Ecology of Food and Nutrition, Vol. 16, pp. 223-241
0367-0244/85/1603-0223 $18.50/0

DETERMINING THE AVAILABILITY OF TRADITIONAL WILD PLANT FOODS: AN EXAMPLE OF NUXALK FOODS, BELLA COOLA, BRITISH COLUMBIA

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(Received March 13, 1984; in final form July 23, 1984)

Forty-two plant foods known to have been used in the past by native people of the Nuxalk Nation, Bella Coola, British Columbia, Canada, were studied. To estimate the availability of the most prominent plant food resources, field estimates were made using modifications of standard techniques for quantifying plant species. Assessments of accessibility, abundance and frequency of food species were made. In addition, harvesting efficiency of 24 species was determined. Twenty species were selected as being the most readily available food resources, and therefore good candidates for nutritional research and promotion. These included the trees: *Populus trichocarpa, Pyrus fusca, Tsuga heterophylla*; the shrubs: *Amelanchier alnifolia, Ledum groenlandicum, Ribes divaricatum, Rosa nutkana, Rubus idaeus, R. parviflorus, R. spectabilis, Sambucus racemosa, Vaccinium ovalifolium, V. parvifolium, Viburnum edule*; and the herbs: *Cornus canadensis, Epilobium angustifolium, Heracleum lanatum, Maianthemum dilatatum, Potentilla pacifica, Trifolium wormskioldii.* It was concluded that the variety and quantity of plant food resources of the Nuxalk Nation in the Bella Coola Valley are substantial.

KEY WORDS: plant food availability, indigenous foods, Nuxalk, Bella Coola, Native Indians

INTRODUCTION

When explorer Alexander MacKenzie arrived at the Pacific Coast via the Bella Coola Valley in 1793, the people now known as the Nuxalk occupied villages along the entire length of the Bella Coola Valley, Dean Channel, and South Bentinck Arm. Population figures for this time are speculative at best, but it has been suggested that the Nuxalk numbered well into the thousands (McIlwraith, 1948). Although the extent of present Nuxalk territory is greatly reduced, and the reserve-resident population is currently at less than 700, several aspects of the traditional culture still persist. Among these are food use practices, particularly the procurement and processing of fish resources (Kuhnlein, *et al*, 1982). The use of traditional plant foods, however, has greatly declined in recent years. The potential value of these foods, both nutritionally and economically, gives the impetus to reinstate these foods into the contemporary Nuxalk diet. (Kuhnlein, Turner and Kluckner, 1982; Turner and Kuhnlein, 1982, 1983)

Plants used in the past by the Nuxalk were many and varied. Over 135 plant species were traditionally used for food, materials and medicines (Turner, 1973; Smith, 1928). Plant foods included roots, fruits, greens and the inner bark tissues of

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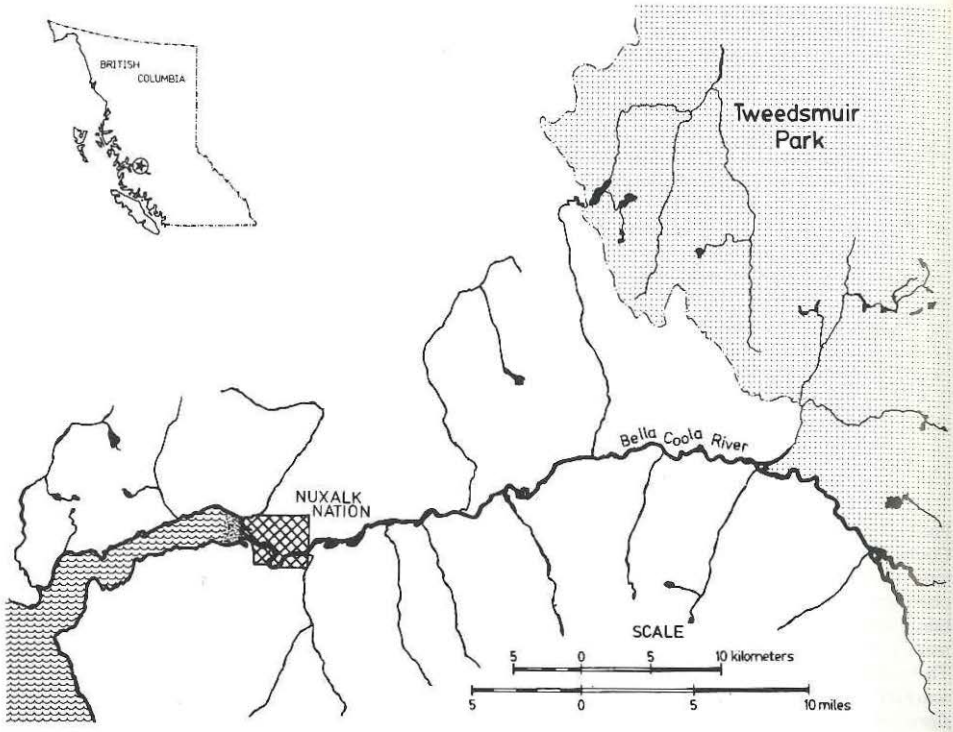

FIGURE 1 The Nuxalk Nation in British Columbia.

certain trees. Many of the food plants still grow commonly within the Nuxalk area. A review of these and other traditional and contemporary foods has recently been completed (Kuhnlein, 1984b).

There is a potential for enhancing the diet and health status of native people by encouraging the use of nutritionally rich indigenous foods (Robson, 1976; Calloway, Giauque and Costa, 1974; Bèhar, 1976; Turner, 1981; Kuhnlein, 1984a, among others). Before a traditional food enhancement program can be planned for a specific group, however, the actual availability of the indigenous foods to families must be known. The research reported here is an assessment of the availability of the most prominent traditional plant foods known to the Nuxalk people. The basic methodology developed for this assessment can be applied to the indigenous food systems of other native people.

