Ecology of Food and Nutrition, 1984, Vol. 14, pp. 219-228
0367-0244/84/1403-0219 $18.50/0

VEGETABLE FOOD PRODUCTS OF THE FORAGING ECONOMIES OF THE PACIFIC NORTHWEST

H. H. NORTON, E. S. HUNN, C. S. MARTINSEN
and P. B. KEELY

Department of Anthropology and Department of Nutritional Sciences and Textiles, University of Washington, Seattle, Washington 98195

(Received July 11, 1983; in final form November 22, 1983)

Twenty-seven roots, berries and sprouts common in the pre-contact diet of Native Americans in the Pacific Northwest have been analyzed and found to be valuable sources of Ca, Mg, Fe, Zn and ascorbic acid. Native peoples serially harvested these indigenous foods as part of their economic rounds. These members of the Lily, Purslane, Barberry, Currant, Rose, Parsley, Heath, Honeysuckle, Sunflower and Water-plantain families are among those regularly collected by these foraging groups whose economic strategies were keyed to the use of multiple resources and the storage of large quantities of processed foods. Stored vegetable foods, particularly berries and roots, along with dried fish, provided ample and nutritious diets during seasonal periods of resource non-productivity. These indigenous foods are compared with some commonly used commercial species.

KEY WORDS: Indigenous roots, berries, sprouts, Pacific Northwest Native peoples, foraging strategies, nutrient composition.

INTRODUCTION

The Pacific Northwest, which today encompasses at least 95 tribal units and nearly 100,000 Indian peoples, was one of last continental territories to be incorporated into the contiguous United States. The settlement of Euro-Americans into this strategic geographical region was enhanced by a rapidly expanding technology, active promotion by corporate and government concerns, and the large immigrations of the mid-nineteenth century. Accompanying this western settlement were swift and dramatic changes in the lifeways of the indigenous peoples. These changes left unanswered fundamental questions concerning the functions of traditional economic systems and their relationships to the indigenous resources upon which they depended. While the Pacific Northwest contains diverse habitats, the large native populations encountered at contact (ca. 1790–1850) were all non-agricultural, foraging peoples, harvesting, and sometimes managing, natural, localized species of plants and animals. Indigenous cultures of the Pacific Northwest, while significantly altered by events of the past century and a half, have retained traditions and values which allow reconstruction of pre-contact subsistence strategies heretofore sparingly and erratically examined. Questions which have not been previously addressed for this region include: What was the nutrient range supplied by local resources? How was it extracted and supplied to alleviate seasonal non-productivity? Were peoples of the Pacific Northwest exceptional among foraging economies in subsisting almost entirely upon one type of food resource?

Contemporary research on foraging societies world-wide and their socioeconomic structures has found such societies to be socially and environmentally integrated systems, allowing the luxury of conservatism along with the possibility of opportunism. Foraging economies are reliable and sensible systems for fullfilling human needs

within their particular social and environmental frames (Gould, 1977; Mechan, 1977; Berkes and Farkas, 1978; Lee, 1979; Harding and Teleki, 1981; Turnbull, 1981). Pacific Northwest foraging economies were well established within their ecological parameters, which indicates long-term viability coincident with economic strategies adapted to Pacific Northwest environmental variation (Suttles, 1951a; Drucker, 1955; Cressman, 1977; Borden, 1979; Norton, 1979a; Hunn, 1981; Norton, Boyd and Hunn, 1983).

BACKGROUND

Prior to contact with Euro-Americans, the Pacific Northwest had been continuously occupied for at least 12,000 years by people employing various foraging strategies to meet subsistence (and other human) needs. In the area which is now Washington State, an ecological division between the regions west and east of the Cascade Range allows examination of patterned, local subsistence strategies (Figure 1). While some species are shared between the two regions; topographical and climatic differences dictate rather distinct environments and several differing economic regimens. The heavily forested western region is typified by a mild-wet, maritime climate, with multiple river drainages as well as large expanses of inland sea. These waterways were not only habitat for varied marine resources but rapid routes of travel, facilitating economic strategies which took advantage of both maritime and terrestrial resources. Peoples of the western region generally were mobile during most of

