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Conservation and Development of Nontimber Forest Products in the Pacific Northwest: An Annotated Bibliography

Compilers

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Abstract

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This bibliography encompasses literature on the historic and current scope of nontimber forest product industries in the Pacific Northwest and includes references on international markets and trade that bear on these industries. Key themes in the bibliography are biological and socioeconomic aspects of resource management for sustainable production; procedures for identifying, monitoring, and inventorying important resources; means for technical innovation and resource development; and public education about nontimber forest resources. Social policy issues address the role of nontimber forest products in rural development and the spectrum of ethical considerations required for socially acceptable policy formulation. Economics literature covers estimating the contribution of nontimber forest products to a whole ecosystem economy, analyzing and planning for joint production of agroforestry systems, and enhancing the performance of nontimber forest product sectors.

Keywords: Bibliography, conservation, sustainable development, economic analysis, wild edible mushrooms, floral greens, medicinal plants, conifer greens, forest policy, nontimber forest products, trade.

Contents

Introduction

This annotated bibliography is intended for researchers, managers, policymakers, and industry participants concerned with development and conservation of nontimber forest products in the Pacific Northwest. Citations are followed by brief abstracts that highlight key themes as well as research methods, the location of the research or analysis, and the implications for management of nontimber forest products in the Pacific Northwest. Keywords at the end of each annotation are organized in an index that references species (both common and scientific name), geographic location, and key themes, topics, and organizations. The Pacific Northwest Research Station is also making this annotated bibliography available on diskette.

The regional literature on nontimber forest products is fairly limited, although it has expanded considerably in the last 5 years. Much of the regional literature, especially that addressing management and policy options, remains, however, in the realm of "gray" literature: unpublished manuscripts, discussion papers, proceedings of meetings, and agency memos. Given the wealth of information and perspectives, we have chosen to include regional gray literature in this bibliography.

We also have drawn heavily on global lessons of nontimber forest product management, particularly from the Amazon basin, where nontimber forest product development has been attempted as a conservation mechanism, and from Scandinavia, where substantial government efforts have been directed towards catalyzing berry and mushroom collecting and bough production for rural development purposes. We have been hampered in our search of global examples by language barriers, access to publications, and time. In particular, a further exploration of the literature in Japanese, Russian, and Polish is warranted. An annotated bibliography of the literature in Russian is currently in preparation (by Weigand and others).

In this introduction, we attempt to guide the reader through the bibliography by introducing the key themes and researchers within various topics. We first describe literature addressing the historic and current size and scope of the nontimber forest product industry in the Pacific Northwest, and then we place the region in a global context through a discussion of international markets and trade. This is followed by a discussion of sociocultural issues, including labor arrangements, patterns of access, and resource conflicts. The management section summarizes key management themes, including the biological, ecological, and socioeconomic aspects of management, inventorying and monitoring, technical innovation and domestication, and education. The section on policy issues explores the use of nontimber forest products to spur rural economic development and as a mechanism for promoting resource stewardship. Economic research, addressed next, centers on four themes: the economic contribution of nontimber forest products in various settings, their value relative to other forest uses, the analysis of joint production and agroforestry systems, and improving the financial performance of nontimber forest product sectors. Finally, there is a discussion of ethical issues raised in the literature.

Size, Structure, and Scope

Although the scope, structure, and economic contribution of the nontimber forest products industry in the Pacific Northwest continues to be poorly documented, the understanding has grown tremendously in recent years. Before 1990, regional literature describing the nontimber forest products industry came primarily from the late 1940s and early 1950s. This post-World War II period saw a number of descriptions of the social organization of "brush pickers" (decorative greens harvesters) and the market structure, trade characteristics, and economic value of

nontimber forest products (Allen 1950, Cronemiller and others 1950, Heckman 1951, Newton 1957, Shaw 1949, Weber 1949). The focus of these studies is primarily decorative greens, but harvest of some medicinal and edible plants also is described. Cronemiller and others estimated the commercial value of nontimber forest products in 1950 in Oregon at US$5 million, and Heckman estimated floral greens employment in the Pacific Northwest at 2,000 people. Following this period, the only regional authors describing nontimber forest products were Bender (1963), who provided a historical description of the cedar leaf oil industry, and Douglass (1970, 1975), who provided excellent status reports on the nontimber forest product industry in the Pacific Northwest. These Forest Service reports were presumably generated every 5 years, starting in 1965, although this first report was not located. The reports describe harvest activity by county and species, regional production and prices, and provide advice to harvesters and landowners. Douglass estimated that nontimber forest products provided US$15 million in income to harvesters in Oregon and Washington in 1969.

In the early 1980s, the commercial wild edible mushroom industry began to develop in the Pacific Northwest. User conflicts and concerns about resource sustainability rekindled interest in nontimber forest products. In 1986, Acker provided a review of the emerging wild edible mushroom industry in Washington, including information on wages, export markets, regulatory issues, user conflicts, and policy options in preparation for potential regulation. Acker's paper, in conjunction with that of Russell (1987), summarized the context for the Wild Mushroom Harvesting Act in Washington, passed in 1989, and described by Russell (1990). In the early 1990s, with timber harvests declining, the interest in nontimber forest products as a potential source of income and employment for forest-dependent communities led to increased interest in these "minor" forest products. Schlosser and others (1991) surveyed the Christmas and floral greens industry, and Schlosser and Blatner (1995) surveyed the wild edible mushroom industry and provided the first methodical surveys and documentation of harvest volumes, prices, employment, production and marketing characteristics, and economic contribution of these industries. These studies have been key in documenting the nontimber forest product industry and providing a framework for management and policy formulation in the region. Additional studies address the production potential of Northwest forest lands (Schlosser and others 1992); critical management and policy issues (Schlosser and Blatner 1993); and potential products from east-side forests (Schlosser and Blatner 1994).

Molina and his colleagues have contributed significantly to the regional understanding of wild edible mushrooms (Molina and others 1993), particularly on issues of monitoring and resource sustainability (Molina and others, in press; Hosford and others 1995), as have Denison and Donaghue (1988, 1992). A number of subregional studies also have emerged, documenting aspects of the nontimber forest product industries in southwest Oregon (Fitzgerald 1986, Van Gaasbeck 1992); central western Oregon (Howell 1991), the Winema and Deschutes National Forests (Lipske 1994), southwest Washington (Seely 1993), and the Klamath region (Richards and Creasy, in press). De Geus (1995) provides an excellent overview of nontimber forest products harvested in British Columbia, including a description of the uses, markets, distribution, ecology, and harvest of 211 products, as well as a discussion of management and policy issues.

Interest in nontimber forest products also was spurred by the recent emergence of taxol, initially extracted from the bark of the Pacific yew (*Taxus brevifolia*), as a

powerful anticancer agent (Wolf and Wortmann 1992). Although taxol has since been synthesized by Bristol-Myers Squibb, the sudden dramatic demand for yew bark gave rise to interesting research and policy discussions about the conservation, management, and use of medicinal plants (Busing and others 1995; U.S. Department of the Interior, Bureau of Land Management 1992; Vance 1995; Wolf and Wortmann 1992) .

Use of nontimber forest products in the region could grow and diversify with the rediscovery of uses by indigenous cultures. In particular, Turner and her colleagues have contributed to our knowledge of uses, harvesting practices, and processing of useful plants among Native Americans, including the Coast Salish (1971a, 1971b), the Bella Coola (1972), the Kwaikutl (1973), the Okanagan-Colville (with Bouchard and Kennedy in 1980), the Hesquiat (1982), the Nitinaht (1983), the Salishan (with Nebda 1990), and the Thompson Indians (with Thompson and others, 1990). In addition, Turner has contributed studies of the traditional use of significant species, such as soapberry (1981), springbank clover and Pacific silverweed (1982), and devilsclub (1982) as well as general studies on food plants of British Columbia Indians (1975, 1978) and plants in British Columbia Indian technology (1979). Gottesfeld also has contributed to knowledge of ethnobotany in British Columbia by describing the role of bark products in aboriginal cultures (1992) and aboriginal burning practices (1994).

Further south, Colville (1897) provided the first published ethnobotanical work in the Pacific Northwest with a study of plant and lichen use by the Klamath of southern Oregon. He was followed in 1940 by Gunther who described the use of plants among Native Americans inhabiting the west coast of Washington. More recent studies include a study of the ethnobotany of the Clallam Indians (Fleischer 1980), Native Americans of the Columbia Plateau (Knudson 1980), traditional foods among the Nuxalk (Kuhnlein 1980, Lepofsky and others 1985), and traditional use of western brackenfern (Norton 1979a), camas bulbs (Smith 1978) and devilsclub (Smith 1983). Norton and others (1984) provide a nutritional analysis of native plants common in the diets of Native Americans. Pojar and MacKinnon (1994) provide an excellent recent compilation of ethnobotanical research, documenting traditional and modern uses of plants found in the coastal zone from southeast Alaska to central Oregon.

Trade, Market Dynamics, and Competition

Most countries do not maintain uniform or comparable data about nontimber forest products. Some countries, however, such as Sweden, Finland, Lithuania, Latvia, Estonia, Russia, and Poland, do have protocols in place to inventory and value stocks of nontimber forest products. Regional reports from the Food and Agriculture Organization of the United Nations (FAO) and the European Union provide comparative information for some individual countries (Baldini 1993, Cesaro and others 1993, Economic Commission for Europe 1993). Iqbal (1993) provides a global overview of key nontimber forest products. Not surprisingly, the bulk of products comes from tropical forests where plant species diversity is highest and traditional uses of plants often remain vital in many households. A comprehensive compilation of global production and directions of trade has yet to take place.

Internationalization of markets for nontimber forest products from the Pacific Northwest—Most products from the Pacific Northwest and elsewhere in the United States are being exported to countries with higher standards of living and labor costs, such as Germany, France, and Japan. The recent rise in European and Japanese imports of edible wild mushrooms appears to be coinciding with declines

in domestic yields of mushrooms in the importing countries (Hosford and others 1995, Jansen and de Vries 1988). Germany and France purchase 25 percent of the wild mushroom harvest in the Pacific Northwest. The American matsutake furnishes a recent example of increased collection and trade for Japanese markets. The United States, Canada, and to a lesser extent Mexico, now increasingly supply Japanese markets (Aguilar 1995, Villareal and others 1989).

Reliable information on the trade and market share of American nontimber forest products remains scarce. Fischer (1992), however, provides good details for the sources of imported floral greens to the German market for 1991. Market shares of Pacific Northwest products in the German market is high: 19 percent of the German market for floral greens comes from wild stocks of Pacific Northwest plants, which are shipped mainly from Seattle. Data on the value of these products is not yet available but probably approaches US$15 million for 1991. The importance of monitoring economic and biological events in major importing countries is crucial to maintaining and expanding foreign markets for Pacific Northwest nontimber forest products.

Sociocultural Issues

This section summarizes three sociocultural issues that appear in much of the nontimber forest products management and policy literature: labor arrangements, patterns of access, and conflicts over nontimber forest products use in postindustrial societies.

Labor arrangements of commercial and subsistence harvesting— A fairly consistent pattern of labor arrangements for nontimber forest products exists across the globe: nontimber forest product harvesters and processors are drawn disproportionately from the ranks of the rural and urban poor (Falconer 1990, Farolfi 1990, Larèrre and de la Soudière 1985, Love 1992, Nash 1994, Schlosser and Blatner 1995, Schlosser and others 1991). Women, children, and elderly people frequently make up a large percentage of the harvesting population, particularly when the nontimber forest products gathered are destined for domestic consumption (Carlson 1986, Falconer 1990, Farolfi 1990, Saastamoinen 1989, Shubat 1983). Women and elderly people also depend on nontimber forest products as sources of income in developing and postindustrial societies (Falconer 1990, Kantor 1994, Robinson 1994, Saastamoinen 1989). The stereotypic image of commercial and subsistence nontimber forest product harvesters as rural, forest dwellers is changing: Falconer (1990) and Paillasse (1992) illustrate the role that nontimber forest products play in urban economies in Africa and Indonesia, and a recent study by Richards and Creasy (in press) of matsutake gatherers in the Pacific Northwest indicates that urban immigrant populations also rely on income from nontimber forest products.

Paillasse (1992) and Anderson and Ioris (1990) provide detailed pictures of the complexities of nontimber forest products trade networks in Indonesia and the Amazon. Their accounts indicate that market relations are based on long-standing, tightly knit “patron-client” relations among harvesters, intermediaries, and transnational corporations (Anderson and Ioris 1990, Paillasse 1992). Their analyses also suggest that these relations will need to change if the objective of sustainability for extractive reserves is to be realized. Larèrre and de la Soudière’s (1985) ethnography of nontimber forest product harvesters in central France suggests that similar kinds of relations also may exist in European nontimber forest product markets. They draw similar conclusions as to the negative impact of these power imbalances on resource sustainability. No studies of market relations among

harvesters, buyers, and dealers have yet been published for the Pacific Northwest, although the general outlines of the market structure have been identified (Schlosser and Blatner 1995, Schlosser and others 1991).

Patterns of access— In contexts where nontimber forest products have considerable market, subsistence, or cultural value, societies develop tenure regimes to regulate their use (Carlson 1986, Kauppi 1979, Knudsen 1980, Larèrre and de la Soudière 1985, Paillasse 1992). In developing countries, locally developed rules may be undermined by an overlay of contradictory state rules or by the imposition of state rules not backed up by appropriate enforcement capacity (Paillasse 1992). Alternatively, the ability for local tenure systems to adjust to the introduction of new resources may be inhibited by the overlay of state authority (Paillasse 1992).

In postindustrial societies, such as France, many of the customary rules fell into disuse as nontimber forest products lost their value (Larèrre and de la Soudière 1985). In Canada and the United States, traditional uses by indigenous peoples and their rights to exclude other users were restricted by rules promulgated by national land management agencies (Cizek 1993; Gottesfeld 1992; Richards and Creasy, in print). The development of new markets for nontimber forest products coupled with the incapacity of public land management agencies to enforce regulations restricting access to these resources, has created a climate of tenure insecurity that bodes ill for sustainable management (Coujard and Commeaux 1981; Denison and Donoghue 1988; Larèrre and de la Soudière 1985; Love 1992; Richards and Creasy, in press; Rizza 1990; Russell 1990).

Conflicts among harvesters in postindustrial settings— Sociological analyses within the tropical nontimber forest products literature focus on power relations among the state, corporations, and user groups. The North American and European literature focuses on conflicts among user groups. These latter conflicts often revolve around tensions between local and nonlocal users (Acker 1986; de Geus 1992; Larèrre and de la Soudière 1985; Richards and Creasy, in press) and between what Coujard and Commeaux (1981) refer to as “symbolic” and “material” users. In central France these categories overlap: nonlocal users frequently have a symbolic orientation (that is, recreation and tourism) and local users have a more material orientation (Coujard and Commeaux 1981). In the Pacific Northwest, these categories also overlap, but sometimes in the opposite direction: resident Native Americans have a largely symbolic orientation toward the matsutake harvest, and nonlocal migrant harvesters have a predominately material orientation to the matsutake harvest (Richards and Creasey, in press). Love (1992) suggests that the conflicts among user groups in the Pacific Northwest have a strong class conflict element; Larèrre and de la Soudière (1985) draw a similar conclusion for harvesters in central France. Sociological analyses of harvester conflicts, indeed of all aspects of nontimber forest product harvesting in postindustrial societies, are virtually nonexistent. Studies by Coujard and Commeaux (1981), Larèrre and de la Soudière (1985), and Richards and Creasy (in press) provide excellent models for investigating sociological relations in this domain.

Management Issues

Management of nontimber forest products has only recently been the object of systematic scientific study in most parts of the world. Huge gaps in scientific understanding of the biological, ecological, and socioeconomic aspects of nontimber forest products exist as the limited studies available focus on only a very limited number of species and types of products. The following section summarizes the extent to which scientific studies are available about nontimber forest products in

various parts of the world and the key management themes emerging from those studies.

During most of the 20th century, scientific study of the management of tropical forest nontimber forest products focused primarily on describing the kinds of plants used by indigenous populations in tropical forests, and only to a lesser degree on the ways in which indigenous people manipulated plants and environmental factors to increase yields or produce certain physical and genetic traits. During the 1980s and 1990s, ecological and anthropological studies in the Amazon basin began to suggest a link between tropical biodiversity and deliberate, long-term human manipulation of the forest environment (Anderson 1990, Panayotou and Ashton 1992, Redford and Padoch 1992). Three issues stand out as particularly important in understanding nontimber forest products and tropical forest management.

First, although many economic development planners and environmentalists currently advocate expanding nontimber forest product markets as a mechanism for encouraging forest conservation, recent studies have pointed out that uncontrolled market expansion has historically led to overharvesting and periodic boom and bust cycles with disastrous social and ecological consequences (Anderson and Ioris 1992, Vasquez and Gentry 1989, Villareal and Perez-Moreno 1989). Consequently, new management regimes must incorporate policies that permit societies to regulate the use of nontimber forest products at sustainable levels.

Second, studies of indigenous and peasant land management practices in Central and South America indicate that many traditional societies rely on the use of multiple product or portfolio approaches to land management (Alcorn 1984, Anderson and Ioris 1992, Balick and Mendelsohn 1992, Browder 1992, Paillasse 1992, Redford and Padoch 1992). These strategies allow rural inhabitants to spread economic risk while biological diversity and soil fertility are maintained at much higher levels than would be possible under other kinds of management regimes (Alcorn 1984, Anderson 1990). Research should thus focus on working with rural inhabitants to develop and implement a continuum of management strategies, rather than focusing on a one-size-fits-all approach (Anderson 1990, Browder 1992).

Third, in the past five years, studies comparing the economic value of managing tropical forests for nontimber forest products, for timber production, for agriculture or pasture, or for some combination of these uses have begun to appear in the literature (Balick and Mendelsohn 1992, Peters and others 1989). These studies suggest that under certain circumstances nontimber forest product production is economically the most viable strategy for rural dwellers, and that under most circumstances, some type of joint production is economically advantageous to rural producers (Anderson 1990, Anderson and Ioris 1992, Balick and Mendelsohn 1992).

Studies of nontimber forest product management in temperate and boreal forests are most abundant for the Scandinavian countries (mushrooms, lichens, berries, and decorative greens), Germany and Denmark (decorative greens), France and Italy (mushrooms), Poland and Russia (mushrooms and berries), Japan (mushrooms), and North America (mushrooms and berries). Articles on Australia (Boutland and others 1991) and South Africa (Davis 1992, Geldenhuys and van der Merwe 1988) indicate that wildflower and decorative greens management is important in temperate forests of the Southern Hemisphere, but published

information about these areas was extremely difficult to locate. The following discussion summarizes three general areas of nontimber forest product management emphasized in the temperate and boreal forest literature: biological and ecological aspects of management, socioeconomic aspects of management, and inventory and monitoring of nontimber forest products resources.

Biological and ecological aspects of management— A small but growing literature describes scientific experiments that assess the effects of various environmental factors, including light intensity, soil moisture, fertilization, and soil compaction, on the yield and commercial quality of nontimber forest products. Fungi and berry studies in northern Europe (Aakre 1986; Jäppinen and others 1986; Kauppi 1979; Ohenoja 1978, 1988; Raatikainen and others 1984) and North America (Minore 1984, Minore and Dubrasich 1978, Minore and others 1979, Norvell and others 1995, Shubat 1983) emphasize management practices for wild species, whereas studies of shiitake in Japan (Iwamura and others 1966; Nishida and Ishikawa 1967a, 1967b; Piot 1983) and truffle production in France and Italy (Garbaye and others 1979, Urbani 1985) focus on management practices under conditions of semidomestication. The German and Danish literatures focus heavily on identifying suitable environmental conditions for the production of florist quality boughs in public and private plantations (Bang 1979; Boge 1983; Christensen 1982; Ehlers 1968, 1970; Grabenstedt 1969; Holstener-Jørgensen and Stope 1985; Schroeder 1977). Recent work in the United States has focused on Christmas and floral greens production (Hinseley and Snelling 1992, Murray and Crawford 1982, Tappeiner and Zasada 1993).

Ethnographic studies of the uses and management of nontimber forest products by Native Americans in the Pacific Northwest also provide useful clues as to the kinds of factors that may influence levels of production under relatively intensive harvesting regimes (Boyd 1986, Gottesfeld 1994, Lepofsky 1985, Norton 1979b). Although most scientists are aware of the role fire plays as a management tool in berry production, ethnographic evidence may be able to help scientists make clearer links between fire intensity and timing, and production.

The literature also addresses questions of interaction between nontimber forest products and other production objectives. Austad (1988), for example, argues for the reintroduction of pollarding as a management practice in Norway to maintain biodiversity and economic and aesthetic values. Studies from Poland (Glowacki 1988), Scandinavia (Aakre 1986, Jäppinen and others 1986, Ohenoja 1988), Italy (Giordano 1983, Urbani 1985), and Germany (Ehlers 1970, Hartwig 1977, Rau 1969, Schroeder 1977) indicate that joint production of nontimber forest products and timber is an economically viable management strategy under wild, semiwild, and domesticated conditions. Hinesley's (1992) work on bough production in North Carolina fir plantations, studies by Kurtz and others (1984) of black walnut agroforestry systems in Missouri, and Murray and Crawford's (1982) study of bough production on a noble fir plantation in the Pacific Northwest support the notion of joint production as a viable management strategy in North American forests.

Basic work on biological production and production relations in systems of joint resource management is greatly needed in the Pacific Northwest. For example, the studies and trials instituted by Minore and others (1978, 1979, 1984) on *Vaccinium* species in the Cascade Range should be continued. Linking biological process of mid- to high-elevation lands to agroforestry and recreation management for multiple outputs is an exciting challenge. A regional consortium of interested

community members and employees of the Gifford Pinchot and Mount Hood National Forests and the Warm Springs and Yakama Nations has assembled to pool resources for management and research to improve scientific understanding and augment the economic and cultural benefits of native huckleberries. [1]

Socioeconomic aspects of nontimber forest products management— Much of the literature emphasizes the somewhat poorly developed nature of nontimber forest product marketing infrastructures, which serves to dampen the ability of producers to produce and market products at an industrial scale (Baldini 1993, Cesaro and others 1993, Hartwig 1977, Schlosser and others 1991). In some countries, trade networks simply did not exist until quite recently (Denison and Donoghue 1992, Hartwig 1977, Mater Engineering 1992, Möhrer 1977, Rau 1977). In other countries, monopoly conditions prevail, stifling competition at the local, national, and regional levels; for example, the truffle trade in France and Italy (Ciani 1990, Larerre and de la Soudière 1985, Signorini and Valli 1984) and the shiitake trade in Japan (Noda 1988) historically have been monopolized by a few companies. Producer cooperatives and grower and trade associations have been influential in promoting infrastructural development in Germany (Hartwig 1977, Rau 1977) and in breaking the power of the shiitake trade monopoly in Japan (Noda 1988).

Inventorying and monitoring— A major concern in the nontimber forest products sector is whether commercial levels of harvesting will negatively affect the regenerative capacity of the resources. To address this concern, several countries have instituted national-level programs to inventory and monitor nontimber forest products on public forest land. Poland, Lithuania, and Bulgaria, for example, included nontimber forest product inventorying and monitoring as a priority of state forest management while under Soviet control (Budriuniene 1988, Glowacki 1988, Grochowski 1966, Grochowski and Ostalski 1981, Kostov and Stojanov 1985). In the 1970s, Sweden also conducted large-scale, time-series inventories of mushrooms and blueberries (Kardell 1980). Researchers in the Pacific Northwest have recently emphasized the need to develop comparable inventory procedures for Federal and state forests (Molina and others 1993, Russell 1990). The European inventory and monitoring programs may provide some insights on how to structure such programs.

Tracking an individual's foraging activities (Godoy and Lubowski 1992) and mapping harvest areas (Ellanna and Sherrod 1985) are two means for generating a database for socioeconomic impacts on ecosystems from gathering of nontimber forest products. Such data can be adapted for use in GIS (geographic information systems). Descriptive demographic and economic information about the populations of pickers is frequently included in these studies (Stratton 1990, 1992).

Technical innovation and domestication for product substitutes— Some nontimber forest products, such as eucalyptus foliage, are grown under conditions of intensive horticultural management in places far from their original ecosystems (Bazzocchi and others 1987). Access to desired nontimber forest products often is facilitated by introduction of exotic "domesticated" species into plantations that are closer to the market source (reducing transportation costs) or more efficient in production amount (lower per-unit cost of production). In Australia, a pronounced shift is occurring from reliance on wild stocks for the floral trade to commercial

[1] Personal communication. 1996. Judith Vergun, Research Associate, College of Oceanic and Atmospheric Sciences, Oregon State University, Corvallis, OR 97331.

culture of native plants. This trend is occurring because the export trade in Australian foliage plants to Japan and the United States is very lucrative (Boutland and others 1992).

Other regions, such as the Pacific Northwest and the cape region of South Africa (Davis 1992), have been slow to domesticate native wild species important to the floral trade. Because little management of wild stocks of decorative foliage plant species is occurring in the Pacific Northwest, much less any domestication of these species, incentives exist for entrepreneurs elsewhere to begin horticultural domestication of Pacific Northwest native plants. Lack of investment initiative may undermine the initial advantages of the presence of native biological diversity.

The decorative conifer bough industry in Denmark has flourished through timely investment in research and marketing. Danish boughs now dominate European markets. Interestingly, the Danish success with boughs has been based almost entirely on exotic species, many of which originated in the Pacific Northwest (Christensen 1982), while little research or market development has been undertaken in the Pacific Northwest.

The existence of domesticated forest plants from Europe and east Asia has encouraged the adoption of exotic plants into North American horticulture (Bluhm 1988). Neglect of native species even in such botanically rich regions as South Africa (Wehmeyer 1986) is the result of a lack of familiarity on the part of the public and on the high cost of integrated research and marketing required to introduce innovation into horticultural markets. The lack of investment in domestication can have devastating ecological results on native plant populations and nearby human communities (Zimmer and Girmen 1987). To date, consideration of domesticating native plants of the Pacific Northwest for economic uses has stemmed from university programs in the Canadian west (MacDonald 1989, St. Pierre 1992).

In some cases, products originating from wild sources have different market niches than cultivated products. The distinct flavor of chanterelles and boletes collected from the wild creates a market different from that for agriculturally grown mushrooms, particularly in countries such as Germany, which has the highest per capita consumption of mushrooms worldwide (Pernau 1990).

Education—Educating people about nontimber forest products may promote better harvesting practices and improve the likelihood of sustainable use and resource conservation. Formal training and research into harvesting practices and tools are largely absent, as are formal mechanisms to share information and “best practices” among harvesters. Little has been written about teaching techniques and curriculum content for programs to inform and educate people involved in the nontimber product industries. Steps are being made, however, toward organized training as a tool for economic diversification. Vance and others (1993) have begun publishing curricula for USDA Forest Service employees in the Pacific Northwest. Contact with extension efforts in other countries such as those in Finland (Härkonen 1988, Härkonen and Järvinen 1993), where an established extension network exists for public instruction about nontimber forest products, may provide additional impetus for educational programs in the Pacific Northwest. Some efforts have been made in Washington to reach Hispanic migrants and in Oregon to reach Southeast Asian and Hispanic mushroom harvesters.

One of the crucial limitations for development of nontimber forest products is convenient access to available information about nontimber forest products. Those who might benefit the most from economic gains in concerted development of nontimber forest products in the Pacific Northwest may have the poorest access to useful information. Public land management agencies at Federal and state levels produce numerous resources to organize information, but public access to and awareness of existing resources, particularly by people in remote communities often is limited. Expansion of current extension efforts to include better outreach and multiple media tools for education and information to people will be useful.

Policy Issues

Two major themes of the literature are the idea that nontimber forest products can serve as a focal point for rural economic development and concerns about the effects of market expansion on resource sustainability. The following section provides an overview of the range of policy instruments advocated for promoting economic development and stewardship of nontimber forest products in a variety of socioecological contexts.

