fatty acids, and plant foods augmenting vitamins and dietary fibre while not adding high levels of saturated fats and concentrated sugars to the diet.

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[1] A version of this chapter has been accepted for publication by Ecology of Food and Nutrition.

[2] Analysis performed by Food Laboratory Services, Alberta Agriculture. Carbohydrate calculated by difference method. Dietary fibre as neutral detergent fibre.

[3] Suggestive data on cambium and inner bark of Scotch pine is included in Airaksinen *et al.* (1986). Although it is not a species which occurs in North America, it represents the only published modern analysis of edible pine bark constituents I am aware of. They report 46.5% polysaccharides, 6% pectins, and 12.7-17.1% lignans for phloem, and report that the cambium contained mainly polysaccharides, the concentrations and qualities of which varied greatly during the growing season. The inner cortex contained 37% hexosans (cellulose) and 25% pentosans (hemicellulose). They report that 61% of the polysaccharides in the inner cortex were hydrolyzable. Scotch pine bark (including cambium, phloem and inner cortex) contained 68 mg of calcium and 90 mg of magnesium/100 grams. Vitamins were not included in the analyses. Airaksinen *et al.* do report lignans and tannins in the inner cortex of scotch pine, along with resins, terpenes, waxes and steroids.

Summary and Conclusions
Chapter 9

As other foraging peoples the Wet'suwet'en used (and still use) a diverse array of plants in their environment for foods, medicines and technological materials. Despite traditional heavy reliance on fish and game for food, raw materials and even medicine, plants in the broad sense made a number of significant contributions to their way of life. Study of factors which influence the perception and use of plants as resources reveals linkages between the intrinsic properties of the plants themselves, their distribution on the landscape, and social and cultural factors. I have maintained that plant use is adaptive, that the use of plants contributes to a viable way of life for the Wet'suwet'en people. The use of plants must be seen in a broader context of the relationship of the Wet'suwet'en people to the landscape they live in. The Wet'suwet'en have a holistic world view, which views people, plants, animals, spiritual entities and the land itself as interacting elements of one system, with mutual obligations and ties.

Plant foods, although not providing the bulk of food energy in most circumstances, provide carbohydrate, vitamin C, and fibre. Without use of plant food supplements or medicinal teas, deficiency conditions like scurvy cause serious health problems. In addition, carbohydrate or fat are required to use lean meat efficiently for food because the nervous system requires glucose for function. In famine conditions, plant food calories helped to ensure survival. Plant foods also provide dietary fibre, necessary for proper bowel function. Dietary fibre may play a preventative role in colon cancer, and low intake of dietary fibre is associated with higher incidence of heart disease and with diabetes.

Plants were used as raw materials for a number of technological uses. Ethnographies of northern hunting peoples may downplay the significance of plant foods, but in a northern environment, the importance of wood for tools, shelter, and above all heat, is seldom missed. The importance of plant materials such as moss for insulation and diapers is also commonly remarked upon by outside observers. The Wet'suwet'en used plant products for these purposes, and also used several types of barks or plant fibres for cordage. The use of wood for smoking to preserve foods and to preserve and colour hides is also important, and requires awareness of the properties of different types of woods or cones.

Plants provided the majority of medicines and were used to treat a variety of conditions including infectious diseases, chronic conditions like arthritis, childbirth, and fractures and wounds. Plant medicines were utilised alongside spiritually based approaches including ritual shamanistic performances and secret society initiation. Plant medicines were sometimes combined with animal products such as grease for compounding salves, or use of animal parts like beaver castor. Both plant and animal medicines also formed part of various ritual treatments, and plant medicines were used for spiritual cleansing and protection.

Questions which have guided my work on traditional plant uses are: what plants are used? where and when are they gathered? what are they called? and most importantly, why are these plants selected for these uses? In Chapter 5 I have largely dealt with what plants are used. I have touched only briefly on where plants are gathered in this work. Discussions of seasonal timing of plant use and gathering have been given in Chapters 5 and 8. The most far reaching question is why are particular plants used for particular purposes. The answer to this question has many facets. I have assumed that the choice of plants for particular purposes is in some sense adaptive or functional. That is, that intrinsic properties of the plants themselves and the spatial and temporal arrangement of their availability combine to render certain choices more adaptive than others given culturally (and biologically) defined needs of a group of people' (c.f. Alcorn 1981). Intrinsic factors of the plants themselves include nutrient and toxin content, active plant chemicals, fibre or wood strength and ease of extraction or use. Spatial and temporal arrangement of plants enters into plant utilisation as it interacts with the seasonal round. Optimal foraging approaches such as diet breadth modelling and patch productivity and choice are useful for investigating the interaction of spatial and temporal arrangement of plants with their utilisation and resource value.