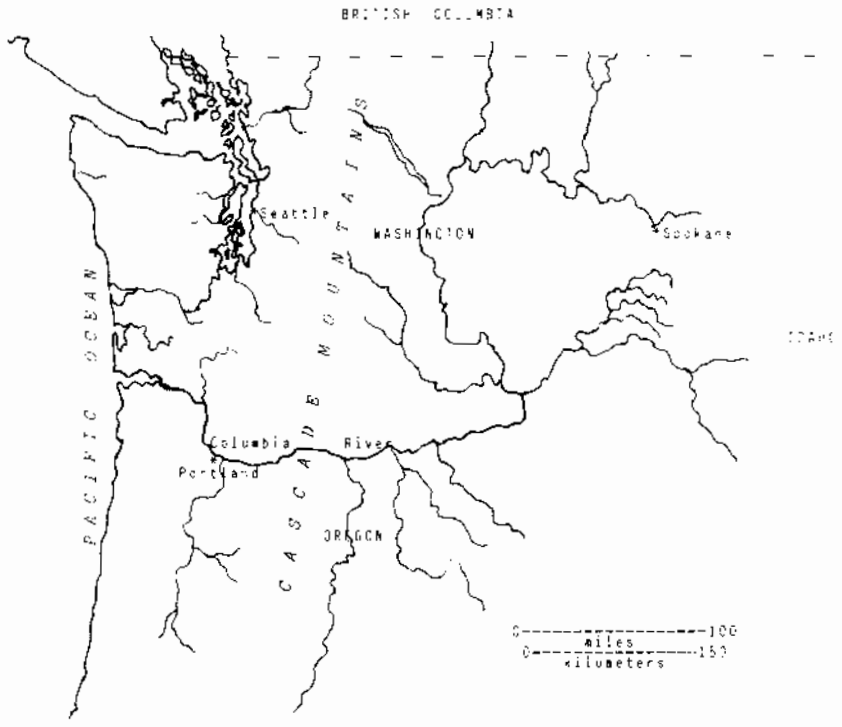

FIGURE 1 Map of Pacific Northwest showing separation of western maritime region and extensive Columbia Plateau by Cascade Mountains.

the year, retiring to permanent (winter) villages as part of seasonal routines predicated on harvests of both floral and faunal resources. Stored foods (particularly salmon [*Oncorhynchus* spp.] and berries) were mainstays of the winter diet. (Gunther, 1945; Drucker, 1955; Hitchcock and Cronquist, 1973; Turner, 1975).

The plateau region east of the Cascade Range is subject to marked seasonal changes in temperature and precipitation presenting, in general, extremes in temperature and more varied habitats than the western region. This interior plateau provides habitat for a greater diversity of terrestrial species than the western coastal zones, but those resources are spatially dispersed. Thus highly mobile pedestrian (after ca. 1730 equestrian) foraging strategies were especially important to the interior peoples.† Seasonal rounds from permanent villages were predicated on weather, distance and resource availability. While salmon‡ and berries were also primary resources for the interior peoples, it is noteworthy that a number of indigenous roots were also dietary staples (Ray, 1933; Franklin and Dyrness, 1969; Krajina, 1969; Hitchcock and Cronquist, 1973; Marshall, 1977).

METHODOLOGY

A major economic investment of the indigenous population was the seasonal capture and processing of anadromous salmon which yearly flood the Pacific Northwest drainages enroute to inland spawning grounds. Five species of salmon serially enter the rivers in early spring and again in late summer. Although not all species are found in all rivers, and cyclic variation determines actual numbers in any given year, salmon were a fundamental and reliable resource, essential to all foraging peoples of the Pacific Northwest (Schalk, 1977). Some salmon species were more valued than others, and locally developed processing methods reflect adjustments to species and environmental differences (fat content, condition and weight of fish along with local weather conditions, available fuel, and storage possibilities). Each year enormous quantities of salmon were dried or processed by several techniques for later consumption. While salmon, fresh or dried, is a good source of protein and vitamins A and D (Heller, 1956–61; Benson *et al.*, 1973; Rivera, 1949) and a valued food, it does not by itself fulfill human nutritional requirements. Native peoples of the Pacific Northwest used multiple, interrelated strategies for selecting resources which offered them a sufficient and varied diet (Brown, 1868; Thwaites, 1959; Hewes, 1973).