METHODOLOGY

Defining the Study Area and its Vegetation

The initial task in determining the availability of indigenous plant foods was to define the physical extent of the study area. The entire reserve was included, even though much of the terrain is rough to which access is not easy. Some areas outside the reserve were also included, where plant foods not present on the reserve were relatively accessible and known to have been used by Nuxalk people. Due to constraints of time and finances, only those special harvesting areas within a half-hour

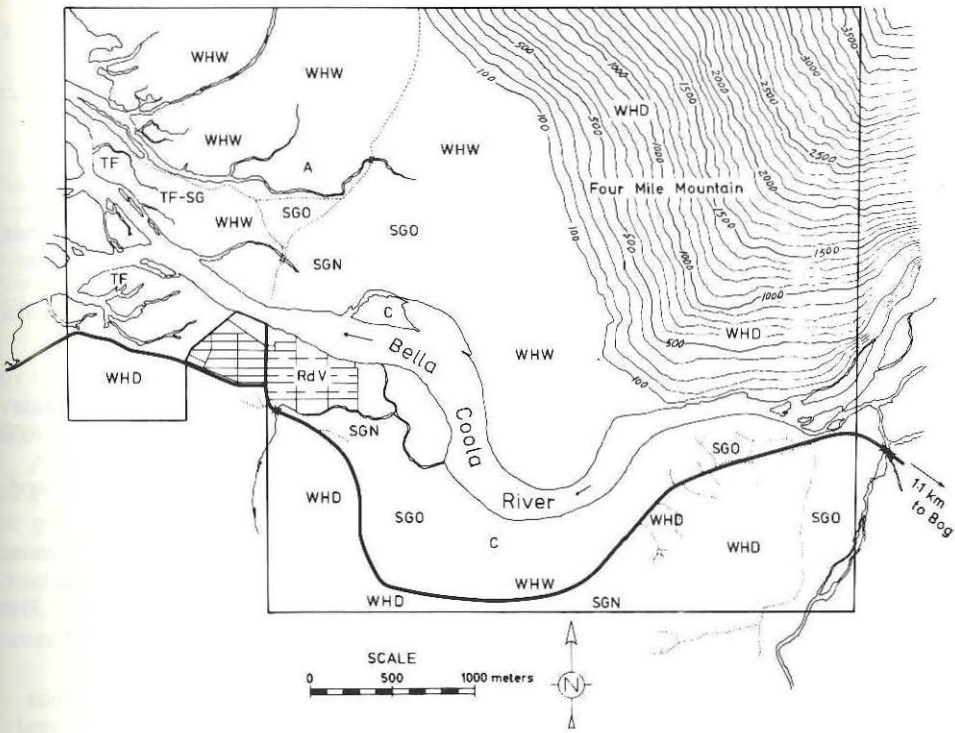

FIGURE 2 Study area with approximate placement of cover-types.

drive from the reserve were considered. Figure 1 shows the Nuxalk Nation in British Columbia and Figure 2 illustrates the exact boundaries of the study area.

The study area was divided into twelve cover-types (Table I). Cover-types were defined as areas with similar vegetation, where the forest cover was of similar age and species composition. Only those cover-types in which edible species were commonly found were included in the study. The boundaries of the individual cover-types were determined through extensive surveys conducted throughout the project area. For those areas which were very inaccessible, specifically much of Four Mile Mountain (see Figure 2), aerial photographs were used to examine the vegetation cover.

Determining Abundance and Frequency of Food Plants

Basic ecological techniques for quantifying plant species were used to quantify the food species within each cover-type (Kershaw, 1964). The species were first classified into tree, shrub and herb layers. Within each cover-type, species coverage for edible plants was estimated in randomly placed quadrats. For the trees, 20m × 20m square quadrats were used. Within each large quadrat, one 10m × 10m quadrat for shrubs, and two 1m × 1m quadrats, for herbs, were placed as shown in Figure 3. Roadside cover-types were too narrow to place square quadrats, and rectangular quadrats of the same area were used.

Within each quadrat, percent canopy coverage of edible species was estimated

TABLE I
Cover-types differentiated within a selected study area in the Nuxalk nation at Bella Coola, B.C. Canada