Examination of the chemical composition of plants chosen for foods or medicines can elucidate nutrients and toxins present, and active compounds which would effect medicinal activity. In this thesis, I have only indicated the potential of examining medicinal plants for active compounds which may relate to their selection for medicinal uses (Chapter 5). In Chapter 8 I have reviewed what is known about the nutrient content of plant foods in the traditional Wet'suwet'en diet to attempt to understand what the contributions of these foods were to the traditional diet. I have assumed that if plants were selected for use they must have provided needed elements of diet, though I recognize that cultural factors and individual preferences also enter into plant use. Plant foods used by the Wet'suwet'en have been demonstrated to contain carbohydrate, food energy, dietary fibre, and a variety of vitamins and minerals. Diet breadth models enter here too (c.f. O'Connell *et al.* 1982); more plants may potentially provide nutrients to the diet than could be profitably gathered. That is, the return for energy invested to harvest certain plants may not be sufficient to repay the effort of gathering and processing.

The contribution made by various plant foods must be viewed with reference to the qualities of other dietary items available at the same time. For example, the use of green vegetables by the Wet'suwet'en in spring must be explained in terms of other foods available at that time, as well as the fact that wild greens are generally only harvestable when they are young. Taking in a diversity of secondary plant compounds may also be significant in the array of wild plant resources used by a given people (c.f. Johns 1990). Other more elusive aesthetic and cultural factors enter into plant food use as well, and may condition which potential plant resources will be perceived and sampled in an environment (c.f. Alcorn 1981).

The Wet'suwet'en possessed a detailed awareness of plants in their environment and when and where plants were available as resources. Plant exploitation sometimes involved planning, coordination of relatively large numbers of people and harvest of large amounts of foods for winter storage or for a planned feast. Berry picking and fern root gathering expeditions such as those described by Elsie Tait from Hagwilget are examples of this type of plant harvest (Turner *et al.* 1992). Other plant use was much more casual and opportunistic, such as picking berries to eat while walking, or cutting fresh willow bark for a rope when a load needed to be hauled.

Optimal foraging models help to explain plant resource use and tie into other cultural factors like the presence of territory and the transition from resource use to resource management. When a realisation of how critical the berry harvest was to annual dietary adequacy is combined with awareness of the spatial and temporal patchiness of berries as a harvestable resource, enhancement of berry patch quality through controlled burning seems a natural and prudent course of action. Economic defensibility and patch productivity also bear on issues like territoriality (Chapter 2).

Ethnobotanical classification at first glance seems to bear little relationship to concepts like adaptation. However, classification and perception of plants is not separate from the rest of the culture; classification and naming of plants bears directly on the relationship to the environment and its floral and faunal resources. In common with other foraging peoples whose ethnobiological classification has been studied (e.g. Hunn and French 1982; and see Berlin 1992), Wet'suwet'en plant classification is not characterised by a well developed hierarchical taxonomic structure. Most plants are recognised at the folk generic level, with few or no folk specifics. Life form groupings are somewhat fluid and include various "empty" categories with a number of forms which are not linguistically distinguished, in common with various other northwestern North American groups (Turner 1974, 1987, 1989). As with the Sahaptin (Hunn and French 1984) and various B.C. Indian groups studied by Turner (1974, 1987, 1989) Wet'suwet'en plant classification reflects in part utilitarian concerns. My attempts to elucidate life forms and intermediate groups in Wet'suwet'en ethnobotanical classification revealed a number of groupings which had varying degrees of functional importance, such as "berries" as a life form, or "prickly plants" and "poisonous plants" as intermediate groups. As Randall and Hunn (Randall 1987, 1976; Hunn 1982) argue, formal taxonomies can be erected for most cultures which do reflect important aspects of human cognition, but limiting ethnobiological classification to such schemata may obscure the functional and important groupings with which people order their relationship to the biological world on a daily basis.

It is logical that people should encode important functional information about the plants in their environment in their labelling and classification of plants because plants are basic constituents of the ecosystems in which people live and on which they depend. This is especially true for foraging and horticultural peoples whose experience with plant life is predominantly with diverse natural vegetation communities whose characteristics they must understand in order to successfully make a living[2]. Utilitarian factors are not the only aspects of perception of plants, as Bulmer (1974:12-13) points out. Concepts like "natural kind" do have salience and help to order our perceptions of the environment. Atran (1990) argues effectively that classification of natural kinds differs from cultural artifacts, and suggests that this difference is fundamental and grounded in neurology. While this appears to be true, nonetheless the literature contains many examples of functional considerations overriding natural affinity as perceived by the botanist in terms of the classifications of plants by various traditional cultures, as, for example, the exclusion of cultivated plants from life form categories where wild congeners will be so classified (c.f. Balée 1989).