Policy instruments for economic development—Various groups have suggested that rural communities around the world can expand economic opportunities by increasing nontimber forest product harvesting and processing opportunities (Mater Engineering 1992; Molina and others 1993; U.S. Department of the Interior, Bureau of Land Management 1992; Wolf and Wortmann 1992). In the tropical developing countries, expansion of the nontimber forest product sector is often advocated as a way to decrease rural poverty while meeting conservation objectives (Anderson 1990, Nepstad and Schwartzmann 1992, Peluso 1992, Plotkin and Famolare 1992). In postindustrial countries, nontimber forest product harvesting and processing is suggested as a means to replace jobs lost to mechanization of the timber and agricultural sectors (Baldini 1993; Cesaro and others, n.d.; Mater Engineering 1992; Noda 1988; Thomas 1993). However, as Schlosser and Blatner (1995) note for the Pacific Northwest, Hartwig (1977) for Germany, and Larèrre and de la Soudière (1985) for France, pay scales in the nontimber forest product sector are generally low, labor needs are seasonal and often dependent on volatile markets, and the number of potential jobs under current nontimber forest product market conditions is relatively low compared to total rural employment needs. Browder (1992) and others find that harvesters of nontimber forest products generally profit poorly from their labors and the greatest gain goes to intermediaries in the marketing process. In addition, the degree of substitutability of products is high, so that producers are highly vulnerable to import competition (Larèrre and de la Soudière 1985, Rau 1977, Schlosser and others 1991).

The obstacles to market expansion are substantial so long as production remains based on the gathering of wild products and quality, and yields differ with seasonal and annual climate changes (Carlson 1986, Larèrre and de la Soudière 1985, Molina and others 1993). In addition, when the gathering range and marketing outlets for a product fall across many administrative and political jurisdictions, each with its own regulations, transaction costs can be prohibitively high (Cagniart 1968; de Geus 1992; Denison and Donoghue 1992; Hartwig 1977; U.S. Department of the Interior, Bureau of Land Management 1992). Expanded economic usage of nontimber forest products increases the necessity for intensified management and puts added pressure on already fiscally strained land management agencies in their efforts to assure ecosystem sustainability. Currently, harvesters gather many products for fees that are below cost or at no cost, without entailing an

appropriate obligation to mitigate possible negative effects of extraction and support sustainable management of the valuable nontimber forest product and its ecosystem.

Intensive commercial management, which could help overcome the issues of product stability and predictability of supply, is hampered by poorly developed market infrastructures (Baldini 1993; Cesaro and others, 1993; Hartwig 1977), by lack of secure resource tenure forms (Coujard and Commeaux 1981, Denison and Donoghue 1992, Giunta Regionale dell'Umbria 1987, Rizza 1990), and by lack of knowledge of the biological, ecological, and economic characteristics of the resources (Browder 1992; Cesaro et al., 1993; Noda 1988; Schlosser and Blatner 1995; Schlosser and others 1991).

In the nonindustrial countries, efforts to promote nontimber forest product-based economic development focus on enhancing local user group access to resources through the creation of extractive reserves, in which state-owned land becomes the object of a comanagement agreement between the state and user groups (Anderson and Ioris 1992, Browder 1992, Panayotou and Ashton 1992, Plotkin and Famolare 1992). Extractive reserves have been established in Brazil (Fearnside 1989), Belize (Balick and others 1994), and New York (Geisler and Silberling 1992) as one means to simultaneously conserve and use forests for economic production of socially useful products. The extractive reserve concept has become popular among international conservation and economic development organizations, and several articles on the potential for extending the concept in the United States have appeared (Geisler and Silberling 1992, Love 1992). Opportunities for learning are available from the recently inaugurated programs for adaptive management areas in Oregon and Washington and in the Fraser Basin Management Program of British Columbia where citizen-based community stewardship agreements are increasingly a part of land management. Recent work by Browder (1992) and Anderson and Ioris (1992), however, cautions a less enthusiastic approach to extractive reserves, noting that they work best in forest contexts where the resources to be harvested are abundant and spatially concentrated, and marketing infrastructures are in place. Joint ventures between drug companies and indigenous populations are suggested as one mechanism for ensuring that a larger portion of the benefits of reserve management remains in the hands of local people (King 1991).

In the industrial economies of Europe, North America, and Japan, economic development efforts for nontimber forest products have focused on encouraging government subsidized private producer and marketing associations (de Geus 1992, Hartwig 1977, Noda 1988, Rau 1977), developing national and regional product quality standards (Denison and Donoghue 1992, Cagniart 1968, Rau 1977), creating standard measurements and terminology (Cesaro and others, 1993; U.S. Department of the Interior, Bureau of Land Management 1992), and standardizing permits and regulations (Cagniart 1968; Denison and Donoghue 1992; Rau 1977; U.S. Department of the Interior, Bureau of Land Management 1992). Producer and marketing cooperatives are advocated to ensure sufficient and stable supplies and as a mechanism for reducing the vulnerability of local harvesters and traders to larger economic forces (Burgess 1994; Carlson 1986; Columbia Pacific Resource Conservation and Development Council, n.d.; Mater Engineering 1992). For highly perishable products, such as truffles and shiitake, government subsidization of product conservation technology has played an important role (Ciani 1990, Noda 1988). Finally, Finland and Italy have relied on

mushroom harvester certification as a mechanism to maintain consumer confidence in product safety (Giunta Regionale dell'Umbria 1987, Härkonen 1988).

Policy instruments for promoting resource stewardship—Collection of nontimber forest products may lead to increasing scarcity of the product species. Two processes can result: product substitution or depletion. If no product substitute or no substitute method for continued production of the nontimber forest product is developed, the increasing scarcity of a species will increase the value of the product. It is likely that without interference or intervention of conservation measures, the population of the species will be exploited until it is depleted. Extinction, at least for commercial purposes, may result. In many areas of the Eastern United States, populations of *Cypripedium* orchids and American ginseng (*Panax quinquefolius*) have been extirpated (Carlson 1986). Depletion of the resource will cause its eventual disappearance as a marketable commodity. When the market price drops, overharvest is likely to occur as people in desperation seek to maintain income levels by harvesting more rather than switching to an alternative nontimber product.

In the tropical nontimber forest product literature, efforts to promote stewardship often are linked to tenure reform and to programs for alleviating rural poverty, on the theory that forest degradation is due largely to the lack of alternative economic opportunities for rural farmers. As noted above, the centerpiece of stewardship promotion efforts is the extractive reserve, a form of resource tenure based on the premise that people will conserve resources only if they believe they will be able to capture a portion of the benefits of conservation. Providing user groups with long-term access rights, or allowing them to comanage state-managed resources, theoretically, encourages more sustainable resource management (Anderson and Ioris 1992, Plotkin and Famolare 1992). The theoretical linking of property rights with stewardship behavior is also evident in the calls to patent indigenous knowledge about genetic resources (Cunningham 1991, Simpson and Sedge 1992); again, on the theory that knowledge producers will be less likely to let those resources degrade if they can realize economic gain from their production and preservation. Other mechanisms for promoting resource stewardship in tropical countries include efforts to develop more effective knowledge production and exchange networks between scientists and traditional healers and producers (Balick and Mendelssohn 1992, Cunningham 1991, Elizabetsky 1991); the creation of green certification programs to enhance consumer demand for sustainable forest products (Cunningham 1991); replacement of classic forest product accounting systems with systems that incorporate subsistence and ecological costs and benefits (Balick and Mendelssohn 1992, Peters and others 1989); and the development of biodiversity prospecting contracts (Reid and others 1993, Simpson and Sedge 1992, Sittenfeld and Villers 1994), that shift a greater share of the value of genetic resources to the countries of origin, and thus create incentives for national governments to implement conservation policies.

In Europe and North America, efforts to promote stewardship have centered around developing secure forms of tenure for nontimber forest products (Cizek 1993, Coujard and Commeaux 1981, Denison and Donoghue 1988, Giunta Regionale dell'Umbria 1987), governmental regulation of harvesting activities (Coujard and Commeaux 1981, Giunta Regionale dell'Umbria 1987, Kauppi 1991, Russell 1990), self-regulation by nontimber forest products industries (Denison and Donoghue 1988, Foster 1991), promotion of green consumerism (Foster 1991), and public education and research (Columbia Pacific Resource Conservation and

Development Council, n.d.; Härkonen 1988; Mater Engineering 1992; Nicolas 1973; U.S. Department of the Interior, Bureau of Land Management 1992). Tropical countries have focused on creating tenure security through extractive reserves; in Italy, where many nontimber forest products have historically been considered "open access" resources even on privately held land, the emphasis has been placed on dividing truffle gathering grounds on private land into "wild" and "cultivated" zones (Giunta Regionale dell'Umbria 1987, Rizza 1990). Areas in which landowners cultivate truffles are thus closed to public access, and non-cultivated truffles continue to be open access resources. To decrease harvesting intensity, Italy instituted government-issued gathering permit systems for mushrooms in the 1980s (Giunta Regionale dell'Umbria 1987, Rizza 1990). As Rizza (1990) notes, however, the regulatory system is hampered by lack of coordination among provinces, each of which has its own set of rules. The trend toward more exclusive forms of access to nontimber forest products also is evident in the United States, where both public and private landowners have begun to replace permit systems with short- and long-term leases (Robinson 1994; Russell 1990; U.S. Department of the Interior, Bureau of Land Management 1992).

Harvester training and certification are used as mechanisms to improve harvesting techniques in Switzerland (Denison and Donoghue 1988), Italy (Giunta Regionale dell'Umbria 1987), and Finland (Härkonen 1988). Similar "wildcrafter" certification programs have been suggested for the Pacific Northwest.

A call for industry self-regulation, including the development of "sustainability" standards, has also been voiced in the Pacific Northwest (Mater Engineering 1992). The industry movement toward such standards is likely a response to the growing strength of the "green consumerism" movement, which has made sustainability of production one of the selection criteria in consumer decisions.

In cases where nonforest products have acquired considerable economic value, the rules regarding access to products and their commercialization have become well defined and often elaborate. The literature describing the trade and regulation of truffles in France (Cagniart 1968) and Italy (Giunta Regionale dell'Umbria 1987, Mannozzi-Torini 1968, Rizza 1990) is extensive. Similar dynamics are apparent in the Pacific Northwest as the systematic harvest of valuable matsutake stocks expands (Richards and Creasy, in press).

Economic Issues and Analysis

Economic research on nontimber forest products has centered on four key themes: economic contribution of nontimber forest products at various scales of social organization, the value of nontimber forest product harvesting relative to other forest uses, the analysis of multiple use and joint production systems, and improving the profitability of various nontimber forest product sectors.

Economic contribution—The precise economic value of nontimber forest products has been difficult to assess, primarily because much of their value is not market based. In many cases, the primary value of nontimber forest products lies in their personal consumption value as food, medicine, building materials, or other uses. Nontimber forest products also play a large role in local markets, but they usually are not counted in "official" national tallies, which favor exports as sources of needed foreign currency. Even when well-developed export markets exist, exploitation of timber is often officially favored as it requires less local knowledge and attracts more foreign capital and technology. In postindustrial societies, the value of nontimber forest products can be largely recreational, or can lie in their

"existence value" or "option value." Recreational collection of nontimber forest products may be valued in some cases as much for the cultural and recreational experience of collecting as for the product collected. Accounting for the recreational values of berrypicking in France, for example, has explained sources of resource conflict between professional berrypickers and weekend pickers (Coujard and Commeaux 1981). Bateman (1991) provides a good review of the type and nature of nonprice benefits of nontimber forest products, and Abd Rauf (1982) presents net present value, benefit-cost ratios, and internal rate of return as methods to assess these benefits for individual development projects. Researchers have attempted a variety of techniques to assess nonmarket value, including the travel-cost method (Markstrom and others 1988), contingent valuation (Campbell 1994, Mattsson and Li 1994), and replacement production methods (Campbell 1994, Chopra 1993).

Analyses of nontimber forest products economic contributions have been conducted for households (Campbell 1994) and communities (Alcorn 1989, 1984) in the tropics. Saastamoinen (1977, 1984, 1989) and Salo (1984, 1985, 1995) have analyzed the economic contribution of nontimber forest products to Finland through surveys, participant observation, market data, and other methods. Saastamoinen (1992) estimates that nontimber forest products contribute 6 to 10 percent of total forest economic production in Finland, with the contribution in some regions reaching 25 percent. Eriksson and others (1979) surveyed berry consumption, production, and trade in Sweden, and Hultkrantz (1991) estimated that mushroom and berries equaled 6 percent of the net Swedish timber product in 1987. In India, Chopra (1993) used a variety of methods to estimate the contribution of nontimber forest products and environmental services. In Zimbabwe, 30 to 40 percent of the value from forests is estimated to derive from nontimber forest products as a source of indigenous foods (Campbell 1994). Cesaro and others (1993) describe the economic role that nontimber forest products play in Europe and the types of forests in which nontimber forest product harvesting should play a larger role. Farolfi (1990) addresses the commercial and recreational role of nontimber forest products in Italy.

To date, the most comprehensive published data on any sector of nontimber forest products have been for wild medicinal plants. World sales of herbal medicines exceed US$6.9 billion, and annual growth of sales ranges from 8 to 15 percent among producer countries (Grünwald 1994). The major supplier country is India, but other significant exporting countries are Argentina, Brazil, China, Pakistan, Poland, and Bulgaria. Growth of medicinal plant imports into Western Europe more than doubled in the 1980s (Lewington 1993). Novel interpretations of species and species diversity have been devised to estimate the "option value" of medicinal resources not yet discovered. Costs of extinction of as yet unused species as a source of pharmaceuticals were estimated to be US$203 million in 1980 dollars (Farnsworth and Soejarto 1985). Principe (1991) has proposed two methods to calculate net economic benefits of biological diversity in forests as a source for current and future pharmaceuticals. Variables for consideration are consumer surplus, option value, existence value, expected value of product revenues, product development costs, and costs of management for resource conservation. In India, value of nonwood timber products comprises 30 to 40 percent of the value from forested ecosystems, and exports of nontimber forest products, much of it medicinal plants, have historically contributed a disproportionate value (over 70 percent) to exports from Indian forests (Gupta and Guleria 1982a).

Nontimber forest products as a land use strategy—The more industrialized a nation, the more likely that timber resources dominate as the primary forest product; however, significant shifts in consumption patterns in postindustrialized nations are occurring. Where valuable nontimber forest products grow in older forests and where the need for watershed protection is great, postindustrialized societies may be best served by maintaining the forest ecosystem structure. In Europe, the shift away from single-use timber production has been especially strong in historically industrialized, urban nations on the north shore of the Mediterranean Sea where climate and topography make intensive forestry unprofitable. The situation is similar in the arid American Southwest and California (Huber 1992). A number of studies have analyzed alternative resource strategies of forest land. Peters and others (1989) calculated the net present value analysis of three harvest strategies (nontimber harvest, clearcut, and selective timber harvesting) for a forest plot in Peru. This study launched a number of net present value analyses of alternative management strategies, including one focused on medicinal plants (Balick 1992) and one on alternative land uses in the Phillippines (Stewart 1994). Love and others (1993) describe a study from the Olympic Peninsula that proposes net present value calculations to assess the relative merit of golden chanterelle (*Cantharellus cibarius*) and Douglas-fir harvest strategies. Mann (1990) compares a management strategy of hunting and Christmas tree and floral green harvests to an exclusive timber focus. Godoy and his colleagues (Godoy and Bawa 1993, Godoy and Lubowski 1992, Godoy and others1993) provide a summary of economic valuation studies of nontimber forest products, analyzing assumptions and presenting methods for improved analysis.

Economic analysis of multiple use and joint production systems—Most nontimber forest product studies conclude that while nontimber forest products are much more economically and socially significant than existing forest management practices would suggest, they are not a perfect substitute for declining timber harvests and declining rural employment. Rather, nontimber forest products should be viewed as a complement to other forest activities, including timber harvesting, hunting, recreation, and the provision of environmental services. Calculation of the costs and benefits of complex ecosystem management for joint production of multiple goods (and services and ecosystem conditions) is problematic. Knowledge of the biophysical production functions, relations between ecological and managerial inputs, and best forecasts of outputs in the form of ecosystem products, byproducts, waste products, services, and ecosystem states (Saastamoinen 1982) are essential to rational decisionmaking in forest management based on societal values. Without basic research to forge knowledge about production functions and economic relations first, management for sustainable production of economically valuable nontimber resources is questionable.

Many of the existing or historic management systems for nontimber forest products and joint production developed without the benefit of economic analyses in advance. Instead, these systems appear to be the product of accumulated indigenous knowledge. Alcorn (1989) studied the market prices and use values of households in Mexico to explain how efficient management developed. Financial and economic analyses of complex land management programs as exemplified in locally developed agroforestry systems is largely lacking in North America. Kurtz and others (1984) provide a stand-level analysis using black walnut, wheat, soybeans, hay, and grazing. This particular regime is inappropriate to conditions in National Forests of the Pacific Northwest, but similarly complex systems could be developed by using native species to produce a range of combinations of timber

and nontimber products. A survey of agroforestry practices in Washington State (Lawrence and others 1992) found that only 12 percent of agroforestry systems included any production of nontimber forest products. Vance (1993) also addresses the extent to which agroforestry is practiced by resource managers in a survey of silviculturists on nontimber forest products, joint production systems, and economic analysis.

Improving financial performance of nontimber forest products sectors—As particular sectors mature, research focuses increasingly on improving economic efficiency. For example, Ehlers (1968, 1970) described methods for deriving the maximum value from Christmas green production and marketing. Paré (1984) estimated the profitability threshold for maple syrup production, and Park (1984) determined the investment effectiveness of shiitake mushroom cultivation. Urbani (1985) provides a pro forma analysis of a hazelnut and truffle orchard.

Ethics

Questions of fairness and justice, as well as professional ethics, play a prominent role in recent nontimber forest product policy debates. These questions are most prominent in the tropical forest arena, where the new ethnoscientists explicitly seek to empower indigenous peoples instead of just describing how they use nontimber forest products. The ethnoscientists propose mechanisms for addressing economic power imbalances within societies and between countries, including the use of subsidies from bilateral and multilateral agencies to support the development of markets for nontimber forest products (Principe 1991, Reid and others 1993), subsidies for rural health care in areas left in forest cover (Elizabetsky 1991, Kloppenburg 1991, Reid and others 1993), and the development of international agreements that provide for and protect the patenting of indigenous knowledge and indigenously created genetic materials (Elisabetsky 1991, Kloppenberg 1991, Principe 1991, Reid and others 1993). Such mechanisms are needed to ensure that a greater percentage of the potential benefits obtained from harvesting nontimber forest products remains in rural areas and in the hands of those who produce the resources (Elizabetsky 1991, Kloppenburg 1991, May 1991, Plotkin and Famolare 1992).

Nongovernmental organizations and scientific research institutes, such as the Ford Foundation, the New York Botanical Garden's Institute of Economic Botany, and the National Cancer Institute, have taken the lead as knowledge and power brokers between relatively powerless indigenous groups and more powerful state and industrial policy actors (May 1991, Principe 1991, Reid and others 1993). Ethnopharmacologists have played a critical role in pressuring policy makers to recognize the value of indigenous knowledge about the medicinal values of nontimber forest products (Elizabetsky 1991, King 1991, Reid and others 1993). The professions of ethnopharmacology and ethnobotany are developing professional codes of conduct that would require members to explicitly acknowledge the source of their information about valuable nontimber forest products, and to adhere to the principle of treating their traditional healer-agronomist counterparts as professional colleagues (Elizabetsky 1991, Kloppenburg 1991, Reid and others 1993).

Although social equity issues are raised in industrial and postindustrial society contexts (Larrère and de la Soudière 1985, Love 1992), the need to establish intellectual property rights for indigenous and local knowledge in these societies is rarely addressed. Burgess' (1994) discussion of the need for tribes of the Southwestern United States to patent seed types developed locally is an indication that intellectual property rights may begin to emerge as an important policy issue in temperate and boreal zones.

Index of Species

Names of vascular plant species follow the nomenclature used by the USDA Natural Resource Conservation Service. Other species are named according to best available information. Specific **names in bold** show species native to the Pacific Northwest and British Columbia.

Scientific name	Common name
Abies spp. P. Mill.	firs
Abies amabilis (Dougl. ex Loud.) Dougl. ex Forbes	Pacific silver fir
Abies fraseri (Pursh) Poir.	Fraser's fir
Abies grandis (Dougl. ex D. Don) Lindl.	grand fir
Abies lasiocarpa (Hook.) Nutt.	subalpine fir
Abies nordmanniana (Stev.) Spach.	Caucasian silver fir
Abies procera Redh.	noble fir
Acacia nilotica (L.) Willd. ex Delile	gum-arabic tree
Acer spp. L.	maples
Acer circinatum Pursh	vine maple
Acer macrophyllum Pursh	bigleaf maple
Acer saccharum Marsh.	sugar maple
Achillea millefolium L.	common yarrow
Adiantum spp. L.	maidenhair ferns
Agaricus spp. L. ex Fr.	
Agastache spp. Clayton ex Gronov.	giant hyssops
Albatrellus ovinus (Fr.) Kotl. & Pouz.	sheep polypore
Alectoria spp. Ach.	
Alectoria jubata (L.) Ach.	
Allium spp. L.	wild onions
Alnus spp. P. Mill.	alders
Alnus rubra Bong.	red alder
Amanita spp. Pers. ex Hooker	
Amaranthus retroflexus L.	redroot amaranth
Amelanchier spp. Medik.	serviceberries
Amelanchier alnifolia (Nutt.) Nutt. ex M. Roemer	Saskatoon serviceberry
Anaphalis margaritacea (L.) Benth. & Hook. f.	western pearly everlasting
Andromeda polifolia L.	bog rosemary
Anenome multifida Poir.	Pacific anenome
Angelica spp. L.	angelicas
Aniba spp. Aubl.	rosewoods
Arbutus menziesii Pursh	Pacific madrone
Arbutus unedo L.	strawberry tree
Arctium lappa L.	greater burdock
Arctostaphylos spp. Adans.	manzanitas
Arctostaphylos columbiana Piper	hairy manzanita
Arctostaphylos uva-ursi (L.) Spreng.	kinnikinnick
Argentina egedii (Wormsk.) Rydb. [syn. *Potentilla anserina*, *P. pacifica*]	Pacific silverweed
Armillariella mellea (Vahl ex Fr.) Kar.	honey mushroom
Arnica spp. L.	arnicas
Aronia melanocarpa (Michx.) Ell.	black chokeberry
Artemisia spp. L.	sagebrushes
Artemisia ludoviciana Nutt.	Louisiana sagewort
Asarum spp. L.	wildgingers

Scientific name	Common name
Asarum caudatum Lindl.	British Columbia wildginger
Asclepias spp. L.	milkweeds
Asparagus acutifolius L.	
Aster spp. L.	asters
Attalea spp. Kuth in Humb.	babaçu palms
Auricularia spp. Bull. ex Mérat	wood ears
Balsamorhiza sagittata (Pursh) Nutt.	arrowleaf balsamroot
Bertholletia excelsa Humb. & Bonpl.	brazilnut
Betula spp. L.	birches
Blechnum spicant (L.) Roth	deer fern
Boletus spp. Dill. ex Fr.	boletes
Boletus edulis Bull ex. Fr.	king bolete
Brodiaea spp. Sm.	clusterlilies
Calamus spp. L.	calamuses, rattans
Calamus manan	
Calocedrus decurrens (Torr.) Florin	incense-cedar
Calochortus spp. Pursh	Mariposa lilies
Camassia spp. Lindl.	camas
Camassia quamash (Pursh) Greene	camas
Cantharellus spp. Adans. ex Fr.	chanterelles
Cantharellus cibarius Fr.	golden chanterelle
Cantharellus lutescens (Pers.) Fr.	
Cantharellus subalbidus Smith & Morse	white chanterelle
Capsicum annuum var. *glabriusculum* (Dunal) Heiser & Pickersgill	cayenne or chiltepin pepper
Carex obnupta Baily	slough sedge
Carya illinoisensis (Wangenh.) K. Koch	pecan
Caryota urens L.	fishtail palm
Cassiope mertensiana (Bong.) D. Don.	western moss heather
Castanea dentata (Marsh.) Borkh.	American chestnut
Castanea sativa P. Mill.	European chestnut
Castanopsis chrysophylla (Dougl. ex Hook.) A. DC.	golden chinkapin
Ceanothus spp. L.	ceanothus
Chamaecyparis spp. Spach.	cedars
Chamaecyparis lawsoniana (A. Murr.) Parl.	Port-Orford-cedar
Chamaecyparis nootkatensis (D.Don) Spach	Alaska-cedar
Chamaedaphne calyculata (L.) Moench	leatherleaf
Chimaphila umbellata (L.) W. Bart.	pipsissewa, prince's-pine
Cimifuga spp. Wernischeck	bugbanes
Cinnamonum camphora (L.) J. Pres.	camphortree
Cladonia spp. (Hill) Hill	
Cladonia alpestris (L.) Rabh.	
Cladonia stellaris (Opiz) Pouz & Vezda	
Claytonia perfoliata Donn. ex Willd.	miner's lettuce
Clitocybe spp.	
Clitocybe nuda (Bull. Ex Fr.) Big. & A.H.S.	blewit
Clitocybe rhacodes (Vitt.) Quél.	
Conyza spp. Less.	horseweeds
Conyza canadensis (L.) Cronq. [syn. *Erigeron canadensis*]	Canadian horseweed

Scientific name	Common name
Coprinus spp. (Pers. ex Fr.) S.F. Gray	inky caps
Cornus spp. L.	dogwoods
Cornus mas L.	
Cornus nuttallii Audubon ex. Torr. & Gray	Pacific dogwood
Cornus unalaschkensis Ledeb. [syn. *C. canadensis* in part]	western cordilleran bunchberry
Corylus spp. L.	hazelnuts
Corylus avellana L.	common filbert
Corylus cornuta Marsh.	beaked hazelnut
Crataegus spp. L.	hawthorns
Crataegus monogyna Jacq.	oneseed hawthorn
Craterellus cornucopiodes Pers.	horn of plenty
Cypripedium spp. L.	cypripediums
Cypripedium acaule Ait.	pink lady's slipper
Cypripedium parviflorum Salis.	lesser yellow lady's slipper
Cypripedium reginae Walt.	showy lady's slipper
Cytisus scoparius (L.) Link	scotchbroom
Delphinium spp. L.	larkspurs
Dentinum spp.	
Dentinum repandum (L. ex Fr.) S.F. Gray	hedgehog mushroom
Digitalis purpurea L.	purple foxglove
Diospyros melanoxylon	tendu
Douglasia spp. Lindl.	dwarfprimroses
Douglasia laevigata Gray	cliff dwarfprimrose
Drosera rotundifolia L.	roundleaf sundew
Dryas spp. L.	mountainavens
Echinacea spp.	purple coneflowers
Echinacea purpurea (L.) Moench	eastern purple coneflower
Elettaria cardamomum Maton	cardamon
Elliottia pyroliflorus (Bong.) S.W. Brim & P.F. Stevens [syn. *Cladothamnus pyroliflorus*]	copperbush
Empetrum spp. L.	crowberries
Empetrum nigrum L.	black crowberry
Epilobium spp. L.	willowweeds
Epilobium angustifolium L.	fireweed
Equisetum spp. L.	horsetails
Equisetum arvense L.	field horsetail
Equisetum hyemale L.	scouringrush horsetail
Eriogonum spp. Michx.	eriogonums
Erythronium spp. L.	fawnlilies
Eucalyptus spp. L'Her.	eucalyptus
Eucalyptus citriodora Hook.	lemonscented gum
Eupatorium spp. L.	thoroughwort
Euterpe oleracea C. Mart.	açaipalm
Evernia prunastri (L.) Ach.	
Flammulina spp. Karst.	velvet foot
Fragaria spp. L.	strawberries
Fragaria chiloensis (L.) P. Mill.	beach strawberry
Fragaria vesca L.	woodland strawberry
Fragaria viridis Duchesne	
Frangula purshiana (DC.) Cooper	Pursh's buckthorn, cascara