Name	Estimated area (ha)	Number of quadrats[a] sampled	Descriptive notes[a]
Western Hemlock Dry (WHD)	368	44	Climax hemlock forest, predominantely on mountain-sides; dominant trees/shrubs: *Tsuga heterophylla, Thuja plicata, Menziesia ferruginea, Vaccinium parvifolium, V. ovalifolium.* Absence of *Oplopanax horridus,* sparse shrub layer, heavy moss layer.
Western Hemlock Wet (WHW)	309	64	Climax hemlock forest, lower mountain slopes; dominant trees/shrubs: *Tsuga heterophylla, Thuja plicata, Vaccinium alaskaense, V. ovalifolium, Ribes laxiflorum, Rubus spectabilis.* Presence of *Oplopanax horridus* (often dense), and heavy shrub layer.
Second Growth, Old (SGO)	219	102	Mature or semi-mature mixed coniferous/deciduous forest, often near water; dominant trees/shrubs: *Alnus rubra, Populus trichocarpa, Pyrus fusca, Picea sitchensis, Tsuga heterophylla, Rosa nutkana, Cornus sericea.*
Second Growth, Intermediate (SGI)	17	18	*Rubus spectabilis, R. parviflorus, Salix* spp. Thick underbrush, wide diversity of species. Successional stage, with young trees, shrubs and herbs including: *Ribes laxiflorum, Rosa nutkana, Rubus parviflorus, R. spectabilis,* and *Viburnum edule.*
Second Growth, New (SGN)	45	34	Recently cleared, with only herbs, seedling trees, and shrubs, including: *Rosa nutkana, Rubus spectabilis, R. parviflorus.*
Cottonwood (C)	44	20	A floodplain habitat, with intermediate to mature *Populus trichocarpa*; thick shrub and herb layers; predominates along the Bella Coola River.
Alder (A)	39	16	Similar to C, but less wet, with *Alnus rubra*; predominately north side of the Bella Coola River.
Tidal Flats (TF)	62	38	At Bella Coola estuary; absence of shrubs or trees; homogeneous herb layer including dominants *Trifolium wormskioldii, Potentilla pacifica, Equisetum* spp., *Cicuta mackenziana.*
Tidal Flat/Second Growth (TF/SG)	31	32	Located above TF, with a similar herb layer, but some shrubs and young trees present.
Bog (B)	27	16	Peat bog located off reserve, near local fair grounds; thick shrub layer, mixed tree layer, including *Picea sitchensis, Alnus rubra, Cornus sericea, Ledum groenlandicum, Vaccinium ovalifolium, Salix* spp.
Roadside (Rd)	23	126	Narrow strip of disturbed area on either side of Bella Coola highway; dense shrub layer; blending with adjacent habitats; heterogeneous.

Roadside, Village (RdV)	3	16	Disturbed area along alleyways around reserve village; dense shrubs, including *Rubus parviflorus, Rosa nutkana, Rubus idaeus, Sambucus racemosa.*

a. A quadrat is an area 20m × 20m for trees, 10m × 10m for shrubs and 1m × 1m for herbs.
b. Common names of species not given in Table IV.

Scientific name	Common name	Scientific name	Common name
Alnus rubra	red alder	*Menziesia ferruginea*	false azalea
Cicuta mackenziana	water-hemlock	*Oplopanax horridus*	devil's club
Cornus sericea	red-osier dogwood	*Picea sitchensis*	sitka spruce
Equisetum spp.	horsetail	*Salix* spp.	willow
		Thuja plicata	red cedar

by two investigators working independently. The estimates were averaged and converted to a coverage estimate scale, whose values have an interval of 20 % (Table II).

Accessibility of quadrats was evaluated according to ease of access for an adult of average physical condition. The degree of difficulty and amount of time required to get to a quadrat by using a vehicle (car, boat) and/or walking, was recorded according to a standard format (Table III). If, for example, a car trip on a paved road of 10 minutes was required to reach a quadrat, the rating would be 1a. If, in addition, a difficult walk of 20 minutes was also necessary to reach the quadrat, the accessibility rating would be la + 2b.

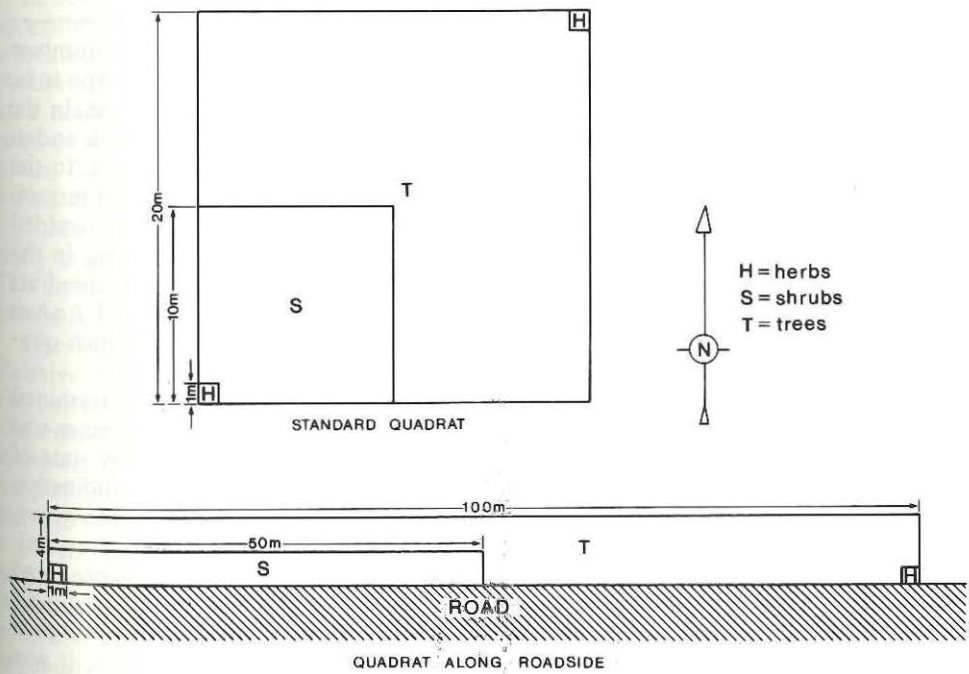

FIGURE 3 Layout of standard and roadside quadrats.

TABLE II

Coverage scale for quadrats of Nuxalk edible plants based on percentage of canopy coverage

estimate for canopy coverage[a]	coverage scale
100-81	5
80-61	4
60-41	3
40-21	2
20-1	1
< 1	+

[a] % canopy coverage is the proportion of the ground within the quadrat occupied by the perpendicular projection on to it of the aerial parts of the species under study.