A number of aspects of Wet'suwet'en land/plant resource relationships can be viewed as "adaptive" where other aspects of Wet'suwet'en culture and adaptations are functions of history, other aspects of cultural integration, or symbolic systems[3]. I have argued that territoriality is adaptive in terms of the distribution of resources on the land from the perspectives of optimal foraging and economic defensibility. A variety of ideological and practical factors can be seen as effecting conservation by the Wet'suwet'en. I have argued that the ideology of respect combined with the proscription on waste tends to conserve resource species, and may contribute to long term stability of the Wet'suwet'en way of life.

Territoriality and the concept of stewardship of land and resources also combine to produce resource management: burning for enhancement of berry patches and vegetation management. In this sense, conservation requires active management on the part of the Wet'suwet'en to maintain the resource base.

The Wet'suwet'en adaptation was apparently viable and stable, at least in the sense of resilience discussed by Berkes (1989) and Clarke (1977). The Wet'suwet'en appear to have lived by fishing, hunting and gathering in the Bulkley and upper Fraser drainages for a period of centuries to millennia. At this point in time it is hard to examine the nature and stability of their aboriginal subsistence adaptation critically, since it has undergone major changes in the historic period. The introduction of European trade goods and the fur trade have transformed the subsistence system and made pervasive changes in the culture, including the feast hall and the territory system. In the recent period, the pace of change has accelerated with the entry of many other actors on scene, notably Eurocanadian settlers. In the past few decades resource exploitation like agriculture and large scale industrial forest harvesting, and large scale commercial fishing have continued to transform the landscape and regional economy, inevitably impacting the Wet'suwet'en people. Despite these changes insights can still be gathered which are useful for comparative purposes with other cultures around world, and possibly for the future of Northwest B.C.

The potential long term stability of subsistence patterns is theoretically significant. The ways of life of various peoples around the world in areas such as Australia (Lewis 1991, 1982), New Guinea (Moylan 1973, Salisbury 1977, Clarke 1977, Smith 1977, Foin and Davis 1987), Micronesia and Melanesia (Carrier 1987, Alkire n.d., Freeman *et al.* 1991), South America (Hames 1987, Stock 1987) and Canada (Berkes 1977, 1987, 1989; Brightman 1987) have been examined to see whether they are "stable" or whether resource depletion is occurring. Sustainability of traditional ways of life has become a major theoretical and practical issue at the present time.

Early models of sustainability involved concepts of stability and adaptive feedback loops incorporated into social structures and cultural values of traditional societies. Links between ideology and conservation were made by authors such as Rappaport (1968). More recent literature has explored both the concept of "stability" and the links between aspects of traditional small scale societies and conservation (Hames and Vickers 1982, Berkes 1989, Clarke 1977, Foin and Davis 1987, Gadgil and Berkes 1991) Some have argued that, for a practice to be described as conservation, it must be deliberate and conscious (Hames 1987). Others such as Berkes (1989), Gadgil and Berkes (1991) and Stock (1987) have argued that conservation functions may be latent. A great deal of the recent common property literature examines the forms of regulation, deliberate and latent, which traditional societies have taken to ensure relative persistence of a shared resource base (McCay and Acheson 1987, Ostrom 1990, Berkes 1989, Freeman *et al* 1991).

Some authors have implied that the search for stabilising feedback loops such as conservation is irrelevant if disequilibrium is such to change the system by external stochastic forces before an equilibrium condition could be achieved (Moylan 1973, Salisbury 1975). However, insofar as system instability is not excessive, people must achieve a quasi-equilibrium in order to persist, or be able to recover from a perturbation or ecological crisis by reestablishing an ecologically viable adaptation. Berkes (1989) and Clarke (1977) have emphasized that "stability" or persistence of a human adaptation requires resilience, rather than an unchanging equilibrium.

Human influenced ecological systems may show significant shifts in populations of animals and plants from a hypothesised "pristine" state; persistence may not include conservation of every game or plant species, and may not be without alteration of plant communities. There is evidence that aboriginal people can be important in regional ecology (Smith 1977). A recent talk by Charles Kay of the University of Utah (University of Alberta March 31, 1993) suggests that the Shoshone were very influential in the ecological balance in the Yellowstone area of the western United States. Kay marshals evidence to suggest that aboriginal predation on elk and bison depressed ungulate numbers sufficiently to prevent range overgrazing, and allowed development of shrub communities which produced berry crops on which the Shoshone depended for food. This adaptation was destabilised after establishment of Yellowstone National Park and the imposition of military authority in 1872 resulting in major shifts in vegetation communities as ungulate numbers increased explosively in a protected state (Kay oral presentation 1993).