Scientific name	Common name
Fraxinus spp. L.	ashes
Fritillaria spp. L.	missionbells
Galax spp. Sims	galax
Gaultheria spp. L.	snowberries
Gaultheria ovatifolia Gray	western teaberry
Gaultheria shallon Pursh	salal
Gentiana spp. L.	gentians
Geum macrophyllum Willd.	largeleaf avens
Gingko biloba L.	maidenhair tree
Glycyrrhiza glabra L.	cultivated licorice
Gypsophila paniculata L.	babysbreath gypsophila
Gyromitra esculenta Fr.	false morel
Hedera helix L.	English ivy
Heracleum maximum Batr.	common cowparsnip
Hericium abietis (Weir ex Hubert) K. Harrison	conifer coral hericium
Heuchera cylindrica Dougl. ex Hook.	roundleaf alumroot
Hevea brasiliensis (Willd. ex Adr. Just.) Mull. Arg.	rubber
Hydrastis canadensis L.	goldenseal
Hylocomium splendens (Hedw.) B.S.G.	
Hyoscyamus niger L.	black henbane
Hypericum perforatum L.	common St. Johnswort
Ilex aquifolium L.	English holly
Iris spp. L.	irises
Jessenia spp. H. Karst	jessenias
Juglans nigra L.	black walnut
Juniperus spp. L.	junipers
Juniperus communis L.	common juniper
Juniperus occidentalis Hook.	western juniper
Juniperus scopulorum Sarg.	Rocky Mountain juniper
Juniperus virginiana L.	eastern redcedar
Kalmia spp. L.	kalmias
Kalmia polifolia Wagenh.	bog laurel
Lactarius spp. DC. ex S.F. Gray	milk caps
Lactarius rufus (Scop. ex Fr) Fries	red hot milk cap
Lamium amplexicaule L.	henbit deadnettle
Larix spp. P. Mill.	larches
Larix occidentalis Nutt.	western larch
Leccinum spp. S.F. Gray	rough-stemmed boletes
Ledum spp. L.	Labradorteas
Ledum palustre L.	marsh Labradortea
Lentinus edodes (Berk.) Sing.	shiitake
Lepidium spp. L.	pepperweeds
Lewisia rediviva Pursh	Oregon bitterroot
Ligusticum spp. L.	ligusticums
Lilium spp. L.	lilies
Limonium spp. P. Mill	sealavenders
Linum spp. L.	flaxes
Lithocarpus densiflorus (Hook. & Arn.) Rehd.	tanoak
Lomatium spp. Raf.	lomatiums
Lomatium cous (S. Wats.) Coult. & Rose	cous biscuitroot

Scientific name	Common name
Lomatium dissectum (Nutt.) Mathias & Constance	fernleaf biscuitroot
Lomatium utriculatum (Nutt. ex Torr. & Gray) Coult. & Rose	common lomatium
Lonicera spp. L.	honeysuckles
Lonicera hispidula (Lindl.) Dougl. ex Torrey & Gray	pink honeysuckle
Lupinus spp. L.	lupines
Lycopodium spp. L.	clubmosses
Madia spp. Molina	tarweeds
Mahonia spp. Nutt.	Oregongrapes
Mahonia aquifolium (Pursh) Nutt.	hollyleaved barberry
Mahonia nervosa (Pursh) Nutt.	Cascade Oregongrape
Mahonia repens (Lindl.) G.Don	Oregongrape
Malus fusca (Raf.) Schneid.	Oregon crabapple
Matteuccia struthiopteris (L.) Todaro	ostrich fern
Mauritia spp. L. f.	aquaje palms
Melanogaster umbrinigleba	
Mentha spp. L.	mints
Menyanthes trifoliata L.	common buckbean
Menziesia ferruginea Sm.	rusty menziesia
Moneses uniflora (L.) Gray	single delight
Morchella spp. Dill. ex Fr.	true morels
Morchella conica Pers.	black morel
Morchella esculenta (L.) Pers.	yellow morel
Muhlenbergia spp. Schreb.	muhlies
Myrica gale L.	sweetgale
Narcissus spp. L.	narcissi
Nyssa sylvatica Marsh.	blackgum
Oemleria cerasiformis (Torr. & Gray ex Hook. & Arn.) Landon	Indian plum
Oplopanax horridus (Smith) Miq.	devilsclub
Opuntia spp. P. Mill.	pricklypears
Oryzopsis hymenoides (Roemer & J.A.Schultes) Ricker ex Piper	Indian ricegrass
Oxalis spp. L.	woodsorrels
Panax quinquefolius L.	American ginseng
Paxistima mysinites (Pursh) Raf.	boxleaf myrtle
Penstamon spp. Schmidel	penstamons
Pentaphylloides floribunda (Pursh) A. Love [syn. *Potentilla fruticosa*]	shrubby cinquefoil
Petasites frigidus (L.) Fries	Arctic sweet coltsfoot
Philadelphus lewisii Pursh	Lewis' mockorange
Phlox spp. L.	phloxes
Pholiota spp. (Fr.) Kummer	pholiotas
Phoradendron spp. Nutt.	mistletoes
Phoradendron villosum (Nutt.) Nutt.	Pacific mistletoe
Phyllodoce empetriformis (Sm.) D. Don.	pink mountainheath
Picea spp. A. Dietr.	spruces
Picea abies (L.) Karst.	Norway spruce
Picea engelmannii Parry ex Engelm.	Engelmann's spruce

Scientific name	Common name
Picea glauca (Moench) Voss	white spruce
Picea pungens Engelm.	blue spruce
Picea sitchensis (Bong.) Carr.	Sitka spruce
Picoa carthusiana	Oregon black truffle
Pinus spp. L.	pines
Pinus albicaulis Engelm.	whitebark pine
Pinus contorta Dougl. ex Loud.	lodgepole pine
Pinus densiflora	Japanese red pine
Pinus lambertiana Dougl.	sugar pine
Pinus monticola Dougl. ex D. Donn.	western white pine
Pinus nigra Arnold	Austrian pine
Pinus ponderosa P. & C. Lawson	ponderosa pine
Pinus radiata D.Don	Monterey pine
Pinus sabiniana Dougl. ex Dougl.	California foothill pine
Pinus strobus L.	eastern white pine
Pinus sylvestris L.	Scotch pine
Pinus teocote Schl. & Cham.	teocote pine
Pleurotus spp. (Fr.) Kummer	oyster mushrooms
Polemonium spp. L.	polemoniums
Polypodium glycyrrhiza D.C. Eat.	licorice fern
Polystichum munitum (Kaulfuss) K. Presl.	western swordfern
Populus spp. L.	cottonwoods
Populus tremuloides Michx.	quaking aspen
Potentilla spp. L.	cinquefoil
Prunella vulgaris L.	common selfheal
Prunus spp. L.	prunus
Prunus emarginata (Dougl. ex Hook.) Walp.	bitter cherry
Prunus spinosa L.	blackthorn
Prunus subcordata Benth.	Klamath plum
Prunus virginiana L.	common chokecherry
Pseudevernia furfuracea (L.) Zopf.	
Pseudotsuga menziesii (Mirbel) Franco	Douglas-fir
Pteridium aquilinum (L.) Kuhn	western brackenfern
Quercus spp. L.	oaks
Quercus acutissima Carruthers	sawtooth oak
Quercus chrysolepis Lieb.	canyon live oak
Quercus garryana Dougl. ex Hook.	Oregon white oak
Quercus kelloggii Newberry	California black oak
Quercus rubra L.	northern red oak
Quercus suber L.	cork oak
Rhizopogon spp. Fr.	
Rhododendron spp. L.	rhododendrons
Rhododendron macrophyllum D. Don ex G. Don	Pacific rhododendron
Rhododendron occidentale (Torr. & Gray ex Torr.) Gray	western azalea
Rhus spp. L.	sumacs
Rhus glabra L.	smooth sumac
Rhus hirta (L.) Sudworth	staghorn sumac
Ribes spp. L.	currants
Ribes sanguineum Pursh	redflower currant

Scientific name	Common name
Rosa spp. L.	roses
Rosa nutkana K. Presl.	Nootka rose
Rosa woodsii Lindl.	Woods' rose
Rubus spp. L.	blackberries
Rubus chamaemorus L.	cloudberry
Rubus discolor Weihe & Nees	Himalayan blackberry
Rubus fruticosus L.	shrubby blackberry
Rubus idaeus L.	red raspberry
Rubus leucodermis Dougl. ex Torr. & Gray	whitebark raspberry
Rubus parviflorus Nutt.	thimbleberry
Rubus saxatilis L.	thornless blackberry
Rubus spectabilis Pursh	salmonberry
Rubus ursinus Cham. & Schlect.	California blackberry
Rumohra adiantiformis (G. Forst.) Ching	iron fern
Russula spp. (Pers. ex Fr.) S.F. Gray	russulas
Russula aeruginea Lindbl.	green russula
Russula xerampelina Fr.	shrimp russula
Sagittaria latifolia Willd.	broadleaf arrowhead
Salix spp. L.	willows
Sambucus spp. L.	elderberries
Sambucus racemosa L.	red or scarlet elderberry
Santalum spp. L.	sandalwoods
Santalum specalum	
Satureja spp. L.	saturejas
Sclerocarya birrea	
Scutellaria spp. L.	skullcaps
Scutellaria lateriflora L.	blue skullcap
Sequoia sempervirens (Lamb ex D. Don) Endl.	redwood
Shepherdia argentea (Pursh) Nutt.	silver buffaloberry
Shepherdia canadensis (L.) Nutt.	russet buffaloberry
Shorea spp.	
Shorea robusta	
Solidago spp. L.	goldenrods
Solidago virgaurea L.	European goldenrod
Sorbus spp. L.	mountainashes
Sorbus acuparia L.	European mountainash
Sorbus sitchensis M. Roemer	western mountainash
Sparassis crispa Wulf: Fr.	cauliflower mushroom
Sphagnum spp.	sphagnum moss
Stellaria spp. L.	starworts
Stokesiella oregana	
Stropharia spp. (Fr.) Quél	
Suillus spp. (Fr.) Kuntze	slippery jacks
Suillus granulatus (Fr.) Kuntze	granulated slippery jack
Suillus luteus (L. ex Fr.) S.F. Gray	yellow slippery jack
Tanacetum spp. L.	tansies
Taxus brevifolia Nutt.	Pacific yew
Thuja spp. L.	arborvitae
Thuja occidentalis L.	eastern arborvitae
Thuja plicata Donn ex D. Don	western redcedar
Tilia spp. L.	basswoods

Scientific name	Common name
Tremella Dill. ex Fr.	witch's butter
Tricholoma spp. (Fr.) Kummer	tricholomas
Tricholoma magnivelare (Peck) Redhead	American matsutake
Tricholoma matsutake (Ito & Imai) Singer	Japanese matsutake
Trifolium wormskioldii Lehm	cows clover
Trillium spp. L.	trilliums
Triteleia spp. Dougl. ex Lindl.	triplet lilies
Tsuga spp. Carr.	hemlocks
Tsuga canadensis (L.) Carr.	eastern hemlock
Tsuga heterophylla (Raf.) Sarg.	western hemlock
Tsuga mertensiana (Bong.) Carr	mountain hemlock
Tuber spp. Mich. ex Fr.	truffles
Tuber aestivum Vitt.	
Tuber brumales Vitt.	
Tuber gibbosum Hk.	Oregon white truffle
Tuber indicum	
Tuber levissimum Gilkey	
Tuber magnatum Vitt.	
Tuber melanosporum	
Tuber uncinatum	
Typha latifolia L.	broadleaf cattail
Umbellularia californica (Hook. & Arn.) Nutt.	California laurel
Urtica spp. L.	nettles
Urtica dioica L.	stinging nettle
Usnea spp. (Dill.) Adans.	usneas
Vaccinium spp. L.	vacciniums
Vaccinium angustifolium Ait.	lowbush blueberry
Vaccinium cespitosum Michx.	dwarf blueberry
Vaccinium corymbosum L.	highbush blueberry
Vaccinium deliciosum Piper	blueleaved huckleberry
Vaccinium macrocarpon Ait.	cranberry
Vaccinium membranaceum Dougl. ex Torr.	blue huckleberry
Vaccinium myrtilloides Michx.	velvetleaf huckleberry
Vaccinium myrtillus L.	whortleberry
Vaccinium ovalifolium Sm.	ovalleaf huckleberry
Vaccinium ovatum Pursh.	evergreen huckleberry
Vaccinium oxycoccos L.	small cranberry
Vaccinium parvifolium Sm.	red huckleberry
Vaccinium scoparium Leib. ex Cov.	grouse whortleberry
Vaccinium uliginosum L.	bog blueberry
Vaccinium virgatum Ait.	smallflower blueberry
Vaccinium vitis-idaea L.	lingonberry
Valeriana spp. L.	valerians
Veratrum viride Ait.	American false hellebore
Verbascum spp. L.	mulleins
Viburnum spp. L.	viburnums
Viburnum edule (Michx.) Raf.	mooseberry viburnum
Viburnum opulus L.	cranberry viburnum
Viola spp. L.	violets
Volvariella spp. Speg.	volvariellas
Xerophyllum tenax (Pursh) Nutt.	common beargrass
Zizania spp. L.	wild rice

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Annotated Bibliography

Aakre, Anders. 1966. Lavsanking i Nord-Østerdal spesielt dens betydning for naturlig foryngelse av furu=Harvesting of lichen in Nord-Østerdal, especially the effects on natural pine reproduction. Meldinger fra Norges Landbrukshøgskole. 45(20): 1-34. In Norwegian with English summary.

Describes the effects on growth of Scotch pine (*Pinus sylvestris*) from commercial harvests of lichens (*Cladonia* spp.) for stock feed and decoration. Analysis of the mineral content of lichens shows low accumulations of critical plant nutrients, and humus layers have no significant differences in nitrogen content or pH with or without lichen cover. Pine regeneration is more prolific on sites where lichens had been removed or thinned out. Dry, exposed sites have coarse soils with more rapid water loss; added evaporation when there is no lichen ground cover stunts tree growth. Where soils are fine-textured with better capillary transport, lichen cover has a neutral effect on tree growth. The high export value of lichen makes joint production with wood fiber the most economically efficient management option. This article demonstrates the site-specific effects that harvesting a special forest product can have on other resources at the site. These effects may not be easily discernible or predictable without careful research.

Keywords: Joint production, lichens, soil moisture.

Abd. Rauf, Salim. 1982. A financial appraisal of rotan manau (*Calamus manan*) cultivation at the Bukit Belata Forest Reserve. The Malaysian Forester. 45(4): 576-582.

Conducts a financial analysis of a mixed cropping system with a species of rattan palm (*Calamus manan*) and *Shorea* spp. as part of national project to select appropriate species for silvicultural trials. Empirical inputs of labor and material for nursery and planting operations were calculated in staff days, and actual costs were measured; harvesting inputs were estimated. Three measures of economic performance were applied: net present value, benefit cost ratio, and internal rate of return. A sensitivity analysis examines effects of two rotation ages (15 and 20 years), two harvest intensities (50 and 75 percent of stems), one model of survivorship with variable rates over time, and three estimated growth rates

(0.50, 0.75, and 1.00 m/yr). The discount rate used is not given. This article provides a template for economic sensitivity analyses for a special forest product.

Keywords: Cost-benefit analysis, financial analysis, internal rate of return, net present value, sensitivity analysis, economic analysis, joint production.

Abriel, Ray; Okholm, Debra. 1994. Pacific Northwest nursery directory and report: for people interested in planting and growing forest trees. R6-CP-TP-0194. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region, State and Private Forestry, Cooperative Programs. 54 p.

Contains directories of nurseries with their addresses, contact persons, and telephone and FAX numbers as a reference for foresters, nursery professionals, natural resource managers, and other interested people. Directories also include participating nurseries in California, Idaho, Montana, and Nevada. Production data are given for bareroot and container stock for all Western States. This publication lists nurseries specializing in diverse planting projects involving species producing special forest products: blister rust-resistant western white pine (*Pinus monticola*), Pacific yew (*Taxus brevifolia*), riparian species, and native shrubs. The authors give guidelines for success in planting projects. The book also shows where gaps exist in local or regional production and capacity for supplying special forest product plants.

Keywords: Horticultural plants, nurseries, directory, Pacific Northwest.

Acker, Randy. 1986. Harvesting wild edible mushrooms in Washington: an issue paper. Olympia, WA: Department of Natural Resources; Prepared for the Wild Edible Mushroom Task Group, November 3, 1986. 44 p.

Provides necessary background material to the Wild Edible Mushroom Task Group, which was convened by the Washington Department of Natural Resources in October 1985. The task group's mission was to identify wild edible mushroom harvesting issues and make recommendations for the possible regulation of the resource.

Growth of the industry without regulation has prompted societal concerns about the sustainability, both economic and biological, of the mushroom resource. Chanterelles (*Cantharellus* spp.) and American matsutake (*Tricholoma magnivelare*) are the principal species of importance economically. Germany, France, and Japan are the major export markets. Data are given for exports from Washington ports. The direct American share of the German import market for wild mushrooms is relatively small (0.2 percent in 1985). Much of the American chanterelle crop consumed in Germany is first exported to Canada. Together, the United States and Canada comprise 25 percent of the German market. Poland, the largest European exporter, supplies 70 percent of the German market imports.

Acker also gives wage data for 1986 and estimates of the labor force of pickers in Washington. Mushroom picking offers seasonal income and supplements income in coastal counties of Washington where unemployment is high as the result of a depressed timber industry. Conflict among user groups is occurring and is likely to increase in the future if harvest intensity increases. On state lands, pickers have

not been required to pay for harvests. This is private gain from public resources without any compensation to the Washington Department of Natural Resources.

The author outlines the positions and concerns of interest groups in Washington. These interest groups include recreational users, scientists, processors and exporters, intermediary buyers, pickers, forest land owners, and state and Federal land management agencies. Strengths and weaknesses of options from which government policies could develop are discussed in detail. Options include (1) expanding research on wild mushroom species and their domestication, (2) expanding commercial harvest levels of wild mushrooms, (3) developing commercial cultivation of nonnative edible mushrooms, (4) imposing a temporary moratorium on harvest and sale of wild edible mushrooms, (5) more stringently regulating harvesting seasons, (6) limiting total harvest take during collection seasons, (7) imposing regional closures on commercial picking, (8) establishing a permit system, (9) requiring licensing or a possession limit or both, and (10) leasing lands for exclusive rights to mushroom harvest. Evaluation of options must deal with uncertainties about achieving desired ecological and economic results, the timing of desired results, their actual cost, funding allocations, and possible redistribution of socially negative impacts.

Keywords: Employment, interest groups, policy analysis, policy options, wild edible mushrooms, trade, Washington.

Aguilar Hernández, Mario. 1995. Informe de Paises—Mexico=Country reports—Mexico. In: Frisk, Torsten, comp. Memoria: Consulta de expertos sobre productos forestales no madereros para America Latina y el Caribe; 4-8 July 1994; [location of meeting unknown]. Serie Forestal 1. Santiago, Chile: United Nations, Food and Agricultural Organization, Regional Office for Latin America and the Caribbean: 229-237.

Summarizes the industry involving the American matsutake (*Tricholoma magnivelare*) from *Pinus teocote* forests. Harvesting currently occurs in Mexico State, Hidalgo, Michoacan, Oaxaca, and Veracruz. Price for this mushroom in Japan may reach as high as US$100/kg. Between 1989 and 1992, Japan imported 7740 tonnes of American matsutake, but of this amount, only 35.8 tonnes came from Mexico. The 1993 harvest amounted to 12 tonnes, yielding US$375,000 to the 3,000 households involved in harvesting. Japan imported 8.4 tonnes of that harvest for a value of US$465,000. Mexico's participation in the Japanese market currently stands at 0.25 percent. Some 35 000 hectares have been designated as potential mushroom habitat, but harvesting occurs on only 48 percent of the habitat. A potential annual harvest of 30 tonnes is projected from the States of Hidalgo and Veracruz alone.

Keywords: Wild edible mushrooms, Mexico, yields, prices, trade.

Alcorn, Janis B. 1984. Development policy, forests, and peasant farms: reflections on Huastec-managed forests' contributions to commercial production and resource conservation. Economic Botany. 38 (4): 389-406.

Proposes that intensified traditional forest management offers an alternative to intensified agricultural production as the basis for sustainable economic development in tropical semisubsistence economies. Huastec forest management in

northeastern Mexico is an example of a management system that can be intensified. The area consists of moist tropical forest and is inhabited primarily by peasant farmers who rely heavily on forest-farm mixtures known as "*télom*" to make a living. *Télom* contain both intensely cultivated and wild species, and different households manage different resources at various intensities. Plant diversity is extremely high, with the average *télom* having more than 300 species. Products are used for a large variety of purposes: food, medicine, construction, and forage. Some products are consumed at home, others, notably coffee, are sold for cash.

The *télom* system differs from agroforestry in that it is a much more permanent forest structure. Unlike Western notions of managed forests, the *télom* contains a high diversity of species and is managed to minimize disturbance of natural communities. *Télom* require relatively little labor and they spread risk. Alcorn stresses that policymakers need to see *télom* as one piece of a larger set of production strategies, rather than as the sole economic strategy for peasant households.

Keywords: Agroforestry, risk diversification, forest management, Mexico.

Alcorn, Janis B. 1989. An economic analysis of Huastec Mayan forest management. In: Browder, J.O., ed. Fragile lands of Latin America: strategies for sustainable development. Boulder, CO: Westview Press: 182-206.

Describes forest management practices by Huastec Mayan Indians in San Luis Potosi, Mexico, to maintain forest patches called *télom*. These forests provide subsistence and market goods (utensils, tools, food, and medicines) and conserve wild genetic resources and environmental amenities (for example, soil conservation) with relatively low labor inputs. The author outlines a financial analysis of a single Huastec farm-forest community. Cash value and shadow prices are used to estimate production inputs. Personal consumption and sales combine for total estimated value. Production of semidomesticated coffee plants is high value and risky but makes the forest component of the rural economy the most profitable in good years. In providing a complete system for rural development, native or semi-wild forest stands should be incorporated as sources for cash and subsistence crops. This article is of significance for showing possibilities for agroforestry systems using combinations of wild and domesticated plant species to provide economic well being.

Keywords: Subsistence, economic analysis, risk, rural development, Mexico, Mayas.

Allen, John W. 1950. Marketing woodlot products in the State of Washington. Bull. 1. Olympia, WA: Washington Department of Conservation and Development, Institute of Forest Products. 61 p.

Outlines the species, product quality requirements, packing and processing features, seasonal availability, prices, markets, and major firms in the trade of miscellaneous products. Miscellaneous products include berries, cascara (*Frangula purshiana*) bark, evergreen huckleberry (*Vaccinium ovatum*), salal (*Gaultheria shallon*), western swordfern (*Polystichum munitum*), and Douglas-fir (*Pseudotsuga menziesii*) resin. At the time of publication, Kitsap and Mason

Counties were the center of the forest greens industry. Wholesale product prices and, for cascara bark, workers' wages are given. The author summarizes a study by the Pacific Northwest Forest and Range Experiment Station about best management practices for western swordfern in a variety of forest types. Other products briefly mentioned include dried cottonwood (*Populus* spp.) stem buds for use in patent medicines, willows (*Salix* spp.) for floral markets, basketry, and plant stock for erosion control, wild bulbs of horticultural value, cedar boughs, ornamental cones, purple foxglove (*Digitalis purpurea*), moss and lichens, Oregongrape (*Mahonia* spp.) for floral markets and roots for patent medicines, devilsclub (*Oplopanax horridus*), prince's-pine (*Chimaphila umbellata*), and American false hellebore (*Veratrum viride*) for medicinal use. The author offers an example of a forest appraisal that includes harvests of salal and evergreen huckleberry before harvesting overstory trees. A list of regulations about trade in nontimber forest products is included at the end of the document. A license is required for all people to transport or sell any huckleberry branches outside the State of Washington. Written permission from a landowner must be obtained before another person may cut, peel, or ship cascara bark. This article gives a valuable early description of the nontimber forest product industry and its regulations.

Keywords: Regulations, economic analysis, processing, prices.

Ammer, N. [and others]. 1982. Sammeln und Langlaufen im Nationalpark Bayerischer Wald=Collecting and cross-country skiing in the Bavarian Forest National Park. Munich: Bayerisches Staatsministerium für Ernährung, Landwirtschaft und Forsten. 65 p.

Anderson, Anthony B. 1990. Alternatives to deforestation: steps toward sustainable use of the Amazon rain forest. New York: Columbia University Press.

Provides different perspectives on how sustainable use of the Amazon rain forest can be attained. In keeping with their belief that there is no "one-size-fits-all" solution to sustainable forest management, the editors have included articles addressing a continuum of forest management possibilities, ranging from traditional natural forest management, to extractive reserves, to extensive and intensive agroforestry systems in environments subject to a high degree of human manipulation. Articles range from fairly technical studies of ecosystem interactions to various kinds of disturbance to analyses of the social and political factors that affect the viability of different management strategies, such as extractive reserves, traditional agroforestry, and new forms of agroforestry. This book describes a range of options that might be applicable to the temperate forests of the Pacific Northwest.

Keywords: Sustainability, Amazon, forest management, extractive reserves, agroforestry.

Anderson, Anthony B.; Ioris., Edviges M. 1992. Valuing the rain forest: economic strategies by small-scale forest extractivists in the Amazon estuary. Human Ecology. 20(3): 337-369.

Outlines the development of the extractive reserve concept as a policy mechanism for balancing economic development and natural resource conservation in Brazil's

Amazon basin. Two factors limit the economic returns of extractive reserves as a mode of production: the dispersed nature of the resources creates high harvesting costs, and the dispersed human population increases transport costs. The authors collected data on forest use strategies from 10 households on the island of Combu in the Amazon delta.

Combu is unique in several important respects: mechanized agriculture is not possible owing to the waterlogged soils, resulting in retained forest cover; economic species are highly concentrated and thus can be readily harvested; and proximity to the metropolitan center of Belem allows Combu harvesters to avoid middlemen and gain a greater share of the profits from the sale of their products. Together these factors encourage conservation-oriented behavior because most Combu residents profit more from the forest than from alternative land uses. Conservation practices are in fact relatively new; only when the economic returns from the sale of açai palm (*Euterpe oleracea*) fruits surpassed that of both farming and logging did forest conservation become common.

Keywords: Forest extraction, economic strategies, land use, survey, household, management, Brazil.

Anderson, James R. 1925. Trees and shrubs, food, medicinal and poisonous plants of British Columbia. Victoria, BC: British Columbia Department of Education. 165 p.

Serves as an encyclopedic reference work for schools in British Columbia to inform residents about indigenous and popular uses of the native flora for food and medicine. The first section on tree and shrub species emphasizes identification and makes cursory mention of traditional and contemporary uses. The second section treats food plants and describes native methods of preparation with details for major species. Wild fungi are not included among edible plants although black lichen (*Alectoria jubata*) is mentioned. Medicinal and poisonous plants are treated together. Many plants served both food and medicinal purposes, including Oregongrape (*Mahonia* spp.), common cowparsnip (*Heracleum lanatum*), common lomatium (*Lomatium utriculatum*), and fireweed (*Epilobium angustifolium*).

This work represents an early invaluable compilation of uses and attitudes toward native vegetation in coastal regions of British Columbia. Although the uses of nontimber forest products receives considerable attention in this volume, the economic emphasis on timber is central to the philosophy of forest management set forth in the final section of the book. Economic development of traditional food and medicinal resources is generally not viewed as a goal in forest management.

Keywords: Traditional uses, wild edible food, medicinal plants, poisonous plants, British Columbia.

Anon. 1985. Report from an ad hoc committee of the Oregon Mycological Society: harvest and commercialization of wild edible fungi. Mycena News. 35(2): [page nos. unknown].