TABLE III

Rating for ease of access to Nuxalk edible plants

1. ≤ 15 min
   a. easy
   b. arduous
2. 15-30 min.
   a. easy
   b. arduous
3. 30 min-1 hr
   a. easy
   b. arduous
4. >1 hr
   a. easy
   b. arduous
5. inaccessible to most
   a. relatively
   b. definitely

Generally, the location of each sample plot was selected using random numbers applied to two lines at right angles superimposed over a map of the cover-type to be sampled. However, there were several cases in which this was not practical. In the areas that were difficult to reach, (for example, the mountainsides in WHD), and in the long, narrow roadside areas, quadrats were placed at regular intervals. In the inaccessible areas this procedure minimized the effort in covering difficult terrain. Although these plots were not randomly chosen, their locations were decided before examining the vegetation cover, to minimize bias in their placement. In the bog (B) cover-type, where a heavy shrub layer made access very difficult, quadrats were selectively placed within the boundaries of the high-density areas of *Ledum groenlandicum*, a species restricted to this cover-type. All locations in which quadrats were placed were recorded on a master map.

The number of sample quadrats placed within each cover-type was determined primarily by its variability. The average percent coverage value for each species was plotted against the number of quadrats in each cover-type. When a steady state of percent coverage was reached (the curve levelled off), it was taken as an indication that a cover-type had been adequately sampled. In the WHD cover-type, however, much of the area was inaccessible, and less empirical considerations were used. Informal surveys of the cover-type area, examinations of air photographs, and information from existing forest ecology surveys (Robinson and Pojar 1981) indicated that the vegetation was relatively homogeneous throughout. Although a steady state had not been reached after 44 quadrats had been examined, it was assumed that the sample quadrats were representative of the entire cover-type. In cover-types with small geographical areas (SGI, SGN, RdV), the limits of area

ultimately determined the number of quadrats delimited. Frequency of a species within each cover-type was determined by the percent of quadrats in which the species was present.

Collection of Harvesting Data

In addition to data collected on species coverage, frequency and accessibility, harvesting efficiency data were gathered for several of the plant foods as they ripened throughout the summer. The time required to harvest 250 ml of food, in a metric measuring cup by one person, and the area needed to collect this amount was recorded. The usual harvesting areas used by native people today were recorded, as well as the time of year of harvesting.

RESULTS AND DISCUSSION

This section summarizes data collected for each of the 42 plant species considered and is organized according to species.

Table IV shows the frequency, accessibility and the coverage scale value of all plant foods falling within the sample quadrats, according to the habitats in which they were growing. Frequency, that is, the total number of quadrats divided by the number of quadrats with that species present, is given for each cover-type. The range of accessibility ratings (1a to 5b) within which these quadrats fall, is also given as well as the mean coverage of each species for each cover-type.

In addition to the accessibility ratings assigned to each sample plot, the general accessibility of each cover-type as a whole is noted. Much of the WHD cover-type is located on mountainsides with a slope of 60°. Although WHD covers the greatest portion of the study area, the difficulties involved in gaining access to much of the area made it impractical for the harvesting of plant foods. Thick underbrush in parts of WHW, SGO, C, A, B, and SGI pose possible deterrents to harvesting plant foods. The use of a machete for trail-making, however, would facilitate access within these cover-types. Access to all other cover-types was generally quite easy.

Table V summarizes the harvesting data for all edible plant species within the study area, although harvesting was not necessarily done within sample quadrats. The data include common cover-type(s) harvested, and the usual procedure and season for harvesting when this is done by native people today.

Harvesting efficiency data for 24 selected plant foods are given in Table VI. Relative density of plant foods was used as a basis for comparing harvesting areas. For berries, density is shown as the number on a single bush. For species too closely clustered to distinguish individual bushes, the number of berries per m^2 of bush area is shown. The density of harvestable greens is given as percent canopy leaf cover. Subjective assessments of plant food density are also given, using a rating of low, average and high.

As the results in Table IV indicate, there is wide variation in the distribution of edible plant species in the study area. Only those species of high availability are discussed here, as they have the greatest potential for use by the Nuxalk people. Plants which occur abundantly only in areas very difficult to reach, or occur only sparsely in readily accessible areas, would be of minimal value. Species of low availability that are otherwise useful foods may be candidates for future horticultural development, but cannot be considered for harvesting from the wild.

Twenty of the 42 food plants were defined in the following way as being readily available. All species with an average coverage value of "+" (1 % or less) were eliminated (see Table II). Quadrats with an accessibility rating of more than 3a (over one hour easy walk), were also excluded (see Table III). From the remaining quadrats, those species not having harvestable food (for example those too immature,

TABLE IV

Availability of selected plant food species of the Nuxalk Nation.

Scientific name (common name)	Cover-type[a]	Frequency[b] (%)	Range of accessibility for walking[c]	Mean cover %	Mean cover value[d]
Trees					
Populus trichocarpa	C	100%	2a-3a	58.0	3
(Black Cottonwood)	SGO	20%	1a-3b	13.0	1
	WHW	19%	2a-4a	13.5	1
	A	13%	1a	30.0	2
	RdV	13%	1a	10.0	1
	SGN	12%	1a	30.0	2
	SGI	11%	1a	50.0	3
Pyrus Fusca	B	50%	1a-2a	10.0	1
(Pacific Crabapple)	SGO	29%	1a-2a	14.2	1
	TF/SG	25%	1a	15.0	1
	SGI	22%	1a	0.1	+
	Rd	17%	1a	13.3	1
	WHW	16%	1a-3b	8.5	1
	WHD	14%	1a-1b	3.7	1
	RdV	13%	1a	10.0	1
	SGN	5%	1a	10.0	1
Tsuga heterophylla	WHW	100%	1a-4a	54.7	3
(Western Hemlock)	WHD	95%	1a-4a	51.9	3
	SGN	35%	1a	21.8	2
	SGI	33%	1a	36.7	2
	SGO	29%	1a-2b	16.1	1
	B	25%	1a-2a	15.2	1
	TF/SG	13%	1a	5.2	1
	C	10%	3a	10.0	1
	Rd	3%	1a	10.0	1
Shrubs					
Amelanchier alnifolia	SGI	33%	1a	13.5	1
(Saskatoon)	SGN	5%	1a	10.0	1
	Rd	4%	1a	3.7	1
	SGO	1%	1b	70.0	4
Ledum groenlandicum (Labrador-tea)	B	75%	1a-2b	40.2	3
Ribes bracteosum	A	88%	1a	11.5	1
(Stink Currant)	C	30%	2a-3a	43.4	3
	Rd	29%	1a	9.6	1