An interdisciplinary research team at the University of Washington has identified, collected and analyzed 27 vegetable foods known to have been commonly used in the pre-contact diet of the peoples of the Pacific Northwest. Samples of fresh plant foods were collected in both eastern and western Washington during preferred harvest seasons in 1978–79. Specimens were refrigerated at 4°C within 48 hours of collection and analyzed within 72 hours of collection. Berries, roots or sprouts were obtained from five to ten plants, except for the elderberry (*Sambucus* spp.) samples which were each from three plants. Roots from each of ten plants were mixed and ground to

† While home bases are a feature of foraging societies, harvesting strategies necessitate group movement to harvest locally available resources. Groups with a higher dependence on vegetable foods or foods like anadromous fish (resources which are more predictable than many game animals) can develop a fairly permanent home base. In the Pacific Northwest we then find well-developed winter ceremonial life co-existent with dependence upon stored foods.

‡ The Columbia River, which drains into the Pacific at what is now the Oregon/Washington border, extends some 1400 miles inland supplying an enormous area with an extremely rich resource of salmon.

obtain a composite aliquot for a species. Berries of the same species were combined and smashed before measuring aliquots, and sprouts from five plants each were also combined for a species sample. Berries were dried using traditional methods, while dried roots were obtained from native peoples. Dried specimens were stored one year before analysis. Three aliquots of each composite sample were analyzed for each procedure.

Proximate Analysis

Moisture Samples weighing 3 to 5 g were dried to a constant weight in an air oven at 102°C, method 34.048(a) (AOAC, 1975).

Protein Percent nitrogen was determined by the micro-Kjeldahl technique, method 47.021 (AOAC, 1975). Protein content was calculated as percent nitrogen times 6.25 (Jones, 1931).

Lipid Fat was extracted by refluxing eight hours with petroleum ether (boiling point 30 to 60°C) in a Goldfisch apparatus, method 7.046 (AOAC, 1975).

Ash Dried samples were ashed in a muffle furnace at 500°C for 12 hours, method 32.012 (AOAC, 1975).

Carbohydrate Total carbohydrate was determined by difference.

Kilocalories Calculated as the sum (g protein × 2.78 Cal/g) + (g carbohydrate × 4.03 Cal/g) × (g lipid × 8.37 Cal/g) (Merrill and Watt, 1955).

Mineral Analysis

Ashed samples were digested in hot 2N hydrochloric acid, method 2.098 (AOAC, 1975). Duplicate portions of each sample digest were analyzed for each mineral by atomic absorption spectroscopy.

Ascorbic Acid Analysis

Total ascorbic acid (L-ascorbic acid + dehydro ascorbic acid) was determined by colorimetry, using 2,4-dinitrophenylhydrazine as the color reagent (Roe and Kuether, 1943; Schaffert and Kingsley, 1955). Three 5 or 10 g portions of each sample were macerated separately in four percent trichloracetic acid. Ten aliquots of each of the three portions were reacted with 2,4-dinitrophenylhydrazine. Absorbance was determined at 515 nm. Sample concentration to absorbance was a linear relationship; the aliquot with absorbance nearest 0.43 was used in all calculations (Pomeranz and Meleon, 1978). Accuracy was determined by recoveries (Schaffert and Kingsley, 1955), which were 95 to 100 percent.

RESULTS AND DISCUSSION

Protein, lipid, carbohydrate, ash and caloric values for fresh and dried Pacific Northwest roots and berries are similar to commercially grown roots and berries. The indigenous berries analyzed are generally good sources of ascorbic acid with

TABLE I

Nutrient composition of selected fresh and dried Pacific Northwest berries[a] and cultivated species[b] per gram, dry weight