Arnolds, E. 1991. Decline of ectomycorrhizal fungi in Europe. Agriculture, Ecosystems, and Environment. 35: 205-244.

Arnst, Albert. 1945. Cascara—a crop from West Coast tree farms. Journal of Forestry. 43(11): 805-811.

Discusses the potential for increasing the production and harvest of cascara bark for medicinal use in the mid-1940s. Although interest in cascara bark increased during World War II, it had been an important cathartic for centuries. At the time of the article's publication, the major species used in the United States was *Frangula purshiana*, which is found in Washington, Oregon, north-central California, and in the mountains of Idaho and Montana. The commercially important areas are mainly along the coast. Labor shortages associated with World War II decreased the supply of cascara bark, which was then an important crop for local economies in rural Washington, Oregon, and California.

The author notes that much of the supply during that period came from new trees on cutover lands. The inability to access remote locations during the war years resulted in overharvesting of trees close to major roads. The author cites lack of knowledge and failure to use proper harvesting practices as a major threat to this million-dollar industry. The high incidence of poaching constituted another threat. The author attributes the prevalence of poaching to the unwillingness of land-owners to enforce their claims to cascara trees. The author argues for the need to disseminate information about the value of cascara bark to increase enforcement of existing laws against poaching.

Keywords: Medicinal plants, harvesting practices, domestication, poaching, sustainability.

Austad, Ingvild. 1988. Tree pollarding in western Norway. In: Birks, Hilary H.; Birks, H.J.B; Kalnad, Peter Emil; Moe, Dagfinn, eds. The cultural landscape—past, present and future. Cambridge: Cambridge University Press: 10-29.

Discusses the modern Norwegian landscape, which is a product of agricultural practices that relied heavily on pollarding. The recent cessation of this practice is likely to significantly alter the aesthetic, recreational, and ecological values of western Norwegian landscapes; for example, many formerly pollarded trees provide habitat for insects and birds. Farmers also benefit as the nutritional value of the leaves of many pollarded species surpasses that of hay. In conclusion, Austad advocates the creation of special pollarding areas and the reintroduction of traditional cutting techniques as a means for restoring the landscape. Given the labor costs required, she recommends the use of government farm subsidies to encourage the maintenance of these traditional forms of management. She notes that additional research needs to focus on determining the value of tree fodder for animal health and on identifying the restoration methods most appropriate to creating specific landscape features.

Keywords: Pollarding, agroforestry, farm forestry, landscape management, Norway.

Bainbridge, DA. 1986. *Quercus*, a multipurpose tree for temperate climates. The International Tree Crops Journal. 3: 291-298.

Focuses on the economic role of oaks (*Quercus* spp.) as important sources for fodder, food, sugar, tanning agents, dyes, and inks. Acorns remain a widespread food in Korea. Production of acorns differs widely from year to year but may

amount to as much as 3000-6000 kg•ha^{-1}•yr^{-1}. Individual trees of Oregon white oak (*Q. garryana*) produce several hundred kilograms per year. Intercropping with other crops is frequent. Acorns are sources of vitamin C and starch. Leaching the tannins improves flavor. Coffeelike beverages from acorns are known from the American midwest and central Europe, and oil from acorns is used for cooking in north Africa and traditionally for cooking and salves by Native Americans in the East. Indians in the Columbia River region used urine to cure acorns that were known as “Chinook olives” by early Euro-American settlers. The author advocates efforts to select productive oak trees for breeding projects that develop the oak resource more efficiently.

Keywords: Acorns, nuts, tannins, dye plants, breeding programs, nutrition.

Baldini, Sanzio. 1993. Produits forestiers non ligneux dans la région méditerranéenne=Nontimber forest products in the Mediterranean region. Rome: United Nations, Food and Agricultural Organization. 34 p. In French.

Presents issues basic to formulating a comprehensive policy in the Mediterranean basin for nontimber forest products. Many resources are spread widely over the landscape but have only modest yields per unit of surface area. Formal economic sectors encompass only some of the resources, and market mechanisms are not in place to ensure resource conservation. Major resources include resins from *Pinus* spp.; medicinal extracts from *Digitalis purpurea*, *Allium* spp., and *Crataegus* spp.; honey from numerous forest plants; and edible fungi, particularly *Boletus* spp. *Amanita* spp., *Pleurotus* spp., and *Tuber* spp. Actual production levels of products and their values are given along with estimates of potential production and value for each Mediterranean nation.

Soil conservation measures for ecosystem restoration projects in deforested and arid regions are essential to achieving greater levels of production. Improvements to the structure of economic systems will increase the flow of revenues and raise employment levels. Product quality improvement, value-added production, and effective marketing are necessary to get products widely represented in domestic and foreign markets. A strategic policy for expanding the nontimber forest products sector requires (1) multidisciplinary coordination (including botany, statistics, sociology, ecology, biochemistry, industrial chemistry, economics and marketing, agronomy and silviculture, and zootechnology); (2) programs to stimulate growth in rural income and employment; (3) education to improve local knowledge and technical expertise; (4) a databank for nontimber forest products in the region; and (5) prioritizing for management intervention and product development. This article outlines a potentially useful policy framework for decisionmakers in the Pacific Northwest.

Keywords: Economic policy, ecosystem restoration, medicinal plants, mushrooms, yields, resins, honey, wild edible mushrooms.

Balick, Michael; Arvigo, Rosita; Romero, Leopoldo. 1994. The development of an ethnobiomedical forest reserve in Belize: its role in the preservation of biological and cultural diversity. Conservation Biology. 8(1): 316-317.

Describes how a focus on the development of nontimber forest products can contribute to sustainable management of a tropical forest ecosystem. The management

of extractive reserves for nontimber forest products can provide incentives for local people to maintain ecosystem integrity, as evidenced by a recent effort in Belize to establish an ethnobiomedical forest reserve structured to benefit local people. Medicinal plants are key nontimber forest products in Belize, and herb gatherers and traditional healers are important elements in Central American health care networks. The Belize Association of Traditional Healers was established in 1992 to stop the loss of knowledge about traditional medicinal plants and their uses. Their efforts have focused on recruiting new members to the traditional healing profession and developing an intellectual property rights system for traditional knowledge.

Keywords: Extractive reserve, networks, traditional healers, ethnobotany, intellectual property rights, Belize.

Balick, Michael; Mendelsohn, Robert. 1992. Assessing the economic value of traditional medicines from tropical rain forests. Conservation Biology. 6(1): 128-130.

Assesses the net present value of medicinal plant harvests for two plots of tropical forest in Belize. The first plot, a 30-year-old, 0.28-ha parcel yielded a net present value of US$726/ha assuming a 30-year harvest cycle and a 5-percent discount rate. The second plot, 50 years old and measuring 0.25 ha, yielded a net present value of US$3,327/ha, assuming a 50-year rotation and the same discount rate. These values compare favorably with alternative land uses in the region, such as intensive agriculture and pine plantations. The authors argue that a medicinal harvest strategy is viable and can be combined with other sustainable nontimber forest products to provide conservation incentives.

Keywords: Medicinal plants, economic value, inventory, net present value, land use, Belize.

Bang, Carl. 1979. Grøntudbyttet ved forskellige klippemetoder og -intensiteter i nobilis=Various lopping methods and intensities for the production of decoration greenery of *Abies procera*. Forstlige Forsøgsvaesen i Danmark. 37(1): 1-22. In Danish with English summary.

Reports preliminary results of seven different lopping methods replicated three times in three experimental blocks to test optimal long-term production of decorative greenery from noble fir (*Abies procera*). Thinnings are combined with lopping in some treatments but did not occur in the same year. Only salable greenery was harvested. After 24 years, the most lucrative practice was found to be a whorl-lopping at age 13 followed by annual removal of a single whorl. Screw-lopping and leaving only two top whorls initially was not economically feasible. The article suggests ways to manage noble fir for bough production in plantations in the Pacific Northwest.

Keywords: Greenery, screw-lopping, thinning, whorl-lopping, experimental design.

Bang, Carl. 1986. En grenanalyse af nobilis=Branching habits of *Abies procera*. Forstlige Forsøgsvaesen i Danmark. 41(1): 1-34. In Danish with English summary.

Bang, Carl. 1988. Grøntudbyttet ved forskellige klippemetoder og -intensiteter i nobilis, II=Various lopping methods and intensities for the production of decoration greenery of *Abies procera*, part two. Forstlige Forsøgsvaesen i Danmark. 42(1): 27-50. In Danish with English summary.

Barfod, A.S.; Bergmann, B.; Pedersen, H.B. 1990. The vegetable ivory industry: surviving and doing well in Ecuador. Economic Botany. 44(3): 293-300.

Bateman, Ian. 1991. Recent developments in the evaluation of nontimber forest products: the extended CBA method. Quarterly Journal of Forestry. 85(2): 90-102

Examines the type and nature of nonpriced benefits and costs of forestry. Examination of only the market price of forest outputs will not accurately reflect the true social value of forests. Five sources of forest value need to be considered: primary user value, secondary user value, option use value, bequest value, and existence value. The difference between the value and price of an item is often a function of the associated property rights. The difference is underscored between financial appraisals of forests, which look at internal (or priced) costs and benefits, and social appraisals, which consider both internal and external (nonpriced) costs and benefits and the use of cost-benefit analysis (CBA) for social appraisals. The single major CBA forestry assessment conducted in Great Britain by the Treasury Department considered a wide, but not exhaustive, range of external criteria and employed different units of measurement for internal and external costs and benefits. There are two other approaches to this conventional CBA approach: improving CBA by better monetary evaluation of environmental externalities, and changing the nature of forestry investing so that external criteria become an investment priority for private forestry companies. Other alternatives include a pure market solution, extension of private property rights and regulation, and non-monetary evaluation. Nontimber forest products such as berries and game are referenced as an external benefit but are not addressed directly.

Keywords: Primary user value, secondary user value, option user value, bequest value, existence value, economic value, cost-benefit analysis, policy, United Kingdom.

Bazzocchi, Raffaele; Giorgioni, Maria Eva; Calzolari, Stefania. 1987. Eucalyptus per la produzione di fronde recise=Eucalyptus for cut foliage production. Colture Protette. 16(6): 27-32. In Italian.

Calls attention to less well-known eucalyptus species suitable for floral markets, which are traditionally sensitive to high quality standards and constant innovation. Eucalyptus foliage stays fresh for a long time and is popular in floral arrangements. Of the land in Italy devoted to growing cut foliage, more than 35 percent of it is in eucalyptus production. A description of species suitable for industrial production of floral greenery comprises most of the text.

This article points out the possibility of stiff market competition for exports of Pacific Northwest floral greens in the event of an increase in industrial supplies worldwide of eucalyptus species grown for the florist trade. Also, local production of cold-hardy eucalyptus species for floral greens could contribute to local economic development in the Pacific Northwest.

Keywords: Competition, eucalyptus, floral greens, Italy.

Becker, M. 1993. Economic value of non-wood products from tropical forests. In: IUFRO centennial meeting; 31 Aug.-4 Sept. 1992; Berlin, Germany. [Place of publication unknown]: [Publisher unknown].

Behaly, Joseph G. 1981. Harvesting evergreen brush and fern. Ext. Bull. 0721. Pullman, WA: Washington State University, Cooperative Extension. [not paged].

Provides a brief overview of forest management and harvesting techniques for salal (*Gaultheria shallon*), evergreen huckleberry (*Vaccinium ovatum*), and western swordfern (*Polystichum munitum*) as floral greens crops. Adjusting the forest overstory and pruning lower trees branches maintain the correct balance of light and moisture for these species. Moderation in harvest intensity is recommended. Spring harvests should be avoided because foliage is tender and easily injured. Trade requirements for frond or branch lengths and quality and suggestions for packing and handling are given. Scheduling of frond harvests proceeds sequentially by forest type from open areas, to alder (*Alnus rubra*) forests, to Douglas-fir (*Pseudotsuga menziesii*), and then to cedar (*Thuja plicata*) and Sitka spruce (*Picea sitchensis*) stands. Pruning guidelines for huckleberry also are given. This brochure provides a succinct introduction to the major floral greens species in the Pacific Northwest.

Keywords: Floral greens, harvesting guidelines, Pacific Northwest.

Belonogova, Tatyana. 1993. Changes in blueberry and cowberry yields under the influence of forestry measures. Aquilo Ser. Bot. 31: 17-20.

Cites the effects of human-caused factors in the decrease of berry production areas in Karelia, Russia, and reports on experiments to increase productivity in naturally occurring berry stands. Berry yields in the Karelian region depend on weather conditions and differ greatly from year to year. An annual average over 5 years has been 5000 tonnes. This amounts to 11 kg of berries per inhabitant of Karelia as compared to 0.6 kg per capita in the rest of Russia.

Silvicultural measures can increase production of whortleberry (*Vaccinium myrtillus*) and lingonberry (*V. vitis-idaea*). Experiments in partial overstory removal increased sunlight reaching the understory and generated more flowering and fruiting. Whortleberry yields in treatment plots doubled by the end of the 6-year study period as compared to control plots. The effect of canopy thinning is stronger when fertilizer is applied, but in 50-year-old pine (*Pinus sylvestris*) stands, increasing competition for space by other vegetation neutralizes the beneficial effect of fertilizers for berry production.

Lingonberries are most numerous on cutover lands where their yields are highest despite susceptibility to night frosts. High productivity is limited to young stands. Overstory thinning provides 2 years of increased lingonberry productivity and a return to low productivity thereafter. The quantities are not sufficient for commercial collecting.

This article provides useful details about possibilities for overstory stand manipulation to enhance berry crop production for different species.

Keywords: Berries, improvement thinnings, mineral fertilizer, productivity, yields, management, Russia.

Bender, F. 1963. Cedar leaf oils. Ottawa: Canadian Department of Forestry. 16 p.

This dated paper surveys potential areas for growth in commercial use of cedar oils from species found in the Pacific Northwest. Until the 1920s, the cedar leaf oil industry was significant in Canada. Uses included perfumes, medicinal preparations, insecticides, furniture polishes, soaps, and microscope slides. The major species used were eastern arborvitae (*Thuja occidentalis*) and eastern redcedar (*Juniperus virginiana*). Western redcedar (*T. plicata*) yields higher amounts of oil per weight (1 percent), and western juniper (*J. scopulorum*) produces the highest yield of leaf oil, 1.8 percent from berry crops.

In recent years production has dropped because of the high cost of collection. Only one small plant operated in British Columbia in 1963 that used western redcedar. Most American production of cedar oil occurred in New England in 1963. Portable equipment and methods for oil preparation are described. Data on prices in Canada in the early 1960s are given. Data on production and consumption of cedar oil are not available for Canada or the United States.

Keywords: Cedar oil, essential oils, distillation, Canada.

Benjamin, Pamela K.; Anderson, Roger C. 1985. Influence of collecting on the reproductive capacity of wild ginseng (*Panax quinquefolius*) in Illinois. Bulletin of the Ecological Society of America. 66(2): 140-141.

Examines the influence of harvesting by comparing age structure and reproductive success of wild ginseng (*Panax quinquefolius*) populations in different age classes in protected and unprotected sites. Sample populations on unprotected sites were one-third as numerous where more productive plants of commercial value (> 7 years old) were selectively removed. This brief article underscores the importance of demographic studies to monitor the reproductive capacity of special forest products.

Keywords: Demography, harvesting, reproduction, medicinal plants.

Benk, Erich. 1987. Zur Kenntnis einiger wenig bekannter Wildfrüchte=Information on some lesser known wild fruits. Gordian. 87(11): 226-227. In German.

Introduces less well-known fruiting trees and shrubs in the Berberidaceae, Ericaceae, and Rosaceae of potential use as fruit crops and ornamental foliage.

Of particular relevance to the Pacific Northwest is the description of hollyleaved barberry (*Mahonia aquifolium*). The multiple uses of the plant give it wide application as a protective hedge and decorative garden plant. The dark red color and acidic flavor of the berry juice improve the color and flavor of other fruit preparations; for example, combinations of Oregongrape with apples, crabapples, and pears in jellies. Other genera mentioned with species native to the Pacific Northwest are *Prunus*, *Rubus*, and *Sorbus*.

This article describes unconventional uses for native *Mahonia* and hints at its possible domestication as a food crop in Europe.

Keywords: Edible wild plants, horticultural plants, domestication, flavoring, food coloring.

Binkley, D.; Graham, R.L. 1981. Biomass, production and nutrient cycling of mosses in an old growth Douglas-fir forest. Ecology. 62(5): 1387-1389.

Estimates the biomass, productivity, and nutrient cycling of ground-level mosses in an old-growth Douglas-fir/western hemlock forest, and examines the importance of mosses to system dynamics. Research was conducted in the H.J. Andrews Experimental Forest (western Oregon), where moss cover was about 40 percent. Two species, *Stokesiella oregana* and *Hylocomium splendens* made up 99 percent of the total ground-level moss biomass. The authors estimated that annual net production was composed of 39 percent of the standing crop of *Stokesiella* and 18 percent of the standing crop of *Hylocomium*. Total moss biomass was estimated at 1075 ±100 kg/ha, which was consistent with earlier studies. Mosses contributed 20 percent to the total biomass and 95 percent to the photosynthetic tissue biomass in the understory. Although ground-level mosses made up only 0.13 percent of the aboveground biomass, they contributed significantly to system dynamics.

Keywords: Moss, system dynamics, H.J. Andrews Experimental Forest.

Black, B.E. 1948. Oregon's farm forest products. Corvallis, OR: Oregon State University, Extension Service.

Bluhm, Wilburd L. 1988. Native herbaceous perennials of the Pacific Northwest worthy of commercial production. Combined Proceedings of the International Plant Propagators' Society. 38: 135-137.

Lists low- and mid-elevation Pacific Northwest native herbaceous perennials that deserve consideration for commercial production. At present, these species are little used because of the preference of horticultural species from eastern North America, Europe, China, and Japan. This brief article is a starting point for targeting likely species from which cuttings or seed collections could be taken to begin domestication and wider introduction in the horticultural trade.

Keywords: Domestication, horticultural plants, perennial plants.

Blumenthal, Mark. 1992. Focus on rain forest remedies. HerbalGram. 27: 8-10.

Reviews selected articles published in 1991 and 1992 on use of nontimber forest products among indigenous rain forest communities and the potential for new drugs and cures.

Keywords: Medicinal plants, rain forest.

Boge, L. 1983. Hinweise zur Weidennrutenproduktion=Guidelines for osier production. Sozialistische Forstwirtschaft. 33(2): 45-46. In German.

Describes important considerations for economically viable intensive management of willow (*Salix* spp.) stands for osier production in Germany. Details of correct site selection, soil treatments, control of competing vegetation, stand size, harvest scheduling, and the practice of alternating land uses are given. The importance of personnel experienced with willow silviculture also is emphasized.

Keywords: Basketry, weaving, stand management.

Bolsinger, Charles L.; Jaramillo, Annabelle E. 1990. *Taxus brevifolia* Nutt. Pacific yew. In: Burns, Russell M.; Honkala, Barbara H., tech. coords. Silvics of North America: Volume I, Conifers. Agric. Handb. 654. Washington DC: U.S. Department of Agriculture, Forest Service: 573-579.

Provides an overview of the range and habitat where Pacific yew is found, and the associated climate, soils, and vegetation. Yew reproduces both vegetatively and by seed. Seeds germinate slowly, with germination favored by the presence of a deep organic layer. Yew also sprouts from stumps and rootstocks. Logging appears to have a negative impact on the vigor of yew. Yew grows slowly and is rarely found at high densities. It is highly shade tolerant but is able to adapt to overstory removal. Yew wood is used for many products, including bows, canoe paddles, furniture, and tool handles. It also is valued by Japanese and Taiwanese woodcarvers. In the late 1960s, yew bark was identified as a source of taxol, a potential anticancer compound. The National Cancer Institute began acquiring yew bark on a commercial scale in 1988. Their orders for 27 700 kg of yew bark represented about 6,000 to 7,000 trees, most of which were on Federal lands where yew has not been inventoried. At the time the article was written, a synthetic substitute for taxol had yet to be discovered, and Pacific yew was the only species known to have commercial quantities of taxol. Alternative sources from tissue culture and seedlings were being investigated.

Keywords: Pacific yew, medicinal plants, Pacific Northwest.

Bounous, Giancarlo; Peano, Cristina. 1990. Frutti dimenticati=Neglected fruits. Monti e Boschi. 41(4): 23-32. In Italian with English summary.

Calls attention to the economic potential of European or Near Eastern fruit tree species, many of which have members of the same genus in the Pacific Northwest.

Details are provided about respective horticultural requirements for commercial stands of these shrubs and trees. Mountain ash or rowan (*Sorbus* spp.) has a high tannin content and needs to ripen after picking to develop a very pleasing sour-sweet taste like grapes. The fruit also may be eaten after being sun dried for 15 to 20 days. The berries are used as a source for malic acid, which is used as a flavoring and in aging wine. Hawthorn (*Crataegus* spp.) fruit spoils quickly and is best eaten sweetened after harvest. Fruits of dogwood species (*Cornus* spp.) are extremely rich sources of vitamin C, and the berries are added for flavoring in wines and liqueurs in northern Italy. Various industrial and cosmetic dyes are obtained from mountain ashes and dogwoods. The strawberry tree (*Arbutus unedo*—related to the madrone [*A. menziesii*] of the Pacific Northwest) is used frequently as a decorative tree; its fruit is moderately sweet, high in vitamin C, and may be eaten ripe or as jelly. It is also used in production of liqueurs on Sardinia and Corsica. Leaves contain a glucoside (abutine), which is used as a urogenital disinfectant, and the dried leaves have been used as an antiseptic, astringent, and diuretic. Elderberries (*Sambucus* spp.) are widely collected from plantations and wild stocks in Canada and central and eastern Europe for their juice and use in jams. Flowers and bark have medicinal use as diuretics and purgatives. Rose (*Rosa* spp.) fruits are not eaten fresh but are manufactured into jams, syrups, and jellies, often in combination with other fruits not containing high vitamin C levels. Figures in the article give mean values of nutritional and mineral content of *C. mas* and *Sorbus acuparia*.

Keywords: Edible fruits, medicinal plants, Europe, Near East, dye plants, horticultural plants.

Boutland, A., Robinson M., Field, J. [and others]. 1992. Alternative products from trees and shrubs to “The role of trees in sustainable agriculture” conference, Albury, 30 September–3 October 1991. Agroforestry Systems. 20: 25-58.

Examines potential sources of revenue from nontimber and nonfodder uses of trees and shrubs in Australia and provides an overview of the most important alternative tree and shrub product industries. Products include essential oils, honey, wildflowers, tree foliage, and nuts. Most of these industries rely on wild resources but are shifting toward plantations. Production trends, values, and markets for each industry, as well the major problems and research needs, are discussed.

Product substitutions from competitor countries and lack of basic productivity and propagation research are problems for many of these industries. Although there is considerable diversity in potential products, many are not yet viable commercially. The limited research that has been done emphasizes chemical properties, propagation, and growth properties and virtually ignores economic or marketing considerations. Given the high-risk nature of these industries, the authors advocate integrating these products with other economic activities, such as forestry and agriculture. This article articulates parallel issues facing economic development of nontimber forest products in the Pacific Northwest.

Keywords: Agroforestry, Australia, floral greens, honey, medicinal plants, nuts, essential oils, tannins.

Boyd, Robert. 1986. Strategies of Indian burning in the Willamette Valley. Canadian Journal of Anthropology. 5(1): 65-86.

Describes the major food plants of the Kalapuya Indians of the Willamette Valley. Major food species found in forest environments were salal (*Gaultheria shallon*), Cascade Oregongrape (*Mahonia nervosa*), and berries (*Fragraria chiloensis; Rubus* and *Vaccinium* spp.). Important food plants from savannah environments on the valley floor were acorns from Oregon white oak (*Quercus garryana*), hazelnuts (*Corylus cornuta*), camas lily (*Camassia quamash*), tarweed (*Madia* spp.), wapato (*Sagittania esculenta*), and berries (especially *R. ursinus*). An examination of historical records and diaries from early Euro-American settlers and archeological data show that indigenous people burned in specific seasons and ecosystems and thereby exerted a selective effect on the development of ecosystems in the Willamette Valley and adjacent regions. The authors present a reconstructed annual burning schedule. Fire had multiple managerial uses; two uses, the circle hunt of deer and gathering of tarweed, were predominant. Regular low-intensity burns beneath oak trees cleared competing vegetation, made acorn gathering easier, and provided attractive foraging areas for deer. Hazel also was important for basket weaving, and material was collected from shoots in recently burned areas. Numerous references are made to burning practices of other Pacific Northwest peoples, and there is an extensive bibliography. Much of Kalapuyan subsistence practices and fire management must be inferred as the archaeological and ethnographic record is meager.

This article describes forest management for nontimber forest products before Euro-American settlement.

Keywords: Kalapuya Indians, Willamette Valley, burning, indigenous uses.

Bratkovich, Stephen M. 1991. Shiitake mushroom production on small diameter oak logs in Ohio. In: McCormick, Larry H.; Gottschalk, Kurt W., eds. Proceedings of the 8th central hardwood forest conference; 4-6 March 1991; University Park, PA. Gen. Tech. Rep. NE-148. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 543-549.

Reports on an initial experiment to test the productivity of four different spawn strains of shiitake mushrooms grown on small-diameter oak and beech logs. Some logs were additionally treated in subsequent years by soaking in water. Soaked logs had higher yields. Differential fruiting times among strains extends the marketing season for a commercial grower. Determining the optimum combination of host tree species, spawn strain, and log management is crucial and may be site specific.

Although this study is directed at private, nonindustrial timberlands in Ohio, there are significant implications for the Pacific Northwest. Experimentation with intentional inoculations of native edible fungi (for example, *Pleurocybella* and *Pleurotus* spp.) on down wood on public lands has not been conducted widely in the Pacific Northwest.

Keywords: Inoculation, spawn, wild edible mushrooms.

Bray, David Barton; Carreon, Marcelo; Merino, Leticio [and others]. 1993. On the road to sustainable forestry. Cultural Survival Quarterly. 17(1): 38-41.

Browder, John O. 1992. The limits of extractivism. BioScience. 42(3): 174-181.

Identifies a key contradiction between the underlying logic of extractive reserves and the logic of biodiversity protection. Protection of biodiversity typically requires low human population densities, but successful extractive reserves may require a much more widespread human presence. The history of extractivism in tropical rain forests suggests that extraction typically operates in ways that protect economic opportunities of the extractors at the expense of the forest ecosystem; moreover, most extractive reserve harvesters are linked into global economic structures that tend to funnel profits toward intermediaries rather than toward extractors. Consequently, the author questions whether extractive reserves can meet their goals for either economic development or biological conservation.

Three case studies of rubber tapper communities in Brazil and Peru are reviewed to explore whether rubber tapping and sustainability are compatible. These case studies revealed that most rubber tapping groups are very heterogenous, deeply indebted, nomadic, and prone to degrading natural resources for reasons beyond their control. Rather than freeing rubber tappers from the patron system that keeps them in debt to middlemen, extractive reserves may serve to maintain the existing imbalance in economic and political power. The author observes that it is more realistic to see extractive reserves as only one part in a set of solutions to achieve sustainable development; and argues that the major issue is how to get sustainable development outside such reserves. Suggested alternatives include more intensive natural forest management, such as intensive agroforestry and managing second-growth forests; intensifying continuous cropping through the use of natural fertilizers and agroforestry techniques; and protection of small forest reserves rather than focusing solely on large areas.

Keywords: Extractive reserves, agroforestry, sustainable development, Amazon, rubber trees.

British Columbia Ministry of Forests, Integrated Resources Section. 1994. Pine mushroom [matsutake] task force: workshop results; [dates of meeting unknown]; [location of meeting unknown]. Victoria, BC.

Brown, Nelson Courtlandt. 1950. Forest products: the harvesting, processing, and marketing of materials other than lumber, including the principal derivatives, extractives, and incidental products in the United States and Canada. New York: John Wiley and Sons. 443 p.