TABLE IV continued

	SGN	6%	1a	0.5	+
	WHW	6%	1a	20.0	1.5
R. divaricatum	A	100%	1a	8.8	1
(Wild Gooseberry)	C	60%	2a-3a	13.4	1
	SGI	33%	1a	13.5	1
	WHD	5%	1a	0.5	+
	Rd	3%	1a	5.3	1
	WHW	3%	4a	10.0	1
R. lacustre	SGI	22%	1a	20.0	1.5
(Swamp Gooseberry)	WHD	14%	1a-2a	3.7	1
	WHW	13%	2a-4a	5.3	1
	SGO	10%	1a-2a	24.1	2
	Rd	8%	1a	6.0	1
	SGN	6%	1a	10.0	1
R. laxiflorum	SGI	33%	1a	10.0	1
(Wild Blue Currant)	Rd	16%	1a	11.0	1
	WHW	16%	1a-2a	10.0	1
	SGO	12%	1a-2a	13.4	1
	SGN	12%	1a	10.0	1
	WHD	9%	1a-4a	5.2	1
Rosa nutkana	RdV	100%	1a	22.5	2
(Nootka Rose)	SGN	47%	1a	31.3	2
	SGI	44%	1a	5.3	1
	Rd	41%	1a	17.0	1
	B	25%	1a	10.0	1
	SGO	25%	1a-3b	13.3	1
	C	20%	2a	5.3	1
	TF/SG	19%	1a	0.5	+
	WHD	5%	2a	0.5	+
	WHW	3%	2a	0.5	+
Rubus idaeus	RdV	50%	1a	7.6	1
(Wild Raspberry)	SGN	41%	1a	20.2	2
	Rd	30%	1a	10.1	1
	SGI	11%	1a	0.5	+
	WHW	3%	1a	50.0	3
R. parviflorus	RdV	100%	1a	36.4	2
(Thimbleberry)	Rd	98%	1a	29.0	2
	SGN	82%	1a	18.7	1
	SGO	65%	1a-3b	24.5	2
	C	60%	2a-3a	25.1	2
	SGI	56%	1a	46.0	3
	WHW	47%	1a-4a	14.1	1
	A	25%	1a	20.0	1.5
	WHD	23%	1a-2a	14.2	1
R. spectabilis	C	100%	2a-3a	60.0	3.5
(Salmonberry)	A	100%	1a	20.0	1.5
	SGI	67%	1a	18.6	1

TABLE IV continued

	Rd	51%	1a	13.0	1
	WHW	50%	1a-4a	25.7	2
	SGO	49%	1a-3b	52.7	3
	SGN	35%	1a	23.4	2
	WHD	9%	1a	30.0	2
Sambucus racemosa	C	100%	2a-3a	56.0	3
(Red Elderberry)	A	100%	1a	52.5	3
	RdV	75%	1a	10.0	1
	SGO	53%	1a-3b	32.3	2
	Rd	35%	1a	10.1	1
	SGI	33%	1a	50.0	3
	SGN	18%	1a	33.5	2
	WHW	16%	1a-4a	18.0	1
	WHD	14%	1a	13.5	1
Vaccinium alaskaense	WHW	13%	1a-2a	22.6	2
(Alaska Blueberry)	WHD	5%	1a	0.5	+
V. membranaceum (Mtn. Black Huckleberry)	WHD	5%	1a	10.0	1
V. ovalifolium	B	63%	1a-2a	12.1	1
(Oval-leaved Blueberry)	WHW	34%	1a-3b	13.0	1
	WHD	14%	1a-2a	0.5	+
	SGI	11%	1a	0.5	+
	SGO	6%	1a-1b	6.8	1
	SGN	6%	1a	50.0	1
	Rd	3%	1a	0.5	+
V. parvifolium	WHD	59%	1a-4a	2.5	1
(Red Huckleberry)	SGI	22%	1a	20.0	1.5
	WHW	19%	1a-4a	18.4	1
	B	13%	2a	10.0	1
	SGN	12%	1a	30.0	2
	Rd	5%	1a	3.5	1
	SGO	4%	1a-1b	30.0	2
Viburnum edule	SGI	22%	1a	10.0	1
(Highbush Cranberry)	WHW	19%	1a-4a	6.8	1
	SGN	18%	1a	6.7	1
	B	13%	2a	10.0	1
	SGO	10%	1a-2a	6.2	1
	WHD	9%	1a-2a	0.5	+
	Rd	3%	1a	0.5	+
Herbs					
Aralia nudicaulis	SGN	17%	1a	20.0	1.5
(Wild Sarsparilla)	WHD	9%	1a	2.9	1
	SGO	6%	1a-2a	25.1	2
	SGI	6%	1a	70.0	4
	WHW	3%	2a-2b	20.0	1.5
Cornus canadensis	SGI	39%	1a	37.2	2
(Bunchberry)	WHD	34%	1a-4a	24.1	2