	Kjoules $\times 10^3$	Calories	Protein (g)	Carbohydrate (g)	Ash (g)	Lipid (g)	Calcium (mg)	Iron (mg)	Magnesium (mg)	Zinc (mg)	Ascorbic acid (mg)
Pacific Northwest Berries[a]											
Swamp Currant *Ribes lacustre*	15.10	3.61	0.15	0.78	0.04	0.04	3.19	0.05	0.94	0.02	3.33
Oregon Grape *Berberis nervosa*	15.86	3.79	0.18	0.71	0.04	0.08	1.91	0.03	0.85	0.05	1.45
Salmonberry *Rubus spectabilis*	15.60	3.73	0.35	0.59	0.01	0.05	2.25	0.05	1.91	0.05	3.71
Thimbleberry *R. parviflorus*	15.19	3.63	0.10	0.82	0.04	0.04	4.28	0.03	0.65	0.02	2.59
Blackberry *R. ursinus*	15.65	3.74	0.18	0.72	0.04	0.06	3.53	0.04	1.33	0.03	2.01
Salal *Gaultheria shallon*	15.52	3.71	0.13	0.79	0.03	0.05	3.77	0.04	0.91	0.04	4.87
Dried[c]	14.69	3.51	0.06	0.88	0.04	0.01	3.44	0.04	0.20	0.01	7.10
Red Huckleberry *Vaccinium parvifolium*[d]	16.48	3.94	0.16	0.72	0.02	0.09	2.16	0.04	0.55	0.01	3.54
Evergreen Huckleberry *V. ovatum*[d]	15.06	3.60	0.08	0.89	0.01	0.01	1.56	0.02	0.59	0.01	3.46
Dried[c]	14.73	3.52	0.06	0.92	0.02	0.00	1.74	0.02	0.20	0.01	3.84
Red Elderberry *Sambucus racemosa*	15.56	3.72	0.17	0.73	0.04	0.06	3.56	0.07	0.99	0.03	5.33
Blue Elderberry *S. cerulea*	14.39	3.44	0.16	0.68	0.10	0.05	1.15	0.05	0.69	0.02	1.56
False Solomon's Seal *Smilacina racemosa*	15.23	3.64	0.10	0.86	0.02	0.03	1.61	0.03	0.57	0.01	5.08
Cultivated Species[b]											
Strawberries *Fragaria* spp.	15.31	3.66	0.07	0.83	0.05	0.05	2.08	0.10	1.19	—	5.82
Gooseberries *Ribes* spp.	14.69	3.51	0.07	0.87	0.04	0.02	1.62	0.05	2.61	–	2.97

[a] Keely, P. (1980). *Nutrient Composition of Selected Important Plant Foods of the Precontact Diet of the Northwest Native American Peoples.* M.Sc. thesis, Nutritional Sciences Department, University of Washington.
[b] Watt and Merrill, 1975. [c] Dried and stored one year. [d] Found only west of Cascade Range. – indicates data not available.

TABLE II

Nutrient composition of selected fresh and dried Pacific Northwest root foods[a] and cultivated species[b] per gram, dry weight

Roots	Kjoules $\times 10^3$	Calories	Protein (g)	Carbohydrate (g)	Ash (g)	Lipid (g)	Calcium (mg)	Iron (mg)	Magnesium (mg)	Zinc (mg)
Bitterroot										
Lewisia rediviva[c]	16.19	3.87	0.10	0.85	0.01	0.01	2.35	0.33	0.74	0.05
dried	16.28	3.89	0.05	0.92	0.03	0.02	1.90	0.06	0.23	0.03
Desert Parsleys										
Lomatium canbyi[a]	15.94	3.81	0.08	0.85	0.04	0.02	3.05	0.25	0.57	0.02
dried	16.82	4.02	0.04	0.93	0.02	0.02	1.27	0.04	0.22	0.01
L. cous[c]										
dried	16.61	3.97	0.05	0.93	0.01	0.01	1.18	0.03	0.23	0.01
L. farinosum[c]	16.15	3.86	0.08	0.89	0.02	0.01	2.07	0.07	0.56	0.01
L. geyeri[c]	15.77	3.77	0.10	0.81	0.06	0.02	2.42	0.22	0.65	0.03
L. macrocarpum[c]	16.32	3.90	0.04	0.89	0.04	0.02	1.65	0.22	0.37	0.02
L. piperi[c]	16.65	3.98	0.07	0.89	0.02	0.02	1.80	0.12	0.48	0.01
Tauschia hooveri[c]	15.90	3.80	0.09	0.83	0.05	0.02	6.56	0.35	0.46	0.02
Yampah										
Perideridia gairdneri										
dried	16.40	3.92	0.07	0.84	0.03	0.01	0.86	0.05	0.22	0.01
Wapatoo										
Sagittaria latifolia	15.06	3.60	0.16	0.80	0.06	0.00	0.35	0.41	0.63	0.03
Camas										
Camassia quamash	16.32	3.90	0.13	0.80	0.03	0.03	1.67	0.23	0.40	0.03
Fritillaria pudica[c]	14.43	3.45	0.15	0.71	0.12	0.02	2.02	0.88	0.96	0.02
Cultivated species										
Potato										
Solanum tuberosum	15.73	3.76	0.10	0.85	0.04	0.00	0.35	0.03	1.09	0.02
Sweet Potato										
Ipomoea batatas	16.23	3.88	0.06	0.89	0.03	0.01	1.09	0.02	1.05	—
Taro										
Colocasia spp.	15.19	3.63	0.07	0.87	0.04	0.01	2.26	0.04		—