Provides an overview of nonlumber forest product industries in the United States during the 1940s and on ways of managing and using forests for a variety of wood products other than lumber. Chapters include discussions of various construction uses of wood (veneers, plywood, posts, poles, shingles, and shakes), chemically derived products (naval stores, tannins, oils, exudates), fuel (firewood, charcoal, wood gas), and miscellaneous products (bark, Christmas trees, ornamental plants, and wild edible plants). Each chapter outlines the history of the industries covered,

the areas of primary production, and an evaluation of the economic viability of the industry in current social and economic contexts. Of particular interest for the Pacific Northwest is the section on development of the Christmas tree industry, which is gradually shifting from an extraction to domestication mode of production. Sections on Christmas trees, floral greens, and wild edibles provide a few examples of regulations and permit fees for National Forest lands.

Keywords: Historical use, naval stores, tannins, essential oils, resins, exudates, bark, Christmas trees, ornamental plants, wild edible plants, permits.

Budriuniene, Danute. 1988. A model of rational non-ligneous forest resource consumption in intensive forestry in Lithuanian SSR. In: Bannine, I; Raatikainen, M., eds. Proceedings of the Finnish-Soviet symposium on nontimber forest resources; 25-29 August 1986; Jyväkylä, Finland: Acta Botanica Fennica. 139: 7-8.

Argues that management strategies for timber and nontimber products are often competitive, and that sustainable or increasing production of nontimber products is possible only when management plans specifically take nontimber products into account. The Lithuanian Scientific Research Institute of Forestry has designed a model for “specialized forest husbandry” on 6 percent of state-owned forests. Three classes of nontimber vegetation are considered: (1) berry-producing plants under moderate to intensive cultivation (for example, *Vaccinium* spp. and *Arctostaphylos uva-ursi)*; (2) species under protective management to assure regeneration (for example, *Vaccinium* spp. and prime edible mushroom species); and (3) species less intensively used and able to regenerate naturally (for example, hazel [*Corylus* spp.], hawthorn [*Crataegus* spp.], and red raspberry [*Rubus idaeus*]).

The first stage of model implementation is an extensive quantitative and qualitative resource evaluation, including assessing frequency and density of key nontimber species. Three productivity grades are then distinguished based on projected cover and forest stand density, and classified by administrative units, age classes and soil types. These data form the basis for nontimber management plans, the establishment of conservation and production areas, and design of regulations.

Keywords: Wild edible mushrooms, berries, wild edible plants, land allocation, management intensification, Lithuania.

Budriuniene, Danute. 1993. Changes in *Vaccinium myrtillus* coenopopulations in oligotrophic pine stands of different ages. Aquilo Ser. Bot. 31: 13-16.

Finds that the most significant declines in whortleberry (*Vaccinium myrtillus*) populations occur between the final felling or clearcutting of Scotch pine (*Pinus sylvestris*) stands through to the time of the first thinning of the regenerated stand. Highest yields of whortleberries are found in forests between 60 and 80 years of age.

Keywords: Wild berries, clearcutting.

Bulman, Teresa L.; von Hagen, Bettina. 1994. Forests. In: Asbaugh, James, ed. The Pacific Northwest: geographical perspectives. Dubuque, IA: Kendall Hunt Publishing Company: 159-186.

Describes Pacific Northwest forests, including distribution, ecology, management, and ownership patterns. The section on nontimber forest products summarizes the use and distribution of the most commercially significant species, assesses market opportunities, and discusses the potential sustainable development potential of the nontimber forest product industry.

Keywords: Pacific Northwest, sustainable development.

Burgess, M.A. 1994. Cultural responsibility in the preservation of local economic plant resources. Biodiversity and Conservation. 3: 126-136.

Presents examples from the American Southwest to illustrate the need for cultural understanding and participation in conservation of wild and domestic threatened plants. Describes how a nongovernmental conservation organization, Native Seeds/SEARCH, developed from 1977 to 1993. Native Seeds/SEARCH grew out of a nutrition program serving rural areas into an organization of 3,700 members with 17 part-time employees. Its goal is to provide Native American farmers or any gardener with traditional seeds at no cost. Their mission is to conserve indigenous, heirloom-crop genetic resources, and both ex situ and in situ measures are used. Educational outreach is a critical part of their program.

Native Seeds/SEARCH supports several activities designed to build local capacity in resource management. For example, the Native American Farmers network was begun in 1991 to link traditional farmers together. Native Seeds/SEARCH also supports biocultural restoration projects, such as the chile reserve partnership recently entered into with the USDA Forest Service to protect the chiltepin pepper (*Capsicum annuum* var. *glabriusculum*).

Keywords: Indigenous knowledge, cultural protection, genetic diversity, intellectual property rights, threatened plants.

Busing, Richard T.; Halpern, Charles B.; Spies, Thomas A. 1995. Ecology of Pacific yew (*Taxus brevifolia*) in western Oregon and Washington. Conservation Biology. 9(5): 1199-1207.

Reviews the distribution and population dynamics of the Pacific yew (*Taxus brevifolia*) in the mountains of western Oregon and Washington in response to recent intensive harvest of yew bark. The review is based on three sources of data: (1) a vegetation survey of 216 stands, (2) long-term permanent plot observations following logging and burning of three experimental watersheds in the H.J. Andrews Experimental Forest in the central Oregon Cascades, and (3) repeated measurements of tree growth and survival in three sets of plots in mature and old-growth forests in the Oregon and Washington Cascades. The authors conclude that the Pacific yew is widespread but primarily a late-successional species. The Pacific yew is most abundant in old-growth forests and slow to recover from major disturbance. Two major recommendations offered for the conservation and management

of the Pacific yew and similar species are that (1) source populations should be maintained and should serve as important sources for recolonizing disturbed areas, and (2) adding landscape units with sufficiently long absences of disturbance will enhance population viability.

Keywords: Taxol, medicinal plants, management, conservation, distribution, population dynamics.

Cagniart, Pierre. 1968. Commerce et réglementation de la truffe=Trade and regulation of truffles. In: Atti del I congresso internazionale sul tartufo; 24-25 May 1968; Spoleto, Italy. [Place of publication unknown]: [Publisher unknown]: 1-6. In French.

Traces the development of the truffle industry in France. Production at the end of the 19th century is estimated to have been 200-250 tonnes annually and grew to 1200 tonnes by the mid-1960s without any concern about overproduction. The high price for truffles has led to instances of commercial fraud. French law restricts the use of the word "truffles" to members of the genus *Tuber*. Marketed black truffles must consist only of *T. melanosporum* and *T. brumales* ("winter truffles"). "Autumn truffles" (*T. uncinatum*) may comprise up to 2 percent of fresh, labeled black truffles, because identification among species without a microscope is not always possible. The use of summer white truffles (*T. aestivum*) in pâtés also is regulated. Artificial coloring of white truffles to make them appear black is illegal. Coordination among the principle truffle-producing countries (Spain, Italy, and France) is advocated as a means to maintain product standards and consumer confidence.

For people in the Pacific Northwest, this article outlines some of the consumer protection issues addressed by other countries to regulate marketing and commercializing native truffle species.

Keywords: International coordination, legislation, regulation, truffles, France.

Campbell, B.M. 1994. The monetary valuation of tree-based resources in Zimbabwe: experience and outlook. In: Commonwealth Science Council. Non-wood forest products: proceedings of a regional consultation for English-speaking African countries; 17-22 October 1993; Arusha, Tanzania. Series CSC(94)AGR-21, Tech. Pap. 306. Rome: United Nations, Food and Agricultural Organization.

Calculates values of nonwood forest products for an average Zimbabwean household and for an average hectare of woodland per year. Thirty to forty percent of the value of woodlands in Zimbabwe is ascribed to the indigenous plant foods from the forest. Estimates of forest values are based on contingent valuation and replacement-production valuation methods. The author proposes an agenda for research to improve economic methods for calculating the jointly produced resources for Zimbabwean forests.

Keywords: Valuation, contingent valuation, replacement-production valuation, Zimbabwe, household.

Campbell, E.; Nicholson, A. 1991. Working plan to study the ecology of *Taxus brevifolia* Nutt. in British Columbia. Victoria, BC: British Columbia Ministry of Forests, Forest Science Research Branch.

Carlson, Alvar. 1986. Ginseng: America's botanical drug connection to the Orient. Economic Botany. 40(2): 233-249.

Examines how the ginseng (*Panax quinquefolius*) export trade developed in the United States and how production came to be concentrated in north-central Wisconsin. French missionaries appear to have been instrumental in developing the ginseng export trade. Gathering for export, the bulk of which was done by Indians who then sold the product to fur traders, began in the 1720s. Fur trading companies then exported the product to China, where demand was increasing as native supplies were overharvested.

In the 1800s, the supply of American wild ginseng was threatened by over-harvesting and clearcutting, and by the 1890s several states had passed regulation to prohibit spring and summer gathering. As wild supplies declined, attempts were made to cultivate ginseng. Grower associations came into being as a means for distributing information about cultivation experiments, and the USDA supported ginseng as a crop in its extension programs. Ginseng cultivation began in 1904 in Marathon County, Wisconsin, currently the Nation's major producer of ginseng.

To prevent overharvesting, Wisconsin has passed a series of laws regulating the ginseng harvest on public and private land. Seasonal restrictions on gathering have been imposed, and diggers have to be licensed except when digging on their own land for personal use. Digging on state lands was prohibited in 1979. Export of wild ginseng now falls under the Convention on International Trades in Endangered Species, and the product has to be certified as cultivated or wild when it is exported. The bulk of both wild and cultivated ginseng is shipped to the Far East, primarily to Hong Kong. Recent attempts by the former Soviet republics to market a shrub with properties similar to American ginseng pose a potential threat to the existing market.

Keywords: Harvesting regulations, medicinal plant, domestication.

Cesaro, Luca; Linddal, Michael; Pettenella, Davide. 1993. Regional differences in benefits of non-wood forest products and services in Europe. Draft manuscript. Paper presented at a European Union Workshop; Scientific criteria for the establishment of zonal afforestation plans; 1993 November; Brussels, Belgium. On file with: Social and Economic Values Research Program, Pacific Northwest Research Station, Forestry Sciences Laboratory, P.O. Box 3890, Portland, OR 97208-3890.

Characterizes major European nonwood forest products by region. Five regions are considered: the Mediterranean basin, central Europe, northern Europe, Scandinavia, and Eastern Europe. Data about production and export value are presented for European Community countries. Market values and volumes of annual production are given for conifer boughs in Denmark; chestnuts, mushrooms, and truffles in Italy; and cork and chestnuts from Spain. Production data

for berries from Belarus and berries and medicinal plants from Romania are listed. Abundant forest area in Scandinavia is a reservoir for berries and wild edible mushrooms. Sidebars describe truffle markets in Italy, the cork industry in Portugal, and berry and lichen production in Finland.

A major problem in pricing nonwood products is the discrepancy between the product's value (often very high) and its market price (often zero). Another problem is the scarcity of data for nonwood products; information on price elasticity and demand patterns is seldom known for them. Nonwood products can help stabilize economies because the products yield income, though small, at more frequent intervals than do timber products. Regions with declining rural economies and increasing unemployment are apt to benefit most from development of nontimber forest products. European forests are becoming less important as producers of wood and more important for environmental amenities and nonwood products. This is especially true in the Mediterranean region where 50 percent of the woodland is considered to have low timber production. Development of special forest products can help preserve forests on marginal lands. The authors cite the need for improving knowledge of producing, collecting, and processing nonwood forest products, standardizing collection of statistical data about products, researching markets and market identity, developing information systems, and promoting adequate public financing. Greater efficiency in production will be possible with increased cultivation of species based on agronomic techniques. When published, this paper will give key trends and policy issues in economic development and the societal use and benefits of forests that parallel those in the Pacific Northwest.

Keywords: Europe, market values, nuts, cork, wild edible mushrooms, truffles, berries, lichens, edible wild foods, conifer boughs, forest conservation, policy.

Chakravarti, Ila; Verma, Rekha. 1991. Marketing of minor forest produce (MFP) in tribal subplan (TSP) area through cooperatives in Rajasthan. Indian Journal of Economics. 71: 311-320.

Studies the effectiveness of cooperative marketing of minor forest produce (roots, bark, leaves, flowers, honey, and medicinal plants) to help indigenous people derive greater income. The Rajasthan Tribal Area Development Cooperative Federation established large-scale multipurpose agricultural cooperative societies (LAMPS) to collect, store, market, and distribute minor forest produce. Wild honey is used to exemplify the change in economic performance between 1977-78, when the cooperative societies were first created, and 1987-88, the fourth year after the establishment of a honey processing facility to add greater value to the honey products. Quantities and product values have fluctuated greatly from one year to another, largely because of unpredictable droughts. The federation sets aside 10 percent of the total production costs as profit and still keeps its shelf prices lower than other honey brands in the region. Operations of two LAMPS also were studied. Product waste and spoilage is high. The societies' payments to indigenous collectors are not as high as those paid by private agents. The default rate on loans made to indigenous collections is high and jeopardizes liquidity. Poaching and smuggling of minor forest produce on tribal lands remain widespread as the result of limited regional authority of the LAMPS over nontribal lands. Honey prices are fixed and do not account for quality grades. Flexible economic policies and efficient and modern operating capacity are needed to make the LAMPS more viable in serving the needs of local indigenous people.

This article highlights the importance of integrated economic policy in programs designed to use nontimber forest products as instruments for rural economic development.

Keywords: Cooperatives, indigenous people, loan default, marketing, pricing, value-added processing, wild honey, India.

Chandler, R.F.; Hooper, S.N.; Harvey, M.J. 1982. Ethnobotany and phytochemistry of yarrow, *Achillea millefolium*, Compositae. Economic Botany. 36: 203-223.

Reports on the Native American medical uses of yarrow (*Achillea millefolium* species complex) for treating bruises, sprains, and swelling; healing wounds; and relieving rashes. It is useful also in decorative gardens and is purported to have insect-repellent properties. A description of prominent chemical compounds forms the main emphasis of the article. The existence of multiple genotypes of *A. millefolium* may explain the diversity of medical uses of the plant among different folklore traditions.

Keywords: Horticultural plants, medicinal plants, phytochemistry, yarrow.

Chandrasekharan, C. 1994. Issues involved in the sustainable development of non-wood forest products. In: Commonwealth Science Council. Non-wood forest products: proceedings of a regional consultation for English-speaking African countries; 17-22 October 1993; Arusha, Tanzania. Series CSC(94)AGR-21, Tech. Pap. 306. Rome: United Nations, Food and Agricultural Organization. 22 p. [+ appendix].

Covers majors constraints and areas for future action in sustainable development of nonwood forest products in Africa. Factors constraining development of products include neglect and omission of nonwood products from programs for economic development; the need for scientific forest management and conservation; resource depletion stemming from intense exploitation and inappropriate regulation and economic incentives; loss of habitat from land use changes; lack of stability and reliability of product supplies and lack of enduring markets; a lack of processing and storage technology and facilities; lack of research, technology, and information for nonwood forest products; absence of inventories; and a lack of clear and appropriate policy support for development of these products. Integrated management furnishes a more holistic view by combining indigenous silvicultural practices and conventional forestry for a broadened definition of sustainable production of goods and services from forest ecosystems. In multi-product forest management, the need for compromise and compatibility is central. Questions about conservation, domestication of wild plant stocks, and joint management with watershed protection services are important to optimizing societal benefits. Nonwood forest products give indigenous forest dwellers a competitive advantage in situations where they may be otherwise economically disadvantaged, and these products provide work for all members of a household to maximize possible incomes and benefits of improved health and nutrition. The author suggests the following steps be taken to promote fuller development and use of nonwood forest products: inventory and assess products in selected priority areas; promote domestication of wild species; improve harvesting efficiency and control negative

impacts of harvesting with more sophisticated management; develop value-added local processing of nonwood products; develop new products, improve old products, and develop markets; establish comprehensive databases linked to management and marketing; and provide extension support, credit on easy terms for new business enterprises, and incentives for targeted groups to accomplish key objectives.

Keywords: Sustainable development, indigenous people, barriers, Africa, policy.

Chaney, Constance. 1990. Managing wild blueberries for recreation on the Chippewa National Forest. Cass Lake, MN: Chippewa National Forest. 27 p. [+ appendix].

Reports on surveys conducted in 1989 of 131 local blueberry (*Vaccinium angustifolium* and *V. myrtilloides*) pickers about sites preferred for picking. Data were collected on time spent picking per trip, number of picking trips, quarts picked per season, distance willing to travel, and distance willing to walk. Pickers desired sites that were productive, accessible, and easy to find. Most pickers were over 55 years old, and those under 55 usually had children accompanying them. Frequently cited reasons for picking were the recreation of finding berries, gathering a natural food, and being outdoors.The Chippewa National Forest Plan includes projects to burn sites to encourage new and more productive growth of native blueberries, usually on 4- to 5-year cycles in early spring or late fall. Local researchers and managers defined sites suitable for management and methods for promoting productivity. The author suggests that berry sites be monitored for harvest use to control overcrowding and over-harvesting and that plots be established to accomplish monitoring. A copy of the survey used is provided in the appendix.

Keywords: Berries, dispersed recreation, user preferences, site selection, demographics.

Chang, S.T.; Hayes, W.A., eds. 1978. The biology and cultivation of edible mushrooms. New York: Academic Press.

Cheng, T.H. 1965. Utilization of wild plants in communist China. Economic Botany. 19(1): 3-15.

Provides data on harvest amounts and species of wild plants in China.

Keywords: Wild plants, China.

Cherkasov, A. P. 1988. Classification of nontimber resources in the USSR. In: Bannine, I; Raatikainen, M., eds. Proceedings of the Finnish-Soviet symposium on nontimber forest resources; 25-29 August 1986; Jyväkylä, Finland: Acta Botanica Fennica. 139: 3-5.

A classification scheme in the USSR is proposed for vegetation, including wild fruits and mushrooms, honey plants, medicinals and forage; wildlife, including

game animals and ecologically significant vertebrates and invertebrates; and environmental conservation and social uses, including climate regulation and recreation. Important nectar-producing plants are red raspberry (*Rubus idaeus*), fireweed (*Epilobium* spp.), willow (*Salix* spp.), *Viburnum* spp., and mountain ash (*Sorbus* spp.). Fireweed may yield up to 350 kg/ha of honey, and willows can yield up to 150 kg/ha. The author analyzes the economic value of selected nontimber products, providing volume and some monetary value estimates for edible plants, mushrooms, honey, forage for livestock, and game animals and concludes that nontimber values make up about 50 percent of the total economic value in commercial forests and 93 percent of the total value in a protected forest.

This brief article provides an overview of products commonly harvested in the former USSR and that could be adopted in the Pacific Northwest. Of particular interest are the honey-producing plants, which occur or have congeners that occur in the Pacific Northwest.

Keywords: Berries, production, economic uses, honey, total value, wild edible plants, medicinal plants, wild edible mushrooms.

Cherkasov, Aleksey; Mironov, Konstantin; Shutov, Vasiliy. 1993. Response of the berry plants of the genus *Vaccinium* to anthropogenic stress in the European southern taiga of Russia. Aquilo Ser. Bot. 31: 9-12.

Reports on ecosystem management experiments from 1980 to 1990 involving overstory cutting, site draining, and prescribed fire to test their respective effects on the productivity of lingonberry (*Vaccinium vitis-idaea*), whortleberry (*V. myrtillus*), bog blueberry (*V. uliginosum*), and small cranberry (*V. oxycoccos*). Regeneration of the first two species are adversely affected by clearcutting of forests and the subsequent mineralization and mixing of soil layers. As much as 60 years may be required to reestablish lost productivity of these species. Bog blueberry and cranberry generally respond with increased yields after clearcutting.

Thinning naturally regenerated birch (*Betula* spp.) stands caused lingonberry to begin flowering and fruiting, and the bog blueberry crop more than tripled within 3 years relative to unthinned controls. Lingonberry appears within 7 to 8 years of draining mire sites, and high yields of berries occur after more than 15 years. Moderate draining improves bog blueberry yields but excessive draining causes drier site species to take over a site. Cranberry growth is best in areas of undrained bogs. Major factors in the composition and productivity of berry plants in drained sites are weather conditions during the growing season, forest canopy closure, and the level of the water table.

Fire response differs among the berry species. Whortleberry and lingonberry regenerate after severe ground fires about twice as fast (in 30 years) as do bog blueberry and cranberry. Fast berry plant regeneration occurs in sites affected by surface fires that are weak or moderate in intensity. In such cases, whortleberry and lingonberry take only 4 to 5 years and bog blueberry and cranberry 5 to 7 years to recover after low fires of moderate intensity. Subsequent abundance of postfire plants exceeds initial levels for at least 10 years as the result of improvements in light availability, humidity, and soil chemistry.

The authors maintain that an awareness of the human-caused impacts on berry plant physiology and reproduction may lead people to reduce forest practices that have an adverse effect on valuable understory products.

Keywords: Berries, forest fires, improvement cuttings, site draining, thinnings, Russia.

Chopra, Kanchan. 1993. The value of nontimber forest products: an estimation for tropical deciduous forests in India. Economic Botany. 47(3): 251-257.

Estimates the value of tropical dry forests in India. Forested land tends to be undervalued because the value of nontimber forest products is poorly documented. The distinction is made between market exchange value (price) and value to the user; the two values may be divergent and indicate imperfect markets or asymmetry between preferences. Exchange value also depends on the distribution of income and property rights. Subsistence users may not assign high exchange value to products that have high-use values. Other notions of value needed for inclusion in an economic analysis are existence value and option value. Existence value refers to the extent to which a resource is irreplaceable or its loss is irreversible.

The article uses a mix of market and nonmarket techniques to derive value of nontimber forest products: change in productivity approach, alternative technology approach, opportunity cost of labor-time approach, experimental data, and secondary data from national accounting. The value of nontimber goods and services from tropical deciduous forests in India is estimated at US$4,035-6,662 per hectare. Nontimber forest products (excluding fodder and fuelwood) account for 9 to 15 percent of the value. Only soil conservation and existence values (the role of the forests in a global context) exceed the value of nontimber forest products.

Keywords: Economic valuation methods, option values, existence values, India.

Christiansen, P. 1969. Schnittgrün—Erfahrungen bei Anbau, Aufarbeitung und Vermarktung in Schleswig-Holstein=Ornamental greenery—experiences in growing, utilizing and marketing in Schleswig-Holstein. Forstarchiv. 40(9): 185-193. In German with English summary.

Points out that rising costs of forest management along with static stumpage prices have prompted forest managers to find new sources of incomes from secondary products such as decorative greens. Prospects for continued economic development are good but must be accompanied with programs for marketing, product improvement, and diversification of products. Many species are involved; for example, spruces (*Picea* spp.), true firs (*Abies* spp.), cedars, eastern white pine (*Pinus strobus*), northern red oak (*Quercus rubra*), and European mountainash (*Sorbus acuparia*). Preferred species that originate in the Pacific Northwest are noble fir (*Abies procera*), Pacific silver fir (*A. amabilis*), and Douglas-fir (*Pseudotsuga menziesii*). At present, most decorative greens are produced in Denmark. The German contribution of conifer greens to the German markets is still modest and consists mostly of Douglas-fir and Norway spruce (*Picea abies*).

The author covers management questions about single- and joint-use of stands for ornamental greens and timber. Most stands grown for greeery usually have no more than a 25-year rotation. With ample fertilization, harvests can begin in year 6 and be repeated on a 2- or 3-year cycle. Tools and practices (for example, topping) are described. Schedules and techniques for combined wood and bough production are suggested, but in most cases monocultures are advisable for best yields. Costs of stand establishment of exotic species for bough crops are DM3600-4500/ha and annual management costs average DM300-500/ha. Soil and fertilizer requirements for specific species are described. Planting with 2- or 3-year-old trees is recommended. Details of planting, protection measures from frost, drought, and animal damage, and stand care are provided. Suitability of the stock origin to the planting site is emphasized. Also, market considerations are important; for example, Douglas-fir with foliage having a bluish cast (from the Fraser Valley in British Columbia) has a higher market value than that from other sources.

The section on usage and marketing describes the market niches for products (graveside plantings, ornamental greenery for wreaths, pieces for floral arrangements, and boughs) and specifies the market standards for these products. Volume of decorative greens in the Hamburg wholesale market amounts to more than a DM1 million yearly for just the true firs, spruces, and Douglas-fir.

Keywords: Conifer greens, Germany, production, marketing.

Christensen, Paul. 1982. Production and marketing of Christmas trees and decorative greenery in Denmark. American Christmas Tree Journal. 26(4): 42-45.

Reports on Denmark's leadership role in European production of Christmas trees and conifer greens. Profits from these products constitute 25 to 30 percent of the profit in the Danish private forestry sector, and two-thirds of the production is exported, primarily to Germany (80 to 90 percent of the export total), Austria, Sweden, and The Netherlands. Between 1960 and 1980, exports rose from 6000 tonnes to more than 23 000 tonnes. Noble fir (*Abies procera*), introduced into Denmark after World War II, is used principally for decorative greenery. Details of stand preparation, planting, weed control, spacing, fertilization, and harvesting are given for decorative greenery. Normally one whorl is cut off each year, either the fourth or the fifth whorl from the top. Initial harvesting occurs when trees are 8 to 10 years old. Noble fir is much less subject to deer browse than is Caucasian silver fir (*A. nordmanniana*), the other major ornamental conifer species. Demand for better and more uniform quality is rising. There is a need to expand export markets in Europe. Labor is generally inadequate, although national unemployment is high.

This article surveys the role of Denmark as a competitor to the Pacific Northwest in the sale of decorative conifer greenery. Details of Danish methods for growing noble fir stands may be instructive for more intensive management of North American stands.

Keywords: Conifer greens, export markets, stand management, Denmark.

Ciani, Adriano. 1990. Il circuito commerciale del tartufo in Italia. In: Bencivenga, M.; Granetti,B., eds. Atti del II congresso internazionale sul tartufo; [dates of meeting unknown]; Spoleto, Italy. Spoleto, Italy: Comunità Montana dei Monti Martani e del Serano: 621-631. In Italian with English summary.

Analyzes the unique economic position of truffles (*Tuber* spp.) in Italy. Truffles are attractive products for marketing because they are cherished by affluent consumers and are relatively rare. Production is variable and seasonable, thereby causing sharp fluctuation in prices. Between 60 and 80 percent of the national harvest is packaged, canned, or dried. Marketing truffles in Italy is a virtual monopoly. Increasing quantities of product have not meant lower prices in domestic markets.

Low productivity, poor job opportunities, and depopulation continue to plague rural Italy. Increasing agroindustrial production of truffles is part of a broad strategy to raise the standard of living of rural people, but this can be accomplished only if monopoly power is diminished. One alternative is commercial associations of truffle producers to gain more producer control over markets. Technical innovations are needed to improve the short-term packaging of fresh truffles and to expand processing capacity for long-term packaging. Truffle growers will have to become more business oriented in promoting and marketing truffle products.

In export markets, Italy competes strongly with France for the black truffle markets in Germany, France, Switzerland, and the United States. White truffles, which are less well known, are exported mainly to restaurants in the United States. Export markets will likely continue to expand.

This article describes the development and use of the truffle industry for rural development through more concerted production and producer market power. Analogous development of the Oregon white truffle (*Tuber gibbosum*) crop might also have similar capacity to promote rural development in the Pacific Northwest.

Keywords: Commercialization, domestication, marketing, monopoly, producer associations, processing, technological innovation, truffles, rural development, Italy.

Cizek, Petr. 1993. Guardians of Manomin: aboriginal self-management of wild rice harvesting. Alternatives. 19(3): 29-32.