TABLE IV continued

	B	25%	1a-2b	10.0	1
	SGN	24%	1a	28.8	2
	WHW	16%	1a-3b	34.0	2
	SGO	6%	1a	11.9	1
Dryopteris expansa	WHD	9%	2a-4a	42.6	3
(Spiny Wood Fern)	WHW	3%	1a-2a	10.0	1
Epilobium angustifolium	RdV	25%	1a	15.0	1
(Fireweed)	Rd	16%	1a	27.6	2
	SGI	6%	1a	10.0	1
	SGN	3%	1a	0.5	+
Fragaria vesca	SGN	3%	1a	0.5	+
(Wild Strawberry)	TF/SG	3%	1a	10.0	1
	Rd	2%	1a	0.5	+
Fritillaria camschatcensis	TF/SG	6%	1a	0.5	+
(Riceroot)	WHD	2%	1a	0.5	+
Heracleum lanatum	RdV	63%	1a	22.1	2
(Cow-parsnip)	SGI	6%	1a	10.0	1
	Rd	2%	1a	3.7	1
	SGO	2%	1a-2a	15.3	1
Lupinus nootkatensis (Wild Blue Lupine)	TF/SG	22%	1a	27.4	2
Mainanthemum dilatatum	A	63%	1a	12.2	1
(Wild Lily-of-the-Valley)	C	30%	2a-3a	3.7	1
	SGO	28%	1a-3b	15.7	1
	WHW	25%	1a-4a	9.7	1
	WHD	20%	1a	1.6	1
	SGI	17%	1a	6.8	1
	SGN	15%	1a	8.1	1
	TF/SG	6%	1a	5.3	1
Polypodium glycyrrhiza	WHD	7%	1b-3a	3.7	1
(Licorice Fern)	WHW	3%	1a-2a	5.3	1
Potentilla pacifica	TF	97%	1a-2a	36.4	2
(Pacific Silverweed)	TF/SG	66%	1a	20.7	2
	SGO	2%	1a	5.3	1
Pteridium aquilinum	WHD	7%	1a	50.0	3
(Bracken Fern)	SGN	3%	1a	90.0	5
	Rd	3%	1a	35.0	2
	WHW	2%	1a	0.5	+
	SGO	1%	1a	70.0	4
Rumex acetosella	RdV	19%	1a	6.8	1
(Sheep Sorrel)	Rd	17%	1a	11.2	1
Smilacina stellata	SGI	6%	1a	0.5	+
(Solomon's Seal)	SGN	3%	1a	0.5	+
	WHW	25%	2a	10.0	1

TABLE IV continued

	WHD	2%	2a	0.5	+
	SGO	1%	2a	10.0	1
Trifolium wormskioldii (Springbank Clover)	TF	66%	1a-2a	28.9	2
	TF/SG	44%	1a	30.8	2

[a] For key to abbreviations see Table I.
[b] Frequency is the total number of quadrats with species present divided by the total number of quadrats.
[c] See Table III for key to notations. All quadrats have a transportation rating of 1a (15 min. or less).
[d] See Table II for key to notations.

or non-fruiting) were not considered. Finally, the cover-type was not considered as a practical source of a given plant food if the frequency of the species was less than 15 %. (see Footnotes to Table IV).

The following plant food species were identified as presently being the most widely available to the Nuxalk people. Their associated cover-types are shown in Table V.

Trees: *Populus trichocarpa, Pyrus fusca, Tsuga heterophylla*

Shrubs: *Amelanchier alnifolia, Ledum groenlandicum, Ribes divaricatum, Rosa nutkana, Rubus idaeus, R. parviflorus, R. spectabilis, Sambucus racemosa, Vaccinium ovalifolium, V. parvifolium, Virburnum edule*

Herbs: *Cornus canadensis, Epilobium angustifolium, Heracleum lanatum, Maianthemum dilatatum, Potentilla pacifica, Trifolium wormskioldii*

It is important to point out that the results presented here represent only a single point in time, when the study was done in the summer of 1981. The cover-types are in a constant state of change both due to forest succession and interruptions in the sequence as a result of fires, logging, and so on. Consequently, abundance, frequency, and ease of harvest of plants will also change as the vegetation cover changes with time. For example, during the study period, bushes of stink currant, swamp gooseberry, wild blue currant, and mountain bilberry were found in the study area, but they contained few fruits. The two species of strawberry contained fruits only in the SGN cover-type, and kinnikinnick, salal and dwarf wild rose were found only in a few isolated patches. In other years, growing conditions for these species may change. However, stability of occurrence is expected to be greater for the most prominent species than for those that occur less frequently.

Nuxalk elders recall that even within this century burning selected areas was used in the Bella Coola valley as a method of habitat maintenance, to optimize the growth of certain food species, particularly the berries, including wild raspberries, blackcaps, blueberries and huckleberries, and soapberries (*Shepherdia canadensis*). The last are scarcely found today in the lower part of the valley, and, because they are not present on the reserve, were not included in this study. Burning is no longer permitted, and it is said, the availability of the berries has decreased within the last few decades, as forest trees have matured and shaded out the fruiting shrubs.