[a] Keely, 1980. (See Table I). [b] Watt and Merrill, 1975. [c] Species found only east of Cascade Range. — indicates data not available.

TABLE III

Ascorbic acid content of selected Northwest Coast sprouts per 100 g edible portion

Sprouts	Ascorbic acid mg/g
Thimbleberry *Rubus parviflorus*	21.72
Salmonberry *R. spectabilis*	29.58
Cow Parsnip *Heracleum lanatum*	60.00
Desert Parsley *Lomatium grayi*[a]	15.00
Indian Celery *L. nudicaule*	43.23
Balsam Root *Balsamorhiza sagittata*[a]	13.75

[a] Species found only east of Cascade Range. (Keely, 1980. See Table I).

higher ascorbic acid concentration in stored than fresh berries. Mineral contents are comparable to cultivated berries and fruits. The native roots are good sources of calcium, iron, magnesium and zinc, being similar or of higher value than the more commonly used staples, potato, taro and sweet potato (Keely *et al.*, 1982). Ascorbic acid content of shoots ranged from 13 to 60 mg/100 g, making them valuable sources of this vitamin. Tables I, II, and III display nutrient values obtained in this study.

Results of these nutrient analyses† along with ethnohistoric reconstruction and contemporary research reveals the following: That a wide variety of foods were used to meet nutritional needs; that native preparation and preservation techniques were important factors in retaining nutrients (Konlande and Robson, 1972; Keely *et al.*, 1982; Kuhnlein, Turner and Kluckner, 1982) and in maintaining a balanced diet during seasons of low productivity. Further, vegetable foods, while neglected or discounted as lacking food value by many previous researchers, have proved to be significant, essential and valued elements of the Pacific Northwest diet (Cooper, 1853–55; Brown, 1868; Ray, 1933; Norton, 1979b; Hunn, 1981; Hunn and French, 1981; Turner and Kuhnlein, 1982). Flexible, opportunistic work forces divided their efforts to take advantage of many seasonal resources, both floral and faunal, moving from riverine or shoreline habitats to prairie or sub-alpine slopes to harvest locally abundant species. Though many of these foods were eaten fresh, many species also were gathered in quantity to be processed and stored for winter use. First food ceremonies, indicators of cultural value, were held for these seasonal vegetable foods as well as for the cyclic salmon. Berry patches or root fields west of the Cascades were often owned and maintained by weeding, replanting and burning. Many local foods remain important articles in the contemporary diet of native peoples throughout the Pacific Northwest.

† Keely, P. (1980) *Nutrient Composition of Selected Important Plant Foods of the Pre-Contact Diet of the Northwest Native American Peoples*. M.Sc. thesis, Nutritional Sciences Department, University of Washington.