Chronicles comanagement efforts over the last 15 years between the Canadian government and aboriginal representatives in Ontario. Comanagement has become an increasingly common mechanism for dealing with multijurisdictional management issues, such as migratory species or large-scale projects. Aboriginal management is likely to become an issue in wild rice *(Zizania* spp.), which has been controversial since the 1970s when nonnative harvesters began harvesting commercial quantities using airboats rather than traditional canoes. The conflict came to a head in 1979 when the Ontario Ministry of Natural Resources issued a wild rice permit to an entrepreneur under the authority of the Wild Rice Harvesting Act. Both native and nonnative harvesters in the area joined forces to pressure the Ministry to revoke the license. When it became clear that the Ministry would continue to issue permits, local harvesters created the Indian, Métis, and Settlers Wild Rice Association and requested that it be granted sole harvesting rights to the

stand under dispute. In 1982, the association was granted an annual harvest permit to the area.

Long an important wild food among native North Americans, wild rice stands have degraded with rising water levels, increased pollution, and the use of motorized airboat harvesters. A new threat in the form of recreational speedboats has recently emerged. Presently the future of the rice stands is unclear, as the Ministry of Natural Resources has refused to restrict either motorboat size or access to Mud Lake.

The author argues that an indigenous resource management regime would lead to sound management of wild rice at Mud Lake. The author proposes that a decision-making body consisting of provincial representatives and wild rice harvesters be established to develop and carry out a habitat management plan. This would be a new direction in comanagement, as it would be the first time the Ontario government has entered into an agreement with off-reservation Indians and Métis.

Keywords: Comanagement, wild rice, wild edible plants, user conflicts, local knowledge, Canada.

Clay, Jason. 1992. Some general principles and strategies for developing markets in North America and Europe for nontimber forest products: lessons from Cultural Survival Enterprise, 1989-1990. Advances in Economic Botany. 9: 101-106.

States general principles and strategies needed for developing markets for non-timber forest products. Practical experiences in the first years of a nongovernment organization's operation in tropical forests illustrate the following principles: begin with products that already have markets, diversify production, diversify markets for both raw and processed forest products, add product value with local processing which otherwise would be captured elsewhere, expect to make a decent profit and not a "killing," and emphasize certification of environmental sustainability.

Keywords: Market development, tropical forests, certification.

Cohen, Kathryn A. 1989. Wrangell harvest study: a comprehensive study of wild resource harvest and use by Wrangell residents. Juneau, AK: Alaska Department of Fish and Game, Division of Subsistence. 114 p.[+ appendices].

Documents the harvest of wild food resources by Wrangell, Alaska, residents. Local natural history, culture, and demography of residents are presented as a backdrop for present harvest activities. In 1987, 57.5 percent of Wrangell households engaged in berry harvesting, and each participating household harvested an average of 11 lb of berries. Forty percent of gathering households shared some of their harvest, and 23 percent of all households received those berries. Berry consumption was nearly twice as high as use of all other plants combined. This study is the result of a collaboration among the Alaska Department of Fish and Game, the USDA Forest Service, and the Institute for Social and Economic Research at the University of Alaska. The survey consisted of a structured questionnaire and detailed mapping of harvest areas. The appendices are valuable as templates for conducting similar studies in the Pacific Northwest.

Keywords: Alaska, berries, gathering, hunting.

Columbia Pacific Resource Conservation and Development Council. [no date]. Agroforestry business plan. Seattle, Washington: Tradec.

Presents a preliminary business plan for the establishment of an agroforestry cooperative serving Gray's Harbor, Mason, Pacific, and Wahkiakum Counties in Washington State. Although the special forest products industry generates US$60-70 million in annual sales in the Pacific Northwest, 80 percent of the products are distributed out of the region and larger companies are responsible for most of the sales. Small businesses have difficulties meeting the quantity demands of buyers, and therefore have trouble competing successfully. The establishment of a cooperative will allow small firms to aggregate sales and meet buyer demands. The completed business plan will determine the optimal type of cooperative, evaluate the facility needs, and provide a detailed marketing strategy and financial analysis of the proposed cooperative.

Keywords: Agroforestry, cooperative, Gray's Harbor County, Mason County, Pacific County, Wahkiakum County, Washington.

Columbia-Pacific Conservation and Development Council. [no date]. Agroforestry: community concerns about special forest products in Mason County. Shelton, WA: Washington State University Cooperative Extension, Mason County. 1 p.

Outlines problems related to special forest product harvesting in Mason County, and discusses proposals to address these problems and concerns.

Keywords: Resource conflicts, Mason County, Washington.

Columbia-Pacific Conservation and Development Council. [no date]. Agroforestry: phase II. Shelton, WA: Washington State University Cooperative Extension, Mason County. 4 p.

Summarizes business plan development projects for two agroforestry product lines: floral greenery and specialty vegetables or herbs. Two opportunities are presented for floral greenery: the development of a harvesters' cooperative and a floral greenery supply house. Opportunities in the area of specialty vegetables and herbs include investments in hydrocooling or vacuum-packing capacity and the development of either a central or several feeder greenhouses.

Keywords: Agroforestry, floral greens, specialty vegetables, herbs, producers' cooperatives, Washington.

Columbia-Pacific Conservation and Development Council. [no date]. Agroforestry: tourism development and recreational natural resource harvesting. Shelton, WA: Washington State University Cooperative Extension, Mason County. 3 p.

Describes a proposal to develop the recreational mushroom harvesting industry on the Olympic Peninsula in response to increased interest in this activity. The author estimates the value of recreational harvesting of matsutake to illustrate the

potential economic benefits of targeting recreational harvesters. Promotion of the region as a recreational mushroom harvesting destination would require protection of recreational picking areas from commercial interests; this could be accomplished by setting aside and managing land for recreational harvests.

Keywords: Wild edible mushrooms, recreational harvesting, Olympic Peninsula.

Columbia-Pacific Resource Conservation and Development Council. 1991. Agroforestry 1991 project summary. Shelton, WA: Washington State University Cooperative Extension, Mason County. 3 p.

Presents the findings of the 1991 agroforestry research team, charged with investigating the economic options presented by agroforestry management in Gray's Harbor, Mason, Pacific, and Wahkiakum Counties. Agroforestry holds great promise for a broad-based economic development effort in these counties, and a number of specific recommendations are made for further research.

Keywords: Agroforestry, Gray's Harbor County, Mason County, Pacific County, Wahkiakum County, Washington, economic development, research priorities.

Commeaux, G.; Coujard, J.L. 1981. Contribution à l'étude des modalités de la cueillette et de l'utilisation de la myrtille spontanée=Contributions to the study of types of harvest and utilization of wild whortleberries. In: Productions spontanées: Colloque sur les productions spontanées, 17-20 June 1980; Colmar, France. Les colloques de l'INRA 4. Paris: Institut National de la Recherche Agricole: 17-26. In French.

Analyzes the market for wild whortleberries (*Vaccinium myrtillus*) in France by contrasting berry harvest strategies in two regions. Isolation of individual collectors and the diffuse nature of commercial market structure make general descriptions difficult. Pharmaceutical use and jam production comprise an increasing proportion of the berry harvest. Regional data from the Vosges mountains for whortleberry production are given from 1968 to 1977. Over that time, jam production increased threefold. Major markets are Germany, Switzerland, and the United Kingdom. Imported whortleberries were required to meet national demand after 1974, with Poland, Romania, and Sweden serving as the primary suppliers. Exports have fallen as the result of rising domestic consumption. The rise in price of whortleberries since 1950 is shown to be dramatically higher year for year than the rise in the price of milk, particularly after 1960.

Sociological studies in the Vosges mountains show that 70 percent of families interviewed have at least one family member who takes part in the wild harvest. Housewives and people with multiple jobs comprise most of the workforce. Participating families collect on average 20 to 25 kg of various berry species per year. Gatherers who spend more than 30 hours each season comprise 23 percent of all gatherers and account for nearly 70 percent of the volume collected. Less than 5 percent of the gatherers stated that they gathered to make profit. Generally, income from wild whortleberries is regarded as pocket money and supplemental income. One in three years is a bad whortleberry crop year in the Vosges, so reliance on the crop for income alone is avoided.

In the Massif Central, an entirely different mode of berry harvest has emerged. Harvests amount to between 2500 and 5000 tonnes annually and are crops managed along agricultural models. The harvests may contribute as much as 60 percent of household incomes. Comparative benefits are high relative to grain and cattle farming. This creates potential for resource conflicts between the right to gather for commercial use and the right to gather for personal use.

This article highlights types of sociological research useful for characterizing the population of nontimber forest product gatherers in the Pacific Northwest. Alternative harvest strategies provide diverse benefits.

Keywords: Agricultural crops, berries, economic analysis, harvest data, markets, patterns of resource development, price series, resource conflict, France.

Coujard, J.L.; Commeaux, G. 1981. Les déterminants des modes de mise en valeur des “productions spontanées”=Factors determining valuation of “spontaneous productions.” In: Productions spontanées. Les colloques de l’INRA 4. Paris: Institut National de la Recherche Agronomique: 7-15. In French.

Surveys the social evolution of collecting nontimber forest products in France. The value of many forest resources lies in their future use as well as their present use. Foraging for forest fruits and fungi is largely a vestige of past necessity in France to provide subsistence goods. Forest products that appeared “spontaneously” without cultivation provided a means for people to evade the economic limits of medieval social regimentation and regulation of food production. With the advent of an industrialized and urbanized society, nontimber forest products lost their significance as basic elements of existence. Increasingly, collecting became restricted to the most marginalized and poorest rural people. A recent rise in the demand for nontimber forest products represents a shift away from subsistence use toward recreational markets. This new context stems from a desire among affluent, urbanized people to reestablish contact with nature.

Collecting products often serves to emphasize community solidarity and also increasingly serves a symbolic function. The potential for conflict is heightened and the sources of conflict are novel: conflict usually occurs among competing interests for either commercial or subsistence use, but increasingly conflict occurs between symbolic users (recreational or tourist use) and material users (subsistence and commercial use). Trespassing and overharvesting by “strangers” occurs. The authors advocate a systematic market-based distribution of rights to prevent abuses in which preferential rights are granted for specific areas to collectors of nontimber forest products. To achieve a sustainable supply for commercial distributors, gatherers would limit their harvest volumes and, for doing so, retain an exclusive right to gather at a site. The authors analyze the different origins of user groups of special forest products in a postindustrial society and describe causes of conflict about resource use. These analyses may have parallels in the Pacific Northwest.

Keywords: Harvesting, policy formulation, resource use rights, resource conflicts, social norms, France.

Couture, Marilyn Dunlap. 1978. Recent and contemporary foraging practices of the Harney Valley Paiute. Portland, OR: Portland State University. 132 p. M.S. thesis.

Coville, Frederick V. 1897. Notes on the plants used by the Klamath Indians of Oregon. Contributions from the U.S. National Herbarium. 5: 87-108.

Recounts information obtained from several Klamath Tribe members over 3 days in 1896 about traditional uses of lichens and vascular plants. Accompanying each plant is the Klamath language name and details of the preparation, social significance, and distribution of the plant in the Klamath region. This is the first published ethnobotanical work from the Pacific Northwest.

Keywords: Wild edible plants, indigenous uses, dye plants, basketry and weaving, medicinal plants, Klamath Indians, lichens.

Cronemiller, Lynn F.; Woods, John B. Jr.; Ladd, Charles H. [and others]. 1950. Secret treasures in the forest. Bull. 14. Salem, OR: Oregon State Board of Forestry. 47 p.

Surveys minor forest products and opportunities for employment in Oregon in minor forest products. Value of minor products is estimated at US$5 million annually. Christmas season byproducts include greenery boughs, cones from conifers, and Pacific mistletoe (*Phoradendron villosum*) from Oregon white oak (*Quercus garryana*).

Directions are given for establishing and caring for cascara plantations and proper techniques for peeling and storing cascara (*Frangula purshiana*) bark. Other commercially significant medicinal plants are purple foxglove (*Digitalis purpurea*), Oregongrape (*Mahonia* spp.), lady's slipper (*Cypripedium* spp.), and prince's-pine (*Chimaphila umbellata*). The chapter on decorative greens details harvests for western swordfern (*Polystichum munitum*) and evergreen huckleberry (*Vaccinium ovatum*). Tree moss is used for hanging baskets and packing material. Cutover and otherwise denuded forest lands can be used for bee pasture. Fireweed (*Epilobium* spp.) is the prime source of nectar, but there is concern by apiarists that nectar flow from fireweed is generally declining. Other useful plants for food are blackberries (*Rubus* spp.), Klamath plum (*Prunus subcordata*), and wild huckleberries (*Vaccinium* spp.).

Entrepreneurs are cautioned to obtain landowners' permission, secure permits for harvesting forest tree products (such as cascara and conifer boughs), and pay yield taxes. Required permits differ in eastern and western Oregon. A system of farm foresters jointly funded by the USDA Forest Service and the state forestry department provides advice to landowners from regional offices in western Oregon. District fire wardens provide comparable service elsewhere in the State.

Keywords: Oregon, value, employment opportunities, conifer greens, floral greens, cones, medicinal plants, honey, wild edible plants.

Cunningham, A.B. 1991a. Development of a conservation policy on commercially exploited medicinal plants: a case study from southern Africa. In: Akerele, Olayinola; Heywood, Vernon; Synge, Hugh, eds. The conservation of medicinal plants: Proceedings of an international consultation; 21-27 March 1988; Chiang Mai, Thailand. Cambridge, UK: Cambridge University Press: 337-358.

Describes the conditions leading up to the need for policies to protect commercially important species in Natal Province, South Africa. Overexploitation of medicinal forest plants affects the poorest people of a community first, as they often are the people who do the collecting. Reducing harvesting rates of endangered wild populations is critical for recovery and future sustainability. Necessary alternative sources of medicinal plants stocks are possible from sustainable management units, plant salvage and transplanting efforts, and large-scale cultivation. The latter option must offer plant supplies at a lower cost than wild sources. Habitat conservation, education to reduce plant damage, and domestication are important goals.

Keywords: Medicinal plants, development policies, plant conservation, habitat conservation, domestication, education, South Africa.

Cunningham, A.B. 1991b. Indigenous knowledge and biodiversity: global commons or regional heritage? Cultural Survival Quarterly. 15(3): 4-8.

Likens indigenous knowledge of tropical plants to patentable knowledge in the industrial world. Ethnobotanists and anthropologists essentially function as brokers among knowledge communities, but little attention has been paid to who gains and loses from this knowledge flow. To date, the benefits have largely flowed one way. Professional societies have begun to recognize the ethical dimensions of their work and have started to establish codes of ethics to regulate how indigenous knowledge holders are compensated.

The author suggests several mechanisms for ensuring that more of the value of these resources rest with their owners. One mechanism is to strengthen the role of traditional medicine within primary health care systems. A second is to provide royalties to holders of traditional knowledge. The author also advocates product labeling as a means for getting wider recognition of the value of these resources and the development of formal reciprocal links between traditional specialists and researchers. Patents are less likely to be useful because much of the knowledge is already partially in the public domain, which makes patent enforcement difficult. Legal contracts are favored, though people need to be aware that relatively few products are ever commercialized on a large scale. The ethnobotanist could play a critical brokering role by helping negotiate agreements between traditional healers and drug companies, and by helping to establish recordkeeping systems that prevent “poaching” of indigenous knowledge.

Keywords: Intellectual property rights, medicinal plants, local knowledge, labeling, patents.

Davis, G.W. 1992. Commercial exploitation of natural vegetation: an exploratory model for management of the wildflower industry in the Fynbos Biome of the Cape, South Africa. Journal of Environmental Management. 35: 13-29.

Chronicles the rapid expansion of the wildflower industry in South Africa. The lack of harvest regulations threatens water quality, ecotourism, and the survival of a number of threatened and endangered plant species. Little scientific information exists that would help resource managers develop policies supportive of an economically and ecologically viable wildflower industry. To address this lack, the author has developed a model that can be used to model the flow of material from the veld to consumer, and the flow of cash from consumer to the veld. The model has been verified for internal consistency, but validation with the real world is not feasible due to lack of basic data on the volumes and values of materials harvested. The author notes that the model is most useful for helping develop a better sense of where information gaps are. The author notes that the biggest gaps are in economic, not biological, data. The author concludes that a monitoring ethic will need to be created if the kind of information needed is ever to be obtained, and he points to Australia's experience with mandatory information forms for wildflower pickers that were instituted during the 1980s as a model for South Africa to follow.

Keywords: Wildflowers, simulation model, wildflower industry, South Africa.

de Beer, J.H.; McDermott, M.J. 1989. The economic value of nontimber forest products in southeast Asia. Amsterdam: Netherlands Committee for the IUCN. 174 p.

Discusses the market aspects of trade and household economies involved in rattan (*Calamus* spp.) collection in southeast Asia. Local populations involved in gathering rattan and labor arrangements are identified. The authors also describe middlemen, such as small traders, shopkeepers, trade boat operators, and the networks, that supply rattan. Market structure and the generation of local economic value at the rural level also are characterized. Decentralization of the industry is widespread with production of goods often occurring inside homes and with simple technology; neither one requires much in the way of capital inputs. Production is seasonal, occurring when agricultural crops require less labor. Rattan weaving is a part-time activity, often done at night. Value-added processing at the local level is generally of three types: rudimentary processing of raw products before export, manufacture of products for local markets, and production of high-quality products for sale outside local markets. Products originally intended for private use have found markets in urban areas and among tourists.

Factors affecting the economy of nontimber forest products in Southeast Asia include widespread deforestation and degradation. Agricultural and export cash crops in an increasingly commercialized rural economy compete with nontimber forest products for land and labor. Government policies, particularly in Indonesia, aimed at resettling people fundamentally change land tenure arrangements and hasten the decline of traditional management systems. When supplies of nontimber forest products decline, people may allot more time to collecting (with decreased unit returns to labor), allot more time to alternate activities such as farming, wage labor, and so forth, evolve new management systems, shift activity to less depleted areas, or abandon nontimber forest product collecting altogether.

Value of nontimber forest products is often unstable because uses for products fall out of favor, knowledge about their collection is disappearing, synthetic substitutes are increasingly preferred, and changes in dietary preferences develop. Individual households change their economic uses of nontimber forest products and allocation of labor in response to changes in a variety of environmental, commercial, cultural, and personal factors. Impacts of changes on rural welfare also are discussed.

The authors advocate improvements in forest resource management that include increased attention to managing nontimber forest products; improved methods of harvest, storage, transport, and processing; increased processing and manufacturing near the forest source; improved marketing; diversification of products; integrating forest species into agricultural and agroforestry systems; greater attention to conservation and restoration of nontimber forest products; improved accounting of production, consumption, and trade; and increased investment in research and extension.

Keywords: Southeast Asia, economic value, households, rattan, value-added processing, basketry, weaving, furniture.

de Geus, N. 1992. Wild mushroom harvesting discussion session minutes. In: Proceedings of a conference on wild mushroom harvesting; 3 March 1992; Victoria, BC. Victoria, BC: Ministry of Forests, Integrated Resources Branch. 47 p.

Summarizes the proceedings of a 1-day conference on commercial harvesting of wild mushrooms in Canada. The stated purpose of the conference was an exchange of information among representatives of the mushroom industry, researchers, and government agencies. Summaries of three formal papers and the question and answer sessions that followed each session are presented, followed by minutes of an open forum, which included specific concerns of the Vancouver Mycological Society, the Canadian Wild Mushroom Association, the immigration section of the Royal Canadian Mounted Police, First Nations representatives, and the British Columbia Ministry of Environment, Land and Parks. The three formal papers were “History of picking and selling matsutake in Canada,” presented by Graham Howard; “Studying the effects of harvesting on chanterelle productivity in Oregon’s Mt. Hood National Forest,” presented by Lorelei Norvell, University of Washington; and “An overview of commercial harvesting in Canada,” presented by Scott Redhead, Agriculture Canada. The open forum included discussions on the socioeconomic impacts and benefits of mushroom collecting, conflicts between mushroom pickers, options for regulation, Canadian immigration regulations for foreign pickers and buyers, long-term effects of harvesting, and various other topics.

Keywords: British Columbia, wild edible mushrooms, regulation.

de Geus, Nelly. 1993. Agroforestry industry in British Columbia: identification of issues, responsibilities and opportunities for the Ministry of Forests. Victoria, BC: British Columbia Ministry of Forests, Integrated Resources Branch. Draft manuscript. On file with**:** Nelly de Geus, Integrated Resources Branch, BC Ministry of Forests, 1450 Government St., Victoria, BC V8W 3E7.

de Geus, Nelly. 1995. Botanical forest products in British Columbia: an overview. Victoria, BC: British Columbia Ministry of Forests, Integrated Resources Policy Branch. 51 p.

Provides an overview of botanical forest products harvested in British Columbia, examines relevant issues, and provides recommendations for managing the industry. In addition, the report overviews the harvesting of botanical products in other jurisdictions, such as the Pacific Northwest and Minnesota.

In British Columbia, nontimber forest products are divided into special forest products, such as fence posts, rails, shakes, utility poles, and Christmas trees, which are regulated, and unregulated botanical forest products. This report focuses on the latter category, examining 211 botanical products divided into eight categories: wild edible mushrooms; floral and greenery products; medicinal and pharmaceutical products; wild berries and fruit; herb and vegetable products; landscaping products; craft products; and miscellaneous botanical forest products. For each category, the author examines uses, markets, distribution, ecology, and harvesting practices in other jurisdictions. The report concludes with resource issues and recommendations, which address sustainability, multiple forest resource use, revenue to government, social and economic factors, health and safety, and interagency coordination. This report is an excellent synthesis of information on the state of the botanical products industry in British Columbia with highly readable and informative charts. Charts include name, use, and market for each species as well as summary information on 1993 pine mushroom (or American matsutake, *Tricholoma magnivelare*) harvest, Japanese matsutake production, import and consumption from 1950 to 1988, and 1991 redcedar foliage harvest for essential oils.

Keywords: British Columbia, wild edible mushrooms, floral greens, medicinal plants, berries, wild edible plants, horticultural plants, craft products, essential oils, matsutake, markets, distribution, regulation, policy.

Delmas, J. [1987]. La cueillete des “champignons sauvages” et la loi=Harvesting wild mushrooms and the law. [Place of publication unknown]: [Publisher unknown]. 15 p. In French.

Surveys the legal foundation of French law regarding the gathering of wild edible mushrooms. Private property rights are affirmed for the ground itself and for goods derived out of the ground. Legal aspects of three types of harvest are considered: harvests for commercial sale (with each *département* responsible for defining what species may be harvested at which seasons), free harvests from access granted by the landowner in quantities determined at the discretion of the landowner, and harvests for family consumption, where the definition of family is vague and the possibility of abuse high. Laws are promulgated at the departmental, prefectural, and municipal levels.

Keywords: France, wild edible mushrooms, law, private property rights.

Denison, W.C.; Donoghue, J. 1988. The wild mushroom harvest in the Pacific Northwest: past, present and future. [Place of publication unknown]: [Publisher unknown]. 15 p.

Identifies the special forest products industry as having significant potential for the Pacific Northwest. For the industry to grow and thrive, though, regulation is needed to address the conflicts among different groups of mushroom harvesters, to satisfy public health concerns, and to return a portion of the mushroom income to landowners. Without financial returns to landowners from mushroom harvests, there is no incentive to manage forests for the simultaneous production of mushrooms and timber production, and no incentive to invest in the continued long-term health of the wild mushroom industry. Five recommendations are offered.

Keywords: Pacific Northwest, wild edible mushrooms, regulation, incentives.

Denison, W.C.; J. Donoghue. 1992. Regulating the wild mushroom harvest. [Place of publication unknown]: [Publisher unknown]; report to the Committee on Sustainable Forestry, Oregon State University,Corvallis; OR; May 12, 1992. 12 p.

Explores various rationales for regulating the wild mushroom harvest, including protecting public health, protecting future mushroom crops, ensuring landowners are fairly compensated for resources taken from their lands, and protecting the public's right to enjoy public forests that have not been harvested commercially. Existing regulation—both formal and informal—in the areas of public health, conservation, land tenure, and economic issues is reviewed. Finally, several conclusions and recommendations are made regarding adoption of research programs, inspection, uniform revenue distribution practices, and categories of forest land that should be exempt from commercial mushroom harvests.

Keywords: Wild edible mushrooms, regulation.

Douglass, B. 1970. Special forest products: 1969 harvesting report, Oregon and Washington. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region, Division of State and Private Forestry. 39 p.

Summarizes volumes and values of special forest products harvested in Oregon and Washington in 1969. This is the second in a series of reports on special forest product harvests produced every 5 years; the first report summarized harvest activity for 1964. The report was compiled by county and includes information on special forest products that are harvested commercially, such as Christmas trees and boughs, floral greenery, native transplants, wild fruits, medicinals, forest seed cones, fuelwood, decorative woods, split cedar products, and small roundwood products. Recreationally harvested products, such as mushrooms and edible greens, also are described. Special forest products yielded about US$15 million in annual income to harvesters in Oregon and Washington in 1969. The report contains fairly detailed descriptions of the distribution and use of the products covered as well as harvest data.

Keywords: Oregon, Washington, harvest volume, economic value, harvest data, distribution, use, Christmas greens, floral greens, horticultural plants, medicinal plants, cones, decorative woods, wild edible mushrooms, wild edible plants.

Douglass, Bernard S. 1975. Floral greenery from Pacific Northwest forests. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 35 p.

Surveys supply and demand trends, advises harvesters about prerequisites for selling to processors, and describes the cultural practices and conservative harvest techniques for evergreen huckleberry (*Vaccinium ovatum*), salal (*Gaultheria shallon*), and western swordfern (*Polystichum munitum*) for use as floral greenery. Includes some discussion of minor floral products, including scotchbroom (*Cytisus scoparius*), Port-Orford-cedar (*Chamaecyparis lawsoniana*), redwood (*Sequoia sempervirens*), and boxleaf myrtle (*Paxistima mysinites*). Changing tastes alter market demand for products over time. Conifer boughs are used mostly (80 percent) during the Christmas holiday season. Processors must stockpile materials of shrubby species before late May and June, when new plant growth is forming and is unsuitable for picking. Western true fir (*Abies* spp.) and cedar (*Chamaecyparis* spp., *Calocedrus decurrens*, and *Thuja plicata*) boughs must compete against Eastern species. Transportation costs can be critical. Increased salal harvests have come from British Columbia to meet rising demand, capturing one-third of the total market in 1972. Western swordfern production has been in decline since 1947 with major competition from ferns with similar appearance from Florida, Mexico, and Guatemala.

Harvesters are cautioned to obey laws and landowners' wishes, to enter into formal contracts for gathering, to obtain necessary permits, to use efficient transportation, equipment, tools, cutting techniques, and clothing, and to store floral greens appropriately before delivery. For landowners, coordination of floral green production with timber management goals and use of fertilizers is recommended to secure and improve product quality. Data for regional production of the major floral greens are given for 1969 and 1972, and prices for selected species are as of 1972.

Douglass' publication, although dated, is an outstanding introduction to native products and collection practices in the Pacific Northwest floral trade. Updating this volume would be a significant contribution to knowledge of the nontimber forest products in the Pacific Northwest.

Keywords: Conifer greens, harvesting methods, fertilization, floral greens, market demand, market supply, pruning techniques, Pacific Northwest.

Economic Commission for Europe. 1993. The forest resources of the temperate zones: the UN-ECE/FAO 1990 forest resource assessment. Volume II: benefits and functions of the forest. New York: United Nations. 268 p.

Characterizes the role of temperate forests, by nation, in supplying environmental and other nonwood goods and services. Details of nontimber vegetation products were not explicitly solicited. Many countries, however, provided data about edible fungi, honey, berries, nuts, syrups, aromatic and medicinal plants, decorative foliage, wicker cane, and essential oils. Economic values for some products from some nations are given. Respondents from each country describe with varying specificity major nontimber products and frequently provide information about areas of public concern and conflicts between forest functions.

This volume is an invaluable reference resource for an overview of special forest products from temperate regions. The summary from Sweden is particularly valuable for its bibliography about management experiments of *Vaccinium* spp. and economic methods of resource valuation.

Keywords: Aromatic plants, international survey, conifer greens, floral greens, economic valuation, wild edible mushrooms, wild edible plants, essential oils, honey, medicinal plants, nuts, resource conflict, basketry, weaving, Sweden.