To some extent, logging has replaced burning by native people as a process by

TABLE V

Nuxalk Nation foods by species

Scientific name (common name)	Cover-type(s) most commonly harvested	Harvesting procedure[a]	Time of year[a]
TREES			
Populus trichocarpa (Black Cottonwood)	C; SGO	pull off bark and scrape off inner cambium	May-July
Pyrus fusca (Pacific Crabapple)	TF/SG; Rd; SGO	pick ripe fruits	August-October
Tsuga heterophylla (Western Hemlock)	WHW; WHD; SGO	strip off bark and scrape off inner cambium	May-July
SHRUBS			
Amelanchier alnifolia (Saskatoon)	Rd; SGI	pick ripe fruits	July-September
Arctostaphylos uva-ursi (Kinnikinnick)	WHD mountainside	pick ripe fruits	August-September
Crataegus douglasii (Black Hawthorn)	found only as domestic in village	pick ripe fruits	August
Gaultheria shallon (Salal)	WHD mountainside	pick ripe fruits	June-September
Ledum groenlandicum (Labrador-tea)	B	gather leaves	any time of year; after frost is preferred by some
Ribes bracteosum (Stink Currant)	C; A; Rd	collect string of ripe berries	July-August
R. divaricatum (Wild Gooseberry)	SGI; C; A	pick ripe or green berries	June-August
R. lacustre (Swamp Gooseberry)	SGO	pick ripe berries	July-August
R. laxiflorum (Wild Blue Currant)	WHD; WHW; SGO; Rd; SGI	pick ripe berries	July-August
Rosa gymnocarpa (Dwarf Wild Rose)	WHD mountainside	pick ripe hips	August-October

TABLE V continued

Rosa nutkana (Wild Rose)	SGO; Rd; SGN; SGI; RdV	pick ripe hips	August-October
Rubus idaeus (Red Raspberry)	SGN; Rd; RdV	pick ripe berries	June-September
R. parviflorus (Thimbleberry)	WHW; SGO; SGN; Rd; SGI; RdV	pick ripe fruits	June-September
R. spectabilis (Salmonberry)	WHW; SGO; C; A; Rd; SGN; SGI	pick ripe berries	May-July
Sambucus racemosa (Red Elderberry)	SGO; A; C; Rd; RdV	pick cluster of ripe berries and take off larger stems	June-September
Vaccinium alaskaense (Alaska Blueberry)	WHW	pick ripe berries	June-September
V. membranaceum (Mountain Bilberry)	WHD	pick ripe berries	July-September
V. ovalifolium (Oval-leafed Blueberry)	WHD; WHW; B	pick ripe berries	June-August
V. parvifolium (Red Huckleberry)	WHD; WHW	pick ripe berries	July-September
Viburnum edule (Highbush Cranberry)	WHW; SGO; SGI	pick fruit when just under ripe	July-September
HERBS			
Aralia nudicaulis (Sarsaparilla)	WHD; SGO	Collect roots with shovel	May-September
Chenopodium album (Lamb's-Quarters)	RdV	Collect young leaves	May-September
Cornus canadensis (Bunchberry)	WHD; WHW; SGO; SGN; B; SGI	pick ripe fruit	August-September
Dryopteris expansa (Spiny Wood Fern)	WHD; WHW	collect underdeveloped leaves ('fingers')	September-October
D. filix-mas (Male Fern)	WHW; SGO; A	collect underdeveloped leaves ('fingers')	September-October
Epilobium angustifolium (Fireweed)	Rd; RdV	collect young shoots	March

TABLE V continued

Fragaria vesca (Wild Strawberry)	Rd; SGN; RdV	collect ripe fruits	June-August
F. virginiana (Blue leaf Strawberry)	Rd; SGN; RdV	collect ripe fruits	June-August
Fritillaria camschatcensis (Riceroot)	TF; TF/SG	collect 'rice' with shovel	September-March
Heracleum lanatum (Cow-Parsnip)	Rd; RdV	collect young stems	February-May
Lupinus nootkatensis (Wild Blue Lupine)	TF; TF/SG	collect rhizomes with shovel	March-May
Maianthemum dilatatum (Lily-of-the-Valley)	WHD; WHW; SGO; A; C	collect ripe berries	July-August
Polypodium glycyrrhiza (Licorice Fern)	WHD; WHW	collect rhizomes	year round
Potentilla pacifica (Silverweed)	TF; TF/SG	collect roots with shovel	October-March
Pteridium aquilinum (Bracken Fern)	WHD; Rd; SGN	collect rhizomes with shovel	October-March
Rumex acetosella (Sorrel)	Rd; RdV	collect leaves	May-September
R. occidentalis (Western Dock)	RdV	collect young leaves	May-August
Smilacina stellata (Star Flowered Solomon's-Seal)	WHD; WHW; SGO; SGN; SGI	collect ripe berries	July-August
Trifolium wormskioldii (Springbank Clover)	TF; TF/SG	collect roots with shovel	October-March

[a] Harvesting procedures and/or time of year are taken from Turner (1973) and Kuhnlein (1984b)

TABLE VI

Harvesting efficiency of selected food plants of the Nuxalk Nation, Bella Coola, B.C., Canada

Scientific name (common name)	Density of harvest area	Size of harvest area	Relative density of harvest area	No. of min. to harvest 250 ml food — by one person
TREES				
**Pyrus fusca* (Pacific Crabapple)	1000 fruits/tree	one tree	average	5 min
SHRUBS				
**Amelanchier alnifolia* (Saskatoons)	1000 berries/bush	one bush	high	5 min
Arctostaphylos uva-ursi (Kinnikinnik)	25% coverage	$3m^2$ area	average	20 min
Crataegus douglasii (Black Hawthorn)	550 fruits/sm. tree	one tree	average	1.5 min
Gaultheria shallon (Salal)	10 berries/branchlet	$5m^2$ area	average	8 min
**Ledum groenlandicum* (Labrador-tea)	70% coverage	$2m^2$ area	average	2.5 min
Ribes bracteosum (Stink Currant)	0-150 berries/bush	$3m^2$ area	high	5 min
**R. divaricatum* (Wild Gooseberry)	350 berries/bush	one bush	average/high	12.5 min
**Rosa nutkana* (Wild Rose)	30-50 pods/bush	2 bushes	average	5 min
**Rubus idaeus* (Wild Raspberry)	450-600 berries/bush	$4m^2$ area	average/high	30 min
**R. parviflorus* (Thimbleberry)	175 berries/$1m^2$ area	$6m^2$ area	average	10 min
**R. spectabilis* (Salmonberry)	30 berries/bush	$3m^2$ area	low/average	5 min