Berries were as much a mainstay of the pre-contact diet as salmon, with over 40 edible species recorded for the Pacific Northwest. Salal (*Gaultheria shallon*), salmonberry (*Rubus spectabilis*), cranberry (*Vaccinium oxycoccos*), elderberry (*Sambucus* spp.) gooseberry or currant (*Ribes* spp.), serviceberry (*Amelanchier alnifolia*) and 12 species of blueberry or huckleberry (*Vaccinium* spp.) are all known to have been significant in the maintenance of indigenous households. Numerous historical and ethnographic documents attest to the importance and frequency of fruits, roots and sprouts in the pre-contact diet. Berries and other fruits (crabapples [*Pyrus fusca*], cherries [*Prunus* spp.], etc.) were gathered when ripe or slightly green and processed, most often by drying, then carefully stored for later consumption. Berries were rehydrated before serving. Processed berries or fruits were an article of trade between different groups and a staple in the daily diet (Brown, 1868; Ray, 1933; Reagan, 1934; Drucker, 1955; Kuhnlein *et al.*, 1982). Fresh or dried wild berries offer ascorbic acid as well as calcium, iron, magnesium and zinc in quantities comparable to modern cultivated fruits. Table I shows values for 11 berries common in the Pacific Northwest and two common cultivated species.

Roots† are also frequently mentioned in the ethnohistorical literature as a common food for indigenous peoples, although they are less often adequately identified. Camas (*Camassia* spp.) is recorded as a basic food of the plateau area and also locally important in the west where fern root, or bracken (*Pteridium aquilinum*), was used by almost every group. Large quantities of these roots were harvested, stored and traded each season. These foods were roasted fresh and also preserved after being dried or pit steamed. Roots were often blended and formed into patties, as well as being used as thickening agents in soups or stews. The underground parts of other plants (for instance, *Fritillaria* spp., *Erythronium* spp., *Lilium*, *Calochortus* spp., *Brodiaea* spp., *Allium* spp.,) cinquefoil (*Potentilla anserina*), bitterroot (*Lewisia rediviva*) and parsleys (*Lomatium* spp.) along with many other bulbs, corms, tubers and rhizomes were gathered and processed as part of the seasonal rounds. Harvests occurred in spring as well as in the late summer or early fall months. These foods are found throughout the Pacific Northwest from sea-level to sub-alpine slopes in meadows, sagebrush desert, tidelands and anthropogenic prairies maintained for the production of resource species. Roots, like salmon and berries, were essential elements in the larders of the Native Americans (Brown, 1868; Suttles, 1951b; Drucker, 1955; Thwaites, 1959; Konlande and Robson, 1972; Norton, 1979b; Hunn and French, 1981; Kuhnlein, Turner and Kluckner, 1982). These native roots contain substantial amounts of calcium, iron, magnesium and zinc and may be better sources of these minerals than the cultivated potato (*Solanum tuberosum*), sweet potato (*Ipomoea batatas*) or taro (*Colocasia* spp.). Table II shows nutritive values for some Pacific Northwest members of this important food group along with some cultivated species.

Stalks or shoots, the "Indian celeries," and greens were not overlooked by native Americans of the Pacific Northwest, although these foods are underrecorded compared to the more readily preserved and stored foods. Fresh sprouts, stems, leaf stalks and leaves were harvested in early spring when stored foods were in low supply and would have been timely and important sources of nutrition. They remained a part of the diet throughout the early growing season whenever they were found. They were eaten fresh, sometimes garnished with oil, and added to soups and stews. Some sprouts were stored in oil for future consumption. Young sprouts of several

† The term "roots" encompasses the various tubers, bulbs, corms, rhizomes and roots which are used as food.

food plants (especially *Rubus* spp.) were annually gathered in enormous quantities (Brown, 1868; Reagan, 1934; Hunn and French, 1981). These fresh foods contain considerable amounts of ascorbic acid and would have been a substantial addition to the pre-contact diet. Table III gives the ascorbic acid content of some of the most commonly used sprouts of the Pacific Northwest.

SUMMARY

This research demonstrates that native Americans of the Pacific Northwest used multiple resources throughout their range, relying on both faunal and floral species to provision themselves with an ample and varied diet. Such foraging strategies are common throughout the world, and the indigenous people of the Pacific Northwest were no exception. Processing and storage methods were important elements in the economic cycle. This and other research indicates that those methods were well able to provide nutritious food, even with extended storage. The research reported here finds vegetable foods to have been systematically gathered and processed in quantity for use as staples in the daily regimen. Analyses show that these native foods are superior to cultigens in providing necessary fiber, minerals, and vitamins, making substantial contributions to pre-contact diets.