Egli, S; Ayer, F.; Chatelain, F. 1990. Der Einfluss des Pilzsammelns auf die Pilzflora: Zwischenergebnisse einer Untersuchung im Pilzreservat “La Chanéaz,” Montagny-les-Monts, FR=The influence of mushroom collecting on the mushroom flora: preliminary results from research in the La Chanéaz mushroom reserve, Montagny-les-Monts, Canton of Fribourg. Mycologia Helvetica. 3(4): 417-428. In German.

Reports preliminary results from a long-term study of mushroom harvests on populations of mushroom species from five blocks. Three treatments were carried out in each block: no harvest and census of all edible and inedible mushrooms sporocarps; census of all edible and inedible mushrooms and plucking edible mushrooms; and census of all edible and inedible mushrooms and cutting all edible mushrooms. Weekly censuses occurred from mid-May to mid-November from 1975 through 1988. Previously counted mushrooms were marked with methylene blue dye. The Wilcoxon rank sum test and cluster analyses were used to test statistical significance. In the study time frame, no significant effects resulted from harvesting or harvest methods (plucking vs. cutting) among the 15 species investigated on the basis of their presence in all three treatments of at least one block. Other negative effects from people were found: populations of fruiting bodies of *Cantharellus lutescens* underwent distinct but reversible declines as the result of trampling, and a colony of *C. cibarius* studied for many years disappeared as the result of a regeneration cut in the stand.

Keywords: Wild edible mushrooms, harvesting effects, forest practices, trampling, Switzerland.

Ehlers, H.-U. 1968. Der Wald als Schmuckgrünlieferant=The forest as supplier of ornamental greenery. Forst- und Holzwirt. 22(24): 528-530. In German.

Characterizes the market and production of ornamental conifer greens in Germany. Consumption of greens averages 5 kg per family per year, amounting to 50 000-60 000 tonnes annually for western Germany. Total yield is 10 000 kg/ha for each harvest, which occurs every 2 to 3 years. The majority of decorative greens comes from The Netherlands and Denmark (10000 tonnes from Denmark in 1967). Major domestic sources are in Schleswig-Holstein and the Black Forest region. Selected uniform, fresh, full foliage in 10-kg bundles is the preferred market quantity. Major urban areas with wholesale foliage and flower markets are Hamburg, the Ruhr region, Frankfurt, Stuttgart, and Munich. Different markets require different dimensions of branches. Noble fir (*Abies procera*) is given the highest grade (first quality extra). Constant observation of market demand is a precondition for profit with boughs and greens. Eastern white pine (*Pinus strobus*) is always in demand, but *Thuja* and *Cupressus* spp. are not as popular. Other popular specialty products

are larch (*Larix decidua*) branches covered with lichens, selected mosses, northern red oak (*Quercus rubra*) branches, holly (*Ilex aquilfoium*), and willow (*Salix* spp.) catkins.

Keywords: Moss, floral greens, conifer greens, foreign trade, Germany, harvest scheduling, lichens, markets.

Ehlers, H.-U. 1970. Schneiden und marktfertiges Bündeln von Schmuckgrün: Erfahrungen und Hinweise aus dem Anbaugebiet Schleswig-Holstein=Cutting and bundling ornamental branches for sale: experiences and tips from Schleswig-Holstein. Forstarchiv. 41(10): 214-216. In German.

Traces the process for market preparation of decorative greens from conifer stands in Schleswig-Holstein. In 1967-68, decorative greens constituted 18.4 percent of the average timber income. Preconditions for profitable harvest are sustainable production of large quantities of decorative greens and constant contact with buyers. Data are provided about best ages for first and final cuttings, minimal tree height for the first bough cut, harvest frequency, optimal stand spacing, and average yield per hectare for many locally grown species: Douglas-fir (*Pseudotsuga menziesii*), *Thuja* spp., *Chamaecyparis* spp., grand fir (*Abies grandis*), and noble fir (*A. procera*). True fir species command the highest prices. In monoculture stands, the product yield is generally greater and has better quality than in mixed-species stands. At harvest, the two or three top whorls and the leader are left on the tree. New branches grow out very quickly and permit another harvest usually within 2 years.

The biggest demand for decorative greens is in late October through December. Organization of the labor force is essential. Average production rates are 250-500 kg per person per day, depending on the type of equipment used. Fresh, debris-free greens are preferred, cut to uniform length and branch diameters, and arranged in 10-kg bundles. Guidelines for storage and shipment of foliage are given. Criteria for grading and sorting for sale to retail outlets also are given.

This article surveys the market for decorative conifer greens in northern Germany and provides guidelines for managing and harvesting species native to the Pacific Northwest and for preparing products.

Keywords: Conifer greens, Germany, grading, harvesting, labor efficiency, packing, sorting.

Eligh, P.K. 1989. The harvesting of edible wild mushrooms in British Columbia. Victoria, BC. British Columbia Ministry of Forests, Integrated Resources Branch.

Elisabetsky, Elaine. 1991. Folklore, tradition, or know-how? Cultural Survival Quarterly. 15(3): 9-13.

Discusses the pharmaceutical use of plants with bioactive compounds. Statistics from the pharmaceutical industry indicate that roughly 7,000 natural compounds are used in modern medicine and 25 percent of the drugs prescribed in the United States contain at least one plant-derived ingredient. In 1985, medicinal plants

accounted for US$43 billion of the estimated US$90 billion value of drugs sold on world markets. Despite the importance of plant compounds in medicine, only a small percentage (2 percent of the vascular plants) have been tested for their medicinal values. Tropical forests are a “hotspot” of biodiversity and likely are repositories of plants with potential medicinal value. Sorting out useful plants is a daunting task. Learning from people who already use such plants (ethnopharmacologists) would considerably reduce production costs and reduce the time needed to research and produce drugs. Elisabetsky notes that traditional remedies are social products whose production requires considerable effort and skill.

The author proposes the formation of joint ethnopharmacological ventures among research laboratories in developed countries and local healers to reduce the costs of drug production and provide incentives for rain forest conservation. The author notes that in destroying the rain forest we lose more than the plants; we also lose the knowledge of those plants, and thus a valuable medical resource. Securing local cooperation is not easy, however, in large part because few of the benefits of such research accrue to local residents. To ensure that indigenous people receive adequate compensation for their knowledge, scientists have argued for legislation that secures intellectual property rights. The author suggests establishing a patent system modeled on utility patents in the United States to compensate healers and local communities for their knowledge and genetic resources.

Keywords: Ethnopharmacology, intellectual property rights, indigenous knowledge, patents.

Ellanna, Linda J.; Sherrod, George K. 1985. Subsistence mapping: an evaluation and methodological guidelines. Tech. Pap. 125. Juneau, AK: Alaska Department of Fish and Game, Division of Subsistence. 266 p. [+ appendix].

Gives theoretical foundations for the research methodologies and variables involved in mapping resource use with special reference to subsistence activities. Mapping is fundamental to understanding the relations among people for resource acquisition. Studies that map gathering activities by people also inform managers about gathering productivity, time constraints for achieving adequate harvests, effects of tenure and access, “predator-prey” relations, optimal foraging strategies, resource valuation, and optimal management scenarios. Knowledge of harvest quantities alone does not provide adequate criteria to assess the socioeconomic benefits to people. Other important features of a map-configured database of wild product harvests include intensity of resource use, changes in use, delineation of group or individual territories. Chapters in this book include a description and evaluation of methods for mapping resource use patterns and yields in North America and guidelines for advancing the process of subsistence mapping in research. Documentation, hypothesis formulation, technical considerations, sampling design, data collection, and data analysis methods are essential to useful subsistence mapping of nontimber forest products. This volume is an outstanding tool for providing direction to monitoring programs in nontimber forest product management.

Keywords: Alaska, mapping, management tools, resource use, subsistence.

Eriksson, L.; Ingelög, T.; Kardell, L. 1979. Blåbär, lingon, hallon: förekomst och bärproduktion i Sverige, 1974-1977=Whortleberry, lingonberry, and red raspberry: distribution and berry production in Sweden 1974-1977. Rapport 16. Garpenberg, Sweden: The Swedish University of Agricultural Sciences. 124 p. In Swedish with English summary.

Summarizes data gathered during National Forestry Surveys from 1974 through 1977 with emphasis on whortleberries (*Vaccinium myrtillus*), lingonberries (*V. vitis-idaea*), and red raspberries (*Rubus idaeus*). Berry pickers accompanied survey crews from 1975 to 1977 to estimate berry production nationally for those years. Historically, berries had little significance in Swedish diets, and berry picking was not considered real work. Berries were most important in times of famine. Trade in berries is known as early as the 1730s, and exports of lingonberries to Germany began about 1900 and continued until World War II. Since then, Sweden has been a net importer of lingonberries. Total annual biological production of berries equls about 500 000 tonnes, but estimates of human consumption of that production range from only 2 to 5 percent.

Forest practices considerably affect the distribution of berry plants and production of berries. Clearcutting drastically reduces the cover of whortleberry shrub biomass to less than 5 percent of the clearcut area. Recolonization occurs as the regeneration stand grows, and whortleberry cover levels off at 22 to 24 percent of total area after year 30. Raspberries, in contrast invade clearcuts and cover 2 to 4 percent of a clearcut area but disappear by year 30.

Keywords: Berries, inventory, survey methods, historical use, clearcutting, management practices, Sweden.

Eriksson, L; Kardell, L. 1980. Murklor—en ekonomisk tillgang?=Morels—an economic asset. Skogsvardsforbunds Tidskrift. 78(5): 21-44. In Swedish.

External Affairs and International Trade Canada. 1990. The mushroom market. Ottawa, ON: External Affairs and International Trade Canada, The Japan Trade Development Division.

Falconer, Julia; Chapel, C.R.S. 1990. The major significance of minor forest products: the local use and value of forests in the West African humid forest zone. Comm. For. Notes 1990/nr. 6. Rome, Italy: United Nations, Food and Agriculture Organization. 232 p.

Underscores the major economic and social importance of so-called minor forest products to rural economies in West Africa. Such products are important both daily and seasonally, allowing people to survive periods of famine and economic hardship. The author cites examples of minor forest product use in Ghana to illustrate how the products fit within the socioeconomic framework of rural communities. Both urban and rural households depend on trade in these products. The market at Kumasi, Ghana, where 700 people are full-time traders of forest products, is described. Demand seems to be increasing, and prices fluctuate radically over the course of a year.

Sustainable-development advocates assume that commercialization of minor forest products is somehow more sustainable than commercial timber production. They also assume that by focusing on increasing the exploitation of minor forest products, rather than timber, local people will benefit more. The author argues that these assumptions are flawed because they focus on the products rather than on the needs of the people, which drive use of the products. The author observes that poor people are more likely to harvest minorforest products, because minor forest products often are located on common areas, the profit margins are low, and their extraction is sometimes difficult. Developing minor forest products thus is a two-edged sword from an economic equity standpoint, because by increasing their value, wealthier people are likely to assert claims over these resources and thus deprive poorer people of access to them.

Keywords: Sustainable development, Ghana, household strategies, trade patterns.

Farnsworth, N. 1988. Screening plants for new medicines. In: Wilson, E.O., ed. Biodiversity. Washington DC: National Academy Press: 83-97.

Points out the continued reliance of U.S. consumers on vascular plants as the active ingredients in about 25 percent of prescribed drugs, representing in excess of US$8 billion in annual pharmaceutical sales. Globally, about 80 percent of residents of developing countries rely on traditional medicines for their primary health care needs, and about 85 percent of this traditional medicine is derived from plant extracts. Despite these facts, no U.S. pharmaceutical firm had an active research plan investigating higher plants as a source for new drugs.

Keywords: Medicinal plants, phytomedicines, indigenous medicines, economic values, pharmaceutical industry.

Farnsworth, Norman R.; Soejarto, Djaja Doel. 1985. Potential consequence of plant extinction in the United States on the current and future availability of prescription drugs. Economic Botany. 39(3): 231-241.

Addresses the question of placing a monetary value on a plant species so that the cost to society of extinction can be calculated. One way is to estimate the pharmaceutical value of a species. In the period 1959-73, an average of 25.36 percent of all prescriptions sampled had one or more chemical compounds derived from higher plants. The total value estimated of plant-derived drug sales in the United States in 1973 is estimated by doubling the amount of drugs sales (valued on average at US$4.13 per prescription) from public pharmacies to include untracked dispensing through hospitals, government agencies, and mail order. This totaled US$3.188 billion. An extrapolated value for 1980 (not adjusted for inflation) was US$8.112 billion. No plant can be wholly discounted no matter how intensively it has been studied for biological effects. The authors assume, however, that 5,000 species of flowering plants have been “exhaustively” researched for potential drugs and only 40 plant species are currently used in the United States as drug sources. Each of the 40 species was thus individually worth US$203 million in 1980. Projected extinction of 16 useful drug plants by 2000 would represent a US$3.248 billion loss.

The authors remark that presumptions of value include much value-added processing and combining with other drugs. American scientists, unlike their counterparts elsewhere, have not traditionally investigated native American flora for their medical properties. Budgets of pharmaceutical companies for research and development are limited, and in 1980 no U.S. drug company had programs to develop new drugs from plants.

Keywords: Economic valuation, medicinal plants, pharmaceuticals, research and development, species extinction.

Farolfi, Stefano. 1990. Ruolo economico dei prodotti secondari spontanei del bosco: un'indagine nel Casentino=The economic role of wild-grown secondary forests products: an analysis in the Casentino region. Monti e Boschi. 41(1): 49-52. In Italian with English summary.

Examines the changing socioeconomic function of collecting wild foods in the face of increased urbanization, the growth of individual wealth, and ample access to substitutable food sources. Use of the principal products, boletes (*Boletus edulis*) and honey mushrooms (*Armillariella mellea*), among residents of two communities in the Casentino region are studied. Although the values of these resources are less than timber and watershed protection, income and benefits from commercial and recreational use of special forest products are significant. Annual harvest amounts and the value of boletes ranged widely over the 3-year study. Only 20 percent was for personal use, the rest going to restaurants, local stores, and wholesalers. The collectors came mostly from middle to lower income classes. Housewives were the most numerous group of collectors, but professional collectors were the most productive. Nearly 45 percent of mushroom collectors were between 50 and 60 years old. This study represents one of the few studies available that characterizes the wild mushroom pickers living in a postindustrial society.

Keywords: Wild edible mushrooms, demography, harvesters, Italy.

Farris, G.J. 1982. Aboriginal use of pine nuts in California: an ethnological, nutritional, and archaeological investigation into the uses of the seeds of *Pinus lambertiana* Dougl. and *Pinus sabiniana* Dougl. by the Indians of northern California. Davis, CA: Department of Anthropology, University of California, Davis. PhD. dissertation.

Fearnside, Philip. 1989. Extractive reserves in Brazilian Amazonia. BioScience. 39(6): 387-393.

Describes the history and formation of extractive reserves to legally protect forest land traditionally used by extractivists or special forest product harvesters. The author cautions against the practice of justifying extractive reserves based on the economic value of the rubber (*Hevea brasiliensis*). The Brazilian government is having trouble maintaining price supports for Amazonian rubber, and tropical hardwood prices are rising by contrast. The author suggests instead that extractivists should diversify and that marketing mechanisms for new products

should be developed. He argues against the strict use of cost-benefit analysis in determining forest use, given the difficulty in estimating the large and uncertain numbers associated with medicinal products. Instead, forest preservation should be a given, from which economic options are considered.

Keywords: Extractive reserves, Amazon, resins, exudates, economic analysis.

Fellows, Linda. 1992. What are forests worth? Lancet. 339: 1330-1333.

Describes one method to assign economic value to a plant species. Full economic value consists of the use value (the current and future utilitarian value of the species) and the nonuse value (the vicarious value that individuals place on the continued existence of a species). Use values may be further divided into direct, indirect, and option values. Direct consumption includes local consumption, use in plant breeding or medicine, and recreation. Indirect uses involve the species' contribution to essential ecological processes, such as nutrient recycling, watershed protection, and air quality. Option values refer to the possibility that a species, as yet without economic use, might have some future value, either direct or indirect. Analyses of value usually treat only direct uses and market values. Underestimates of true value are inevitable under such circumstances.

Plants used in medicine offer one means of forecasting financial benefits foregone when biological diversity is lost. The author cites Peter Principe's work: assuming that 25 percent of known plant species will be extinct by 2050, the foregone benefit from loss by plant extinctions when discounted at 5 percent will amount to US$3-5 billion (1990 dollars). This total refers only to retail drug sales and not to the value of lives saved or extended. The analysis gives an idea of the magnitude of benefits from plant conservation and points to the need to improve methods of analyses for quantifying benefits of ecosystems and their constituent species.

Keywords: Use value, non-use value, direct value, indirect value, option value, biodiversity value, phytomedicines, medicinal plants.

Fischer, Hartmut. 1992. Schnittgrün aus Übersee: Transport per Flugzeug oder Schiffscontainer =Cut greens from overseas: transport by airplane or ship container. Gärtnerbörse und Gartenwelt. 92(39): 1937-1940. In German.

Reports on the German market for imports of floral greens, which is increasing in volume as the variety of marketed cut greens increases. Imports of greens come primarily from the United States (38.1 percent in 1991), Costa Rica (22.7 percent), and Italy (19.8 percent). German and Dutch traders in floral products in turn supply over 85 percent of the total European imports of greens. Imports from the United States are estimated at DM60 million rather than the official figure of DM33.2 million. Import data for individual species of floral greens are not available. Major centers for floral greens in the United States are Florida (tropicals), North Carolina (*Galax* spp. and *Lycopodium*), and the Pacific Northwest (western swordfern [*Polystichum munitum*], salal [*Gaultheria shallon*], beargrass [*Xerophyllum tenax*], huckleberry [*Vaccinium ovatum*], Oregongrape [*Mahonia* spp.], and scotchbroom [*Cytisus scoparius*]). The export activity in the Pacific Northwest is concentrated in Seattle. A costly infrastructure is necessary because the collection area in native forests extends 1200 km from north to south.

Salal and western swordfern are shipped from August to May in refrigerated containers by rail to the U.S. East Coast and then by ship to Europe. From May through July, air transport is used when the greens cannot survive the 3-week voyage without damage. Beargrass is sent by rail and ship year round. Air cost per kilo is DM2.35 versus DM1.10 for containers via land and sea. In 1992, the European Common Market lifted trade tariffs on floral greens from Central America in an attempt to encourage economic development there.

Keywords: Germany, markets, Pacific Northwest, floral greens, transportation routes, transportation costs, Olympic Peninsula.

Fitzgerald, Stephen. 1986. Southcoast Oregon "brush" provides income source for woodland owners. Northwest Woodlands. 2(1): 12-13.

Describes economic options for landowners in managing understory vegetation as an income source between timber harvests. Local buyers purchase floral and Christmas greens and medicinal species and in turn sell them to wholesalers in the Eastern United States. Major floral species in southern Oregon are western swordfern (*Polystichum munitum*), evergreen huckleberry (*Vaccinium ovatum*), salal (*Gaultheria shallon*), and Port-Orford-cedar (*Chamaecyparis lawsoniana*). Major medicinal species are cascara sagrada (*Frangula purshiana*), Oregongrape (*Mahonia* spp.), purple foxglove (*Digitalis purpurea*), prince's pine (*Chimaphila umbellata*), and British Columbia wild ginger (*Asarum caudatum*).

The harvest season begins in midsummer and continues through autumn in a sequential pattern through different forest habitats. Careful picking and pruning improve foliage yields. Joint production with timber is easy and thinning allows for controlling light levels on the forest floor. Salal harvesting occurs mainly from midsummer to early autumn. Prices for salal in 1985 were US$0.55-0.60 per bunch ($1^1/_4$ lb). In 1985 western swordfern prices ranged from US$0.45 to US$0.60 per bunch (52 fronds per bunch). One-fourth to one-third of the fronds from a plant may be harvested without damage to the plant. Port-Orford-cedar is harvested year-round. Good quality foliage sprays were US$0.15 per lb.

Between 1.4 and 1.1 million bunches of huckleberry, salal, and western swordfern were harvested in coastal Oregon counties in 1969 and 1972. One buyer estimates harvests of these species from Coos and Curry Counties alone at US$500,000 annually. Pickers earn US$50-$100 or more per day.

Keywords: Economic value, harvest price, southern Oregon, medicinal plants, floral greens, conifer greens, Coos County, Curry County.

Fleischer, Mark S. 1980. The ethnobotany of the Clallam Indians of western Washington. Northwest Anthropological Research Notes. 14: 192-210.

Documents the ethnobotanical uses of plants by the Clallam people on the northern shore of the Olympic Peninsula. Data are compiled from existing publications and from two Clallam-Salish speakers. Native names for plants are given in an appendix.

Keywords: Ethnobotany, Clallam, Olympic Peninsula.

Food and Agriculture Organization. 1991. Non-wood forest products: the way ahead. For. Pap. 97. Rome, Italy. 37 p.

Calls attention to nonwood forest products as valuable resources for rural communities and vehicles for rural development. Recognition of the important role these products play in providing rural people with food, construction materials, medicines, forage, and other products, as well as cash from the sale of these products, underlines the need to keep forested ecosystems intact. Consequently, the Food and Agriculture Organization (FAO) has recently created a nonwood forest products position, and the Tropical Forest Action Plans being prepared under FAO guidance in 80 countries will incorporate nonwood forest products concerns.

Past interest by the FAO in nonwood forest products has focused on commercial products and has generally ignored nonwood forest products used for subsistence. Community forestry programs, however, have demonstrated that these other products need to be included. The authors recommend that FAO increase collaboration with other international organizations in the nonwood forest product sector. Nonwood forest products have been difficult to address within the FAO structure because they cross sectoral lines (forestry, agriculture, horticulture). Similar difficulties exist within many governmental bureaucracies where some nonwood forest products are considered part of forestry and others are treated as agricultural crops. The diverse nature of nonwood forest products thus requires collaboration among traditionally noncollaborative departments at both the national and international levels.

Governments tend to ignore nonwood forest products because their markets usually are domestic and thus generate less foreign exchange. As a consequence, the contribution of nonwood forest products to the rural economy is undervalued, and little research or monitoring is conducted. However, nonwood forest products are likely to receive more attention in the future, because developing countries often lack the foreign exchange needed to import many products for which locally available nonwood forest products could substitute. As realization grows of the benefits of nonwood forest product development to rural communities, new markets are developing. The green movement in the West, new ethnic markets due to migration, and the growing recognition of the need to retain forested areas also contribute to the growing interest in nonwood forest products.

Keywords: International policy, economic diversification, rural development, Food and Agriculture Organization.

Forests and People. 1989. Weaving pine needles into gold. Forests and People. 39(3): 30-31, 36-37, 40.

Describes the emergence of pine straw baling as an industry in Louisiana. Producers and representatives of government agencies have formed a group, the Pine Straw Industry Work Group, to help catalyze the growth of the industry. Pine straw baling has increased in Louisiana as competition in North and South Carolina has become more intense. The pine straw is used for mulch by commercial and noncommercial users.

Keywords: Pine straw, Louisiana, mulch.

Forlines, David R.; Tavenner, Terri; Malan, Johannes C.S.; Karchesy, Joseph J. 1992. Plants of the Olympic coastal forests: ancient knowledge of materials and medicines and future heritage. In: Hemingway, R.W., ed. Plant polyphenols. New York: Plenum Press: 767-782.

Represents an effort to reconcile the cultural use of forest plants with the present-day needs of science. Indigenous people have used polyphenolic compounds of native plants from the Olympic Peninsula to make dyes, paints, adhesives, medicinal teas, and medicinal herb mixtures. Lists of plants and their dye products and medicinal uses are provided. Parallels exist with European and Chinese medicinal traditions for similar species, particularly in the *Rosaceae* family. *Rubus* spp. have the greatest number of plant uses. The biochemical function of most of the active compounds of the native plants of the Olympic Peninsula is yet to be described. The authors call for greater attention to the pharmaceutical potential of traditional medicinal plants. This article is useful for its synthesis of economic botany and plant chemistry and makes a case for increased awareness and research of Pacific Northwest plant species for industrial applications.

Keywords: Indigenous uses, medicinal plants, dye plants, Olympic Peninsula, polyphenols.

Fortmann, Louise. 1992. Locality and custom: non-aboriginal claims to customary usufruct rights as a source of rural protest. Journal of Rural Studies. 6(2): 195-208.

Examines the dynamics of three protests over the allocation of fuelwood and timber harvesting rights on National Forest land in the Western United States between 1983 and 1986. The author argues that legal pluralism, or the coexistence of multiple legal systems in a single society, continues to play an important role in the allocation of resources in the United States, despite the paucity of scientific studies on the extent of customary usufruct rights. She categorizes the usufruct claims that form the basis for the protests into two types: subsistence claims and preferential livelihood claims. Both claims are based on the idea that local needs for forest products and economic opportunities should take preference over outside claims. The protesters clearly perceived that they had legitimate, though *de facto*, rights to National Forest resources surrounding their communities. The protests also illustrate that residents of the communities are willing and able to mobilize various sources of power, including appeals to local ordinances, as a means to enforce their claims. The author concludes that understanding of resource conflicts between government and local communities will be enhanced if the role of informal law is recognized.

Keywords: Usufruct, resource conflicts, firewood, timber harvesting, Western United States, law.

Forum, Steen. 1988a. De nye sorteringer i nobilis=The new grading system for *Abies procera* boughs. Pyntegrøntsektionen Nåledrys. 4(8): 4-7. In Danish.

Forum, Steen. 1988b. Høst af mellemgrene fra skørtet i nobilis—og den mulige økonomiske gewinst=Harvest of side branches in *Abies procera*—and the possible economic gain. Pyntegrøntsektionen Nåledrys 4(7): 12-14. In Danish.

Foster, Steven. 1991. Harvesting medicinals in the wild: the need for scientific data on sustainable yields. HerbalGram. 24: 10-16.

States that the increase in popularity of herbs and herb products has led to uncertainty about the long-term effects of harvesting native medicinal plants. There is little information on the sustainable yield of wild native medicinal plants; however, some broad categorizations can help determine which species are especially at risk of overharvesting. The greatest questions on sustainable harvest arise with root commodities where the whole root is harvested. The author cites American ginseng (*Panax quinquefolius*), once frequent in eastern North America and now listed as threatened or endangered, as the classic example of overexploitation. Goldenseal (*Hydrastis canadensis*), *Echinacea* spp., pink lady's slipper (*Cypripedium acaule*), and *Trillium* spp. also are discussed. Cascara sagrada (*Frangula purshiana*) in the Pacific Northwest is the major medicinal bark crop. Coordinating of timber operations with partial debarking of cascara trees deserves investigation. The author ends with a plea to develop information on sustainable harvest levels or develop cultivated species before it is too late.

Keywords: Medicinal plants, sustainability, harvesting effects.

Foster, Steven, ed. 1992. Herbs of commerce. Austin, TX: American Herbal Products Association. 78 p.

Compiles common names of commercial herbal plants in U.S. trade and cross-indexes them with their corresponding scientific binomial. This publication seeks to reduce the confusion in commerical labeling for herbal products by standardizing a single common English name for a single plant species.

Keywords: Medicinal plants, food plants, taxonomy.

Foster, Steven. 1995. Forest pharmacy: medicinal plants in American forests. Durham, NC: Forest History Society. 57 p.

Provides an overview of the historic and current role of plants in traditional and modern medicine, with a particular focus on the changes that have occurred in the United States over the past century. Also provides a chart of medicinal trees and plants, including scientific names, common names, form in which used, and medicinal value and uses for plants of the United States. Notes that new technologies introduced over the past 15 years have made the identification of medically useful plant compounds easier and less costly. These advances, coupled with a renewed interest among Americans and Europeans in the use of traditional medicines have contributed to rising demand for a variety of plants and plant parts. The bulk of medicinal plants in the United States are harvested in the east and southeast; only recently has extensive commercial gathering of medicinal plants begun to occur in the west and southwest. In contrast to Europe, where many plant compounds are categorized as drugs, in the United States most medicinal plant compounds are categorized as foods. The author attributes the relative lack of interest in developing plant compounds on the part of U.S. pharmaceutical companies to an inability to patent whole plant compounds. In addition, extensive testing is required before plant compounds can be categorized as drugs and their healing qualities

advertised. The Dietary Supplement Health and Education Act of 1994 addresses some of these concerns by shifting the burden of proof of safety for dietary supplements to the government. It remains inadequate in the author's view, however, in that manufacturers of herbal supplements are prohibited from making any claims about the connections between use of these plant compounds and treatments of disease.