Authors such as Gadgil and Berkes (1991) argue that conservation practices and traditional resource management are likely to be adaptive, and reduce some of the instability of the system, leaving more capacity for adaptation to external forces such as infrequent severe weather or geological events. Vayda and McCay (1975) emphasize that homeostatic models do not imply static equilibria, but instead relate to system properties like resilience.

Wet'suwet'en plant use, subsistence and other aspects of their way of life have not been static and unchanging over the past 200 years despite the apparent long term stability (persistence) of aboriginal populations in the region. We can document from historic documents and oral histories a series of disasters and technological changes, including the introduction of metal for tools in the late 1700's[4], various wars with the Fraser Lake (Carrier) and Kemano (Haisla) people, the disruption of fishing and ensuing village shift in the 1820's, smallpox epidemics during the 19th century, particularly in the 1860's, the introduction of firearms, the introduction of alternative carbohydrate foods such as flour, sugar and beans, the introduction of steel traps and European style clothing. Finally, in the late 19th century and early 20th century, deliberate missionization, the 1918-19 influenza epidemic, the imposition of British Columbia provincial government authority, direct Eurocanadian settlement, the introduction of wage labour, and the construction of the Grand Trunk Pacific Railroad occurred. Environmental changes like the end of the Little Ice Age, the decline in woodland caribou and the expansion of moose also occurred around the turn of the century. The 'contact-traditional' way of life recalled by the elders I have interviewed spans this period of documented change. Yet a continuity of ideology and subsistence practices endures throughout this period. In spite of the accelerated pace of change, aspects of traditional values and plant uses remain a part of modern Wet'suwet'en culture.

Despite the many changes in Wet'suwet'en subsistence, enough can be understood and reconstructed to be useful in examining traditional ways of life. Conservation ideology and territory acted to allocate resources and maintain the resource base. Management practices like burning enhanced plant resources like berry patches and may have been involved in maintenance of game habitat. A balanced diet was achieved from local resources, and traditional medicines helped to maintain health.

Cultures are integrated. Aspects of cultural practices and beliefs can be interpreted from the perspective of adaptation, while other aspects can be related to history, symbolic systems, social integration, etc. There is no necessary relationship between environment and plant use and culture (c.f. Berkes 1989), but practices which are maladaptive are not likely to persist. The Wet'suwet'en culture is resilient, surviving environmental and social change and disruption. This thesis is in part a celebration of the knowledge and persistence of the Wet'suwet'en [illegible] nd their enduring relationship with their land.

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[1] Alcorn (1981) reviews the issues surrounding plant resource perception for a group of Huastec cultivators in Mexico. Alcorn points out, in addition, that individual needs at particular times will influence the resource status of particular plants and their products.

[2] Hays (1982) clearly articulates the utilitarian/ adaptionist position regarding the function of ethnobiological classification, and then discusses problems with applications of the approach. He retains the separation between general purpose and special purpose taxonomies put forth by Berlin (1992 and earlier works), which confounds this discussion somewhat. Hays has no difficulty with the idea that so-called special purpose classifications have an empirical and functional base, but regards it as an open question whether general purpose taxonomies also have a utilitarian base.

[3] Douglas (1966) and Hunn (1979) exemplify the contrast and complementarity of symbolic and ethnobiological approaches in examination of the food taboos contained in Leviticus.

[4] Salisbury (1975:129) outlines the effects of introduction of steel tools to New Guinea and Australia and argues that this caused pervasive changes in culture and ecological relationships without changing the types of subsistence activities per se because of the far greater efficiency of steel tools for activities like felling trees.

Optional Questions which could be considered

[Do you have any family problems?

Does anyone in your family have a problem with alcohol? Drugs? Depression? Mental health problems? [Do not record names]]

Do you consider Fort Chipewyan to be a healthy community? Does Fort Chipewyan have problems with alcohol abuse? Drug abuse? Family violence? Sexual assault? Mental health problems or depression?

Do you think any problems have become worse in recent years? Better in recent years?

Do you think that Fort Chip. has more problems than other communities in the North? Fewer problems?

Do you think Native people have more problems when they live in large centres like Edmonton?

Do you think that health and counselling services are adequate in Fort Chipewyan? If not, what things do you think should be improved? How do you think this should be done?

Community Values and Future

What kinds of opportunities for making a living do you see as possibilities in the future in Fort Chipewyan?

Do you feel satisfied with the environment you are raising your children in (or your grandchildren are being raised in?) (or you are growing up in?). What would improve the environment for(you, your children, your grandchildren...) if you feel that it could be better?

How would you like the community to change to make it a better place to live?

What do you see as the best future for the community?

For younger people:

What do you like to do?

What kind of job or career or way of life do you want or hope to live when you grow up?

How do you feel about your education?
Do you feel that you are learning about things you need to know?

Are you learning skills which will help you make a living or help you in your adult life?

How much time have you spent with relatives learning "bush skills"? Would you like to learn more?