ACKNOWLEDGEMENTS

We would like to thank the National Science Foundation (BNS 76-16914) and the University of Washington Graduate School Research Fund for their support in partially funding this research.

REFERENCES

Association of Official Analytical Chemists (1975). *Official Methods of Analysis*. 12th ed. Washington, D.C.

Benson, E. M., J. M. Peters, M. A. Edwards and L. A. Hogan (1973). Wild edible plants of the Pacific Northwest. *J. Am. Dietet. Assoc.* **62**, 143–147.

Berkes, F. and C. Farkas (1978). Easter James Bay Cree Indians: Changing patterns of wild food use and nutrition. *Ecol. Food Nutr.* **7**, 155–172.

Borden, C. E. (1979). Peopling and early cultures of the Pacific Northwest. *Science* **203**(9), 963–970.

Brown, R. (1868). On the vegetable products, used by the North-West American Indians as food and medicine, in the arts, and in superstitious rites. *Trans. Botan. Soc. Edinburgh* **9**, 378–396.

Cooper, J. G. (1853–1855). *Notebook, Northern Pacific Railroad Survey*. Smithsonian Institution Archives, Washington, D.C.

Cressman, L. S. (1977). *Prehistory of the Far West: Homes of Vanished Peoples*. University of Utah Press, Salt Lake City.

Drucker, P. (1955). *Indians of the Northwest Coast*. Natural History Press, New York.

Franklin, J. and C. T. Dyrness (1969). *Vegetation of Oregon and Washington*. Forest Service General Technical Report, U.S.D.A., Portland, Oregon.

Gould, R. (1977). Discovering the Australian Desert culture. *Pac. Discov.* **30**, 1–11.

Gunther, E. (1945). *Ethnobotany of Western Washington*. University of Washington Press, Seattle.

Harding, R. and G. Teleki (Eds.) (1981). *Omnivorous Primates*. Columbia University Press, New York.

Heller, C. A. and E. M. Scott (1956–1961). *The Alaska Dietary Survey*. U.S. Gov. Printing Office, Washington, D.C.

Hewes, G. W. (1973). Indian fisheries productivity in pre-contact times in the Pacific Salmon Area. *NW. Anthropol. Res. Notes* **7**(2), 133–155.

Hitchcock, C. L. and A. Cronquist (1973). *Flora of the Pacific Northwest*. University of Washington Press, Seattle.

Hunn, E. S. (1981). On the relative contribution of men and women to subsistence among hunter-gatherers of the Columbia Plateau: A comparison with ethnographic atlas summaries. *J. Ethnobiol.* **1**(1), 124–134.

Hunn, E. S. and D. French (1981). Lomatium: A key resource for Columbia Plateau native subsistence. *NW. Sci.* **55**, 87–94.

Jones, D. G. (1931). *Factors for Converting Percentages of Nitrogen in Foods and Feeds into Percentages of Proteins*. Agriculture Circular No. 184, U.S. Department of Agriculture, Washington, D.C.

Keely, P., C. S. Martinsen, E. S. Hunn and H. H. Norton (1982). Composition of Northwest native fruits. *J. Am. Dietet. Assoc.* **81**(5), 568–572.

Konlande, J. E. and J. R. K. Robson (1972). The nutritive value of cooked camas as consumed by the Flathead Indians. *Ecol. Food Nutr.* **2**, 193–195.

Krajina, V. J. (1969). *Ecology of Western North America*. Vol. 2, University of British Columbia, Vancouver, B.C.

Kuhnlein, H. V., A. C. Chan, J. N. Thompson and S. Nakai (1982). Ooligan grease: A nutritious fat used by native people of Coastal British Columbia. *J. Ethnobiol.* **2**(2), 154–161.