Foster contrasts the U.S. regulatory framework with that of Germany, where an expert commission develops monographs outlining the therapeutic value of numerous plant-derived drugs. These monographs, which include guidelines for labeling, quality control, and safe dosages, and a system of phytomedicinal training for medical students have contributed to the widespread use of plant-derived drugs in German medicine. Foster recommends that a similar system be adopted in the United States.

Keywords: Medicinal plants, United States, regulation, economic value.

Franz, Chlodwig. 1991. Kultivierung bedeutender wildwachsender Arznei- und Gewürzpflanzen =Domestication of significant wild medicinal and fragrance plants. Entwicklung + Ländlicher Raum. 4(91): 3-7.

Comments on the growing demand for quality in plant materials gathered from wild sources and the attendant threat of overexploitation. Agricultural sciences are striving to rapidly domesticate wild species to protect wild stocks and their ecosystems. Domestication can be a drawn out, complex process. The author proposes an eight-step strategy for research in domesticating plants: (1) site studies of taxonomy, soils, climate, growth, natural reproduction, and distribution; (2) sampling plants and seeds for phytochemical content; (3) research into generative and vegetative means for reproduction; (4) planting trials of various site and environmental conditions, planting methods, and care; (5) research into plant diseases, pests, and means for plant protection; (6) plant breeding to improve ecological amplitude, disease resistance, yields, and desired compounds; (7) work on reducing time-to-harvest, harvest technology, and postharvest processing; (8) and attention to profitability, including labor needs, machinery, tools, infrastructure, use of agrochemicals, yields, and income.

Keywords: Domestication, policy, research agendas, medicinal plants, wild edible plants.

French, K.; French, D. 1955. The Warm Springs Indian community: will it be destroyed? American Indian. 8: 3-17.

Fuller, Douglas O. 1991. Medicine from the wild: an overview of the U.S. native medicinal plant trade and its conservation implications. Washington, DC: World Wildlife Fund. 28 p.

Presents an overview of trade in medicinal plants native to the United States. Wildcrafting, the gathering of wild medicinal plant for economic use, is most widespread in three regions of the United States: the southern Appalachian Mountains,

the Ozark Mountains, and the Pacific Northwest. Poor rural residents practice wildcrafting during times of underemployment, but it is a tenuous business. In the southern Appalachians, a few wholesale distributors control pricing, and prices paid to gatherers are held artificially low. Sustainable collection practices are particularly crucial for species with bark products.

Western Europe is the focus of a growing herbal medicine industry, with a doubling of consumption of medicinal herbs between 1980 and 1990. Herb exports to the United Kingdom, Germany, and Switzerland from the United States are summarized. India and Brazil provide much larger amounts to these countries in comparison. Already, native U.S. medicinal plants, such as *Echinacea purpurea,* are widely cultivated in Europe as a way to eliminate the uncertainty of U.S. supplies. Increased personal preference for natural medicines as a more holistic approach to health and healing still may decimate natural stocks of wild plants; for example, consumers often are willing to pay three times the amount that cultivated ginseng sells for to acquire wild U.S. ginseng (*Panax quinquefolius*).

American ginseng is the only U.S. medicinal herb tracked by the Convention on International Trade in Endangered Species (CITES). Ginseng offers an example of responding to international demand by supplying domesticated stock. Commercial crops have come mostly from Marathon County, Wisconsin. Between 1980 and 1987, American ginseng crop production nearly tripled in the United States. Establishment of ginseng costs about US$30,000 per acre, but payoff within a few years with a product worth about US$200/lb makes for a promising investment. The author proposes that wildcraft prices are the best available indicator of species scarcity until scientifically credible surveys of plant populations can be undertaken.

Species native to the Pacific Northwest that are in commercial demand are maidenhair ferns (*Adiantum* spp.), kinnikinnick (*Arctostaphylos uva-ursi*), prince's-pine (*Chimaphila umbellata*), yellow lady's slipper (*Cypripedium calceolus;* protected), scouringrush horsetail (*Equisetum hyemale*), common juniper (*Juniperus communis*), hollyleaved barberry (*Mahonia aquifolium*), sweetgale (*Myrica gale*), cascara (*Frangula purshiana*), smooth sumac (*Rhus glabra*), willows (*Salix* spp.), blue skullcap (*Scutellaria lateriflora*), Pacific yew (*Taxus brevifolia*), and *Trillium* spp. Genera in the Pacific Northwest that have related medicinal commercial species in the Eastern United States are *Agastache, Asarum, Asclepias, Ceanothus, Cimifuga, Crataegus, Eupatorium, Ligusticum, Pinus, Populus, Prunus, Quercus,* and *Sambucus.*

The author calls for prudent collection linked to propagation and cultivation. Ginseng serves as a model for sustainability through agricultural domestication. Entrepreneurial wildcrafters need information on cultivation to assist them in raising commercial quantities of herbal crops. Better trade information is needed so that people can identify and target domestic and foreign markets. Thinning studies for selective harvesting of herbal materials need to be conducted to document the effects of harvest intensity. Establishment of regional cooperatives also may give local residents greater control over prices. Increased prices may reduce the pressure to overharvest valuable and scarce species. Competition with other conservation issues may make acquiring funds for research difficult.

Keywords: Medicinal plants, conservation, policy formulation, sustainability, Pacific Northwest, Appalachia, Ozarks.

Galambosi, Bertalan. 1993. Considerations and experiences regarding the cultivation of medicinal wildflowers in Finland. Aquilo Ser. Bot. 31: 161-166.

Reports on results of studies by the University of Helsinki on the potential of native wildflower species for agricultural production of medicinal crops. The growing market for phytotherapeutic medicinals in Finland makes growing these plants a promising source of commercial income. The Finnish Four-H Youth Organization has been active in collecting medicinal plants from wild sources, but domestic needs have not been met by internal supplies. The types and quantities of plant materials imported are poorly documented in government trade statistics. Domestic agricultural production may produce better growing conditions, emphasize best plant varieties for production of plant chemicals, and assure product quality and safety.

Field conditions were studied for yarrow (*Achillea millefolium,* PNW [Pacific Northwest] native), common selfheal (*Prunella vulgaris,* PNW native), stinging nettle (*Urtica dioica,* PNW native), common St. Johnswort (*Hypericum perforatum,* PNW introduced species), and goldenrod (*Solidago* spp.) congeners in PNW). The species native to the Finnish flora adapt well to more intensive growing conditions in fields and with fertilization. Crops may be harvested once or twice a year. The importance of siting fields away from factories and traffic is important to secure pure plant products without heavy metal contaminants.

This article outlines the possibilities for advances in domestication of native medicinal plants in the Pacific Northwest.

Keywords: Domestication, medicinal plants, Finland.

Garbaye, J.; Kabre, A.; Le Tacon, F. [and others]. 1979. Production de champignons comestibles en forêt par fertilisation minerale—premiers resultats sur *Rhodopaxillus nudus* [=*Clitocybe nuda*]=Production of edible mushrooms in a forest using mineral fertilization—first results with *Rhodopaxillus nudus* [=*Clitocybe nuda*]. Mushroom Science. 10(part 1): 811-815. In French with English summary.

Describes an installed experiment of five fertilization treatments plus a control on 30 plots. The plots were arranged in three blocks by humus type to measure the production of wood blewits (*Clitocybe nuda*). Mushroom fruiting bodies were counted and weighed for three harvests in autumn 1977. Before fertilization, the species was not apparent in any of the sites. Phosphate fertilization did not have any effect. Fertilization with nitrogen, phosphorus, potassium, and calcium induced abundant fruiting. The value of the mushroom crop more than recouped the value of the fertilizer, labor, and transport and approximated the average annual value per hectare for timber. Fertilization may not be necessary every year because fertilization effects may persist. Comparable results were found in other parts of France.

This replicated experiment shows that in some instances in the short term, fertilization may be practical for inducing production of wild edible mushrooms. Market price of the mushroom species must be fairly high to cover management costs.

Keywords: Fertilization, management costs, wild edible mushrooms, France.

Geisler, Charles; Silberling, Louise. 1992. Extractive reserves as alternative land reform: Amazonia and Appalachia compared. Agriculture and Human Values. Summer: 58-70.

Compares current concepts of extractive reserves in the Amazon with the grazing reserve program at what was formerly Finger Lakes National Forest in New York State to illustrate that extractive reserves can address concerns for conservation, social equity, and economic efficiency in the United States, as well as in the tropics.

According to Geisler and Silberling, extractive reserves are a policy alternative when extraction patterns are decentralized, where the likelihood of assuring limited access and ownership in land and associated resources is high, where local level management is either necessary or desirable, and where there is an interest in sustainable management. They note that the land use areas established in the United States during the 1930s and 1940s are analogous to the extractive reserve concept and represent an alternative to the public-versus-private framing of land ownership and management options.

The authors observe that a major weakness of most land reform strategies is that they allocate uniform parcels to recipients regardless of resource base variability. They argue that this approach provides little social or environmental security and note that extractive reserves are an alternative to the standard approach that might allow for sustainable development. They caution, however, that extractive reserves alone cannot meet rural economic development needs as they are inherently nonintensive and, thus, unable to support dense populations.

Keywords: Extractive reserves, Amazon, New York, land utilization areas, land reform, public-private partnerships.

Geldenhuys, C.J.; van der Merwe, C.J. 1988. Population structure and growth of the fern *Rumohra adiantiformis* in relation to frond harvesting in the southern Cape forest. South African Journal of Botany. 54(4): 351-362.

Studies the effect of various harvest intensities under controlled conditions on the size of fronds from *Rumohra adiantiformis* used for floral greenery. A management experiment was begun in 1982 to allow harvesting of fern fronds from state lands. Only mature, hardened (nonwilting), unblemished fronds have value for the florist trade. Frond size, color, and form are crucial to quality. Demographic and phenological studies of fern populations showed that populations were sensitive to moisture levels and should not be harvested during months of bud initiation and frond maturation. Cycles of total harvest of mature fern fronds had marked effects on the population structure and size of mature fronds when compared to control plots. Deficiencies of potassium and phosphorus may be the cause of loss of productivity in harvested fern plots. Limiting harvests to only 50 percent of mature ferns may allow for nutrient recycling. Recommendations are made for policies on issuing permits and contract terms, length of harvest season, establishment of permanent reference plots, conditions for site closure to harvest, monitoring and future research, and efforts to develop nursery techniques for domestication. A brief description of the land area, labor force, and infrastructure also are

included. This article exemplifies adaptive management strategies using scientific method and statistical analysis for ecosystem conservation of viable populations of commercially valuable species used in the floral greenery trade.

Keywords: Adaptive management, ferns, floral greens, growth rate, harvesting effects, phenology, population structure, South Africa.

Gill, Steven J. 1983. Ethnobotany of the Makah and Ozette people, Olympic Peninsula, Washington (USA). Pullman, WA: Washington State University, Department of Botany. 344 p. Ph.D. dissertation (unpublished).

Details the traditional uses, harvest methods and seasons, and indigenous names of plants by the Makah and Ozette people since 1792 when contact with Spanish explorers occurred. Interviews with 17 residents of the Makah Indian Reservation provided additional previously unpublished data. Plants supplied essential nutrients and fiber not otherwise available from abundant marine fish. With the exception of wild berries, the Makah today have little reliance on the native flora for food.

Rights to scarce plant resources, (for example, western redcedar [*Thuja plicata*] bark) often were in individual or collective possession and could be inherited. Management of sites with small cranberries (*Vaccinium oxycoccos* L.) also occurred. Technological uses of plants included tools, weapons, canoes, nets, clothing, mats, dyes, glues, and baskets. Women were responsible for making baskets and mats from cedar bark and other plant materials. Among the important species for crafting indigenous tools, western redcedar, red alder (*Alnus rubra*), slough sedge (*Carex obnupta*), stinging nettle (*Urtica dioica*), and devilsclub (*Oplopanax horridus*) were the most important. Compares plant use with that of the Nitinaht people from the west coast of Vancouver Island. Seeds from the Ozette village site reveal that 99.7 percent were from salmonberry (*Rubus spectabilis*), red elderberry (*Sambucus racemosa* ssp. *pubens*), salal (*Gaultheria shallon*), and *Vaccinium* spp. This work is one of the few archaeobotanical studies from the Pacific Northwest to uncover physical evidence of traditional uses of native plants.

Keywords: Ethnobotany, Makah, Ozette, Nitinaht, berries, wild edible plants, dye plants, basketry, weaving, indigenous uses.

Giordano, E. 1983. Il bosco tra economia ed ecologia=Economic and ecological aspects of forests. Italia Agricola. 120 (4): 17-24. In Italian.

Attributes the reduction in importance of nontimber forest products to the decline in extensive land use and to technological improvements in agricultural production favoring production of wood and environmental services (for example, erosion protection). Several products have retained their full value to society, such as chestnuts (*Castanea* spp.), hazelnuts (*Corylus* spp.), and pine (*Pinus* spp.) nuts. Programs have been established for domestication of these formerly wild products. Wild mushrooms such as boletes (*Boletus* spp.) and chanterelles (*Cantharellus* spp.) retain an important place in Italian and German cuisine. Ease of access to forested areas has increased interest in mushroom gathering. The economic value of mushroom harvests is difficult to assess. In many regions, such as Abruzzo

and Viterbo, there are large commercial operations. The long-term effects of exploitation on the sensitive ecological relations among mushrooms, soils, and trees is unknown. Fungal productivity has been declining in zones close to urban and recreation centers. Descriptions of the five major truffle species (*Tuber* spp.) and their preferred habitats are given. Increased demand for truffles has prompted domestication into truffle plantations. These plantations are intensively managed with weeding and tree pruning. The truffle industry contributes Lit 20 billion annually. Other significant understory products include strawberries (*Fragaria vesca* and *F. viridis*), red raspberries (*Rubus idaeus*), and asparagus (*Asparagus* spp.). Domestication of *Rubus* berries is not as widespread in Italy as in northern Europe and North America. Nontimber forest products are likely to have the most impact on economic development in foothill and montane zones. A secondary benefit of understory vegetation is as a food source to support native fauna, which are food species for many Italians.

Keywords: Environmental services, economic value, wild edible mushrooms, truffles, fungal productivity, truffle cultivation, truffle markets, Italy, wild edible plants, nuts.

Giunta Regionale dell'Umbria. 1987. Norme concernenti la disciplina della raccolta, coltivazione, conservazione e commercio dei tartufi=Legal norms concerning the collecting, cultivation, conservation and commercialization of truffles. Regional law (dated 3 Nov. 1987) 47. Bollettino Ufficiale della Regione dell'Umbria. 18(81, parts 1, 2, and 3): 2156-2161. In Italian.

Sets forth the legal framework for harvesting, cultivation, conservation, and marketing of truffles (*Tuber* spp.) in Umbria. Truffle collectors have open access in forests and other lands not under cultivation. Truffles under managed production, however, are the property of the landowner. Acceptable management operations to exclude the public from truffle collection in native forests are set forth (for example, irrigation or drainage structure, canopy manipulations). Truffles in areas established specifically for truffle production are subject to separate regulation. Seasons for collecting each of the nine native truffles are stipulated. Immature truffles are protected and no truffle hunting is to occur at night. Excavations are to be covered up immediately after extraction of truffles. Truffle gatherers must pass an examination about collection methods, conservation, the national and local laws, biology, and identification of individual species before a license to gather is issued. The Umbrian government also is obligated to fund training for technical personnel for overseeing truffle harvests, experimental research, public education, marketing initiatives, and demonstration sites for truffle cultivation. Fines are established for hunting truffles without a dog, illegal digging, harvesting of small truffles, and improper terracing of hillsides.

This document details the extensive regulation of an especially valuable nontimber forest product. Although not all regulations may be appropriate to the products, ecological conditions, and social norms of the Pacific Northwest, this law serves as one model for legislation to conserve nontimber forest products.

Keywords: Conservation, funding, Italy, legislation, penalties, public funding, truffles.

Glowacki, Stanislaw. 1988. Die Rohstoffbase von Waldfrüchten auf natürlichen Standorten und Plantagen in Polen=The resource base for forest fruits in natural stands and plantations in Poland. Norwegian Journal of Agricultural Sciences. 2(2): 151-159. In German.

Describes the changing circumstances of minor forest product production in Polish forests involving vegetation, animals, and soil products (peat). Inventorying of minor forest products has been done since 1956 through description, sampling, and statistical methods. Research is directed from the Ntional Agricultural University in Warsaw. Forest land with berry plants is divided into four categories based on percentage of berry cover. Forestry employees directly sample the presence and yield of berry plants. A considerable database of yields has accumulated over time. Since 1962, particular emphasis has been placed on tracking the cover density, spatial distribution, and height of whortleberry (*Vaccinium myrtillus*) bushes nationally. Whortleberries comprise 60 to 70 percent of the national wild fruit harvest and 90 percent of wild fruit exports. Data now exist to describe the changes in yield and spatial dynamics of whortleberry plant distribution. Phenological observations led to development of equations to predict production of whortleberries as a function of stand site productivity, flowering, and the number of early ripening fruits.

A state-run minor forest products corporation, LAS, is the major processor and maintains data on fruit that it processes. Additional important species are *Rubus, Sorbus, Sambucus, Prunus, Crataegus,* and *Fragaria* species. Since the 1970s, yields of wild berries have fallen considerably, and in the 1980s harvests have not exceeded 10 000 tonnes annually. A labor shortage and frequent late frosts are seen as major causes for the decline. The authors estimate collection for private use to be 20 to 25 percent of the commercial crop.

Exporting whortleberries has a long tradition with the earliest markets in England. Other major importing countries are Germany, Sweden, Finland, the Netherlands, and Belgium. Large quantities of frozen whortleberries began to be exported to the United States in the 1960s. To meet national demand, development of agricultural crops of berries has brought the American highbush blueberry (*V. corymbosum*) to Poland.

In Poland, commercial use of minor forest products developed earlier and is more advanced than in many other countries. Polish management and inventory practices may be of considerable assistance in inventorying and managing *Vaccinium* spp. in the Pacific Northwest.

Keywords: Exports, inventory, Poland, sampling, wild fruits, yield predictions, berries, wild edible plants.

Godoy, Ricardo; Lubowski, Ruben. 1992. Guidelines for the economic valuation of nontimber tropical-forest products. Current Anthropology. 33(4): 423-433.

Provides a framework with which to analyze the value of nontimber forest products. Inadequate data about costs, quantities extracted, and prices have traditionally impeded valuation studies of nontimber products. Social anthropologists, ethnographers, ethnobotanists, and natural resource economists are important sources of information and need to work in concert to provide accurate analyses.

Examples are drawn from literature and field work. A summary of existing studies is given for reference. Careful descriptions of ecosystem sites being evaluated for economic return are needed so that false inferences are not made for ecologically different sites. It is difficult to achieve an appropriate stratified random sample of the hunter-gatherer population. Multiyear and multiseasonal studies are needed to obtain a complete picture of the economy of gatherers. Tracking gatherers' activities and mapping their harvest areas, weighing their harvests, and survey techniques for memory recall are useful. Potential harvest quantities (stocks) and actual harvests (flows) must be distinguished. Products for subsistence and products for sale in markets ought to be valued differently. Cost of equipment and cost of time spent foraging should be incorporated into the analyses. Researchers should define and measure the sustainability of the existing economic system of nontimber product extraction.

Keywords: Economic analyses, foraging costs, market costs, sampling methods, sustainability, tropical forests, weighing techniques.

Godoy, Ricardo; Lubowski, Ruben; Markandya, Anil. 1993. Economic Botany. 47(3): 220-223.

Presents methods for valuing nontimber products and obtaining better estimates of output quantities, marginal costs, and prices to identify economically advantageous projects for rural development. In the existing literature, nontimber products in tropical forests have been valued from US$1-420•$ha^{-1}$•$yr^{-1}$. Differences are the result of biological diversity in forests, diversity of economic methods used in analyses, and ambiguities in measurements. For example, a depletion premium based on the expected date of extraction is generally omitted from the cost of extraction when extraction rates are unsustainable. Identification of important demographic and technological patterns, careful statistical sampling, and accounting for effects of seasonality are necessary as well. Diaries and interviews are helpful but may be subject to biases of the informants. Obtaining accurate price information is difficult. Where price information is not available from market information, close substitute products and contingent valuation are two alternative methods for pricing. As yet, economic studies of nontimber forest studies have not valued the shadow prices. Generally, information on time spent foraging for plants and the marginal cost of extracting plants have not been calculated. To get better data about marginal values and foraging patterns, researchers can use focal subject sampling. With this method, a researcher tracks the activities of and time spent by a randomly selected gatherer and assigns a value to the gatherer's time, often based on an official wage minimum.

Keywords: Economic valuation, pricing methods, shadow prices.

Godoy, Ricardo A.; Bawa, Kamaljit S. 1993. The economic value and sustainable harvest of plants and animals from the tropical forest: assumptions, hypotheses, and methods. Economic Botany. 47(3): 215-219.

Cites three untested but widely held assumptions about extraction of plants from forests by local populations. The first is that rural people extract resources in a sustainable fashion. Evidence suggests, however, that sustainable extraction

occurs only when there are stable property rights, low population density, traditional uses, and simple technology. The second assumption maintains that extraction of plants is useful for enhancing rural people's incomes. Often, however, rural people view foraging as a temporary occupation with low status. As rural societies become wealthier, they spend less time extracting and using wild plants and animals and instead use more processed substitutes. Third, there is the assumption that forests should be preserved because the economic values of many plants used by local people is high; however, values of forests for nontimber products range widely. The authors propose that economic research about nontimber forest products is needed in five areas: (1) shifts toward specialization of resource use with increasing wealth; (2) the share of nontimber forest products in household incomes; (3) the opportunity cost of forest factors affecting sustainability and depletion of resource supplies; (4) relations between extraction costs and species richness; and (5) the role of commercialization and domestication on deforestation.

Keywords: Sustainable harvesting, rural development, economic valuation.

Goldberg, Michael. 1992. New hope for forest communities. American Forests. (March/April): 17-20.

Highlights a new group of people, calling themselves "forest practitioners," that has emerged to turn the "jobs versus environment" debate into a "jobs and environment" issue. These forest practitioners represent a wide range of interests, geographical locations, and cultures and are united by a commitment to sustainable development. Some groups, such as the Natural Resources Services in Humboldt County, California, focus on restoration of degraded ecosystems; others such as La Madera focus on making better use of timber that is harvested and processing in local areas. In Washington, one such group, the Columbia Pacific Resource Conservation and Development Council, has initiated plans for an agroforestry project.

The goal of such programs is to initiate a process of economic development to help local people and maintain local communities while simultaneously ensuring a healthy environment. The USDA Forest Service also has begun to take part in these efforts, as evidenced by its support for Forest Trust, a network created in Santa Fe in 1991. This network is helping the Forest Service fill its commitment to rural development. Several problems inhibit achieving this objective, such as the congressional appropriations process in which money is allocated for cutting trees but not for rural development. One item on the Forest Trust agenda is to create a line item for rural development in the Forest Service budget.

Keywords: Forest practitioner, rural development, sustainable development, Forest Trust.

Gorbunov, Aleksey B. 1993. Wild fruit and berry plant resources of Siberia and the Soviet Far East and their use for plant breeding. Aquilo Ser. Bot. 31: 75-77.

Discusses wild fruit and berry species and their distribution in Siberia and the Soviet Far East. Genera and species under cultivation that are common to the Pacific Northwest include *Crataegus, Lonicera, Prunus, Ribes,* red raspberry

(Rubus idaeus), Sorbus, Vaccinium, and cranberry viburnum *(Viburnum opulus)*. The Food Plant Introduction Laboratory of the Central Siberian Botanical Garden in Novosibirsk is currently developing a wide range of hybrids between Siberian and North American species.

Keywords: Domestication, wild edible plants, berries, Siberia, Soviet Far East, cultivation.

Gottesfeld, Leslie M. Johnson. 1992. The importance of bark products in the aboriginal economies of northwestern British Columbia. Economic Botany. 46(2): 148-157.

Describes the role that bark products played in the economies of aboriginal peoples in west-central British Columbia. Data about present and past uses of plants were obtained through indepth interviews over 5 years with 31 men and 41 women of the Gitksan, Wet'suwet'en, and Haisla groups. The study identifies 21 different species of trees whose bark was used for various purposes. The inner bark of lodgepole pine (*Pinus contorta*) and western hemlock (*Tsuga heterophylla*) was highly valued as a food source and sweetener. The bark from a variety of species, including white spruce (*Picea glauca*) and Engelmann spruce (*P. engelmannii*), red alder (*Alnus rubra*), and western hemlock was widely used to treat illnesses. Bark also was used for construction materials, cordage, and fiber. Bark-derived products have virtually disappeared with the influx of manufactured and agricultural products to the study area. The major exception is the rising demand for western redcedar (*Thuja plicata*) and willow (*Salix* spp.) bark for basketmaking, which is concurrent with the demand for handicrafts. A number of informants attribute the decline in the use of bark products to harassment from forestry officials, who reportedly discourage the practice of bark-stripping on the grounds that it will decrease timber quality.

Keywords: Ethnobotany, Gitstkan, Wet'suwet'en, Haisla, bark, basketry, weaving, medicinal plants, wild edible plants, resource conflicts, British Columbia.

Gottesfeld, Leslie M. Johnson. 1994. Aboriginal burning for vegetation management in northwest British Columbia. Human Ecology. 22(2): 171-188.

Characterizes historical burning practices of the Gitksan and Wet'suwet'en peoples of British Columbia to stimulate new stems and berry production, principally of blue huckleberry (*Vaccinium membranaceum*) and dwarf blueberry (*V. cespitosum*), for a winter food supply. The author conducted interviews with older members of the two groups, mapped current sites burned annually in the spring, and researched archival records of aboriginal burning. The Gitksan burned patches of montane blue huckleberry patches lightly in the late summer. Fire suppression policies of the British Columbia Forest Service have been in force since the 1930s and together with changes in land tenure have changed the vegetation composition of land adjacent to aboriginal towns. Dwarf blueberry is no longer an important economic species, but blue huckleberry remains available in sites clearcut or burned naturally.

This article describes useful details of historical management for wild edible berry production and points out the changes in vegetation and resource availability that

occurred when different cultural values toward fire supplanted traditional aboriginal values.

Keywords: Aboriginal burning, berries, British Columbia, Gitksan, vegetation management, Wet'suwet'en.

Gow, D. 1992. Forestry for sustainable development: the social dimension. Unasylva. 169(43): 41-45.

Argues that forests can make a unique contribution to sustainable development because of the multiple economic and environmental benefits they provide. He distinguishes between ecological sustainability, which addresses resource stewardship, and social sustainability, which is concerned with the continuing improvement of the quality of life. The social aspects of sustainability can be successfully addressed by encouraging local participation and control of forest resources. Social analysis, which attempts to understand the effects of planned interventions on specific social groups, can improve the social impact of forestry activities. Various mechanisms and examples of social analysis are described.

Keywords: Sustainable development, ecological sustainability, social sustainability, social analysis.

Grabenstedt, H. 1969. Douglasiengrün als nachhaltige Zwischennutzung für eine astfreie Starkholzerzeugung=Douglas-fir greenery as a sustainable interim product while managing for large-dimension clear timber. Forstarchiv. 40(10): 198-200. In German.

Describes German methods used in Douglas-fir (*Pseudotsuga menziesii*) stands to manage for production of both decorative greenery and knot-free clearwood. Planting