TABLE VI continued

**Sambucus racemosa* (Red Elderberry)	18 berry clusters/bush	2 bushes	average	<5 min
**Vaccinium alaskaense* (Alaska Blueberry)	100 berries/bush	three bushes	average/high	10 min
**V. ovalifolium* (Oval-leafed Blueberry)	350 berries/bush	one bush	average	10 min
**V. parvifolium* (Red Huckleberry)	300 berries/bush	one bush	average	8 min
**Viburnum edule* (Highbush Cranberry)	100 berries/bush	one bush	average	4 min
HERBS				
**Cornus canadensis* (Bunchberry)	280 berries 1m^2 area	5m^2 area	high	10 min
Fragaria vesca (Wild Strawberry)	30% coverage	2m^2 area	high	30 min
Fritillaria camschatcensis (Riceroot)	5% coverage	8m^2 area	high	60 min
Lupinus nootkatensis (Wild Blue Lupine)	50-75% coverage	5m^2 area	average	12 min
Pteridium aquilinum (Bracken Fern)	75% coverage	10m^2 area	high	15 min
**Potentilla pacifica* (Silverweed)	90% coverage	2m^2	high	20 min
**Trifolium wormskioldii* (Springbank Clover)	50% coverage	3m^2	average	30 min

* Most available species

which tree cover is reduced and shrub growth thereby encouraged. Many Nuxalk people today journey up the valley to areas that have been recently logged in order to obtain berries. Perhaps in the future consideration should be given to some type of selective logging program, carefully controlled, on some parts of the reserve, as a means of promoting the growth of desirable berry species and increasing their accessibility to people living in the village.

Of the tree foods, hemlock inner bark and crabapple fruits were used often in season and preserved for winter use by the Nuxalk people in former times, whereas cottonwood inner bark was more of a seasonal snack treat. Shrubs that were used often in season and preserved were labrador tea, saskatoons, wild gooseberries and raspberries, thimbleberries, salmonberries, oval-leaved blueberries, red huckleberries and highbush cranberries. Rosehips were used as a snack food and red elderberries were cooked and served in season, but usually not preserved. In the herb category, species that were used often and preserved in former days were bunchberries, silverwood roots and clover rhizomes. Young shoots of fireweed and cow parsnip were eaten as snacks after stripping off the outer coverings of the plant stems in early spring (Kuhnlein, 1984b; Turner, 1973). It is reasonable to assume that the species which would be most successfully used again are those that were most popularly used in the past, and which are readily available.

Other popular plant species (those used often in season and preserved) for the Nuxalk people which were not found in abundance in the study area were kinnikinnick berries, salal berries, stink currants, wild blue currants, blackcaps, soapberries, watery blueberries, mountain bilberries, lowbush blueberries, fern rhizomes, riceroot, and seaweed. Most of these occur abundantly in areas distant to the current reserve, and their harvesting is restricted because of transportation needs or trespassing restrictions.

Fourteen of the 20 most available species were evaluated for harvesting efficiency (Table V). Of these, only four (wild gooseberries, wild raspberries, silverweed roots and clover rhizomes) had harvesting times greater than 10 minutes for 250 ml of food, which indicates that these plant foods are relatively easy to obtain after access is gained to the harvest site.

SUMMARY AND CONCLUSIONS

The availability of 42 plant species occurring in the vicinity of the Nuxalk reserve at Bella Coola has been assessed. Leaf cover and frequency have been measured using modifications of standard ecological techniques. Accessibility and harvest yields of selected species were also estimated. Twenty plants met criteria for high availability, and therefore have the greatest potential for further nutritional research and promotion for increased use in the Nuxalk diet.

The results of this study are important in understanding the possibilities for the Nuxalk community to increase use of their traditional food resources. Other information that is needed for important food species are nutritional composition, toxicological assessment, and acceptability evaluations by the contemporary people. Further, since the land resource base for native people is a critical consideration, the horticultural potential for plant food species should also be understood.

The methodology used in this study for defining cover-types, plant coverage and frequency, accessibility, and harvest yields can be applied to other research projects where a quantitative assessment of traditional plant food resources is needed.

ACKNOWLEDGEMENTS

We would like to especially acknowledge the 1982 summer field crew at Bella Coola — Aaron Hans, David Hunt and Sarah Saunders — for help in collecting the data reported herein. Also, thanks to Anthea Kennelly for her assistance with the project, and to the Provincial Ministry of Forests staff at Bella Coola, for sharing preliminary results of their work on the biogeoclimatic zones of the area. Special thanks also to Willie Hans, James Hans, Buster Hans, Greg Hans, Arthur Hans, Rose Hans, Sandra Moody, Eliza Saunders, Addie Saunders, Margaret Siwallace and Felicity Walkus, and all other people of Bella Coola who offered their help and encouragement throughout the summer field season. Dr. R.T. Ogilvie, Curator of the Botany Division, British Columbia Provincial Museum, is acknowledged with thanks for advice on ecological field methods and for his careful reading of the manuscript from an ecologist's perspective. Keith Jardine is gratefully acknowledged for help in the preparation of the manuscript. Financial support for this project was granted to Harriet Kuhnlein by the Health Promotion Program (655-2-28) of Health and Welfare Canada, the Province of British Columbia Youth Employment Program, the Natural Sciences and Engineering Research Council (A7148). Funds were also provided through a Government of Canada, Summer Canada grant (1128XX6) to the Bella Coola Band Council.

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