Kuhnlein, H. V., N. J. Turner and P. D. Kluckner (1982). Nutritional significance of two important root foods (Springbank Clover and Pacific Silverweed). Used by Native People of the Coast of British Columbia. *Ecol. Food Nutr.* **12**, 89–95.

Lee, R. (1979). *The !Kung San: Men, Women and Work in a Foraging Society*. Cambridge University Press, New York.

Marshall, A. G. (1977). *Nez Perce Social Groups: An Ecological Interpretation*. Ph.D. dissertation, Anthropology Department, Washington State University.

Meehan, B. (1977). Hunters by the Seashore. *J. Hum. Evol.* **6**, 24–31.

Merrill, A. L. and B. K. Watt (1955). *Energy Value of Foods—Basis and Derivation*. Agricultural Handbook No. 74, U.S. Department of Agriculture, Washington D.C.

Norton, H. H. (1979a). The Association between anthropogenic prairies and important food plants in Western Washington. *NW. Anthropol. Res. Notes* **13**(20), 434–449.

Norton, H. H. (1979b). Evidence for bracken as food for Aboriginal peoples of Western Washington. *Econ. Botan.* **33**(4), 384–396.

Norton, H. H., R. Boyd and E. S. Hunn (1983). The Klickitat Trail of South-Central Washington: A reconstruction of seasonally used subsistence sites. In R. Greengo (Ed.), *Prehistoric Places on the Southern Northwest Coast*. Thomas Burke Memorial-Washington State Museum, Seattle, pp. 121–152.

Pomeranz, Y. and C. E. Meloan (1978). *Food Analysis: Theory and Practice*. 2nd ed., AVI Publishing Co., Westport, Connecticut.

Ray, V. (1933). Sanpoil and Nespelem: Salishan people of Northeast Washington. *Uni. Washington Publ. Anthropol.* **51**, 1–237.

Reagan, A. B. (1934). Plants used by the Hoh and Quileute Indians. *Trans. Kansas Acad. Sci.* **37**, 55–70.

Rivera, T. (1949). Diet of a food-gathering people, with chemical analysis of salmon and saskatoons. In M. W. Smith (Ed.), *Indians of the Urban Northwest*. Columbia University Press, New York, pp. 19–36.

Roe, J. H. and C. A. Keuther (1943). The determination of ascorbic acid in whole blood and urine through the 2,4-dinitrophenylhydrazine derivative of dehydro-ascorbic acid. *J. Biol. Chem.* **147**, 399–407.

Schaffert, R. R. and G. R. Kingsley (1955). A rapid simple method for the determination of reduced, dehydro-, and total ascorbic acid in biological material. *J. Biol. Chem.* **212**, 59–68.

Schalk, R. (1977). The structure of an anadromous fish resource. In L. R. Binford (Ed.), *For Theory Building in Archaeology, Essays on Faunal Remains, Aquatic Resources, Spatial Analysis and Systemic Modeling*. Academic Press, New York, pp. 207–249.

Suttles, W. (1951a). *Economic Life of the Coast Salish of Haro and Rosaria Straits*. Ph.D. dissertation, Anthropology Department, University of Washington.

Suttles, W. (1951b). The early diffusion of the potato among the coast Salish. *SW. J. Anthropol.* **7**(3), 272–287.

Thwaites, Reuben (1959). *The Original Journals of Lewis and Clark*. Vols. 3, 4. Antiquarian Press, New York.

Turnbull, C. (1981). Mbuti Womanhood. In F. Dahlberg (Ed.), *Woman the Gatherer*. Yale University Press, New Haven, pp. 205–219.

Turner, N. J. (1975). *Food Plants of British Columbia Indians. Part 1. Coastal People*. British Columbia Provincial Museum Handbook No. 34, Victoria, B.C.

Turner, N. J. and H. Kuhnlein (1982). Two important "Root" foods of the Northwest Coast Indians: Springbank clover (*Trifolium wormskjoldii* Lehm.) and Pacific Silverwood (*Potentilla anserina* L. spp. *pacifica* [Howell] Rousi). *Econ. Botan.* **36**(4), 411–432.

Watt, B. K. and A. L. Merrill (1975). *Composition of Foods*. Agricultural Handbook No. 456, U.S. Department of Agriculture, Washington, D.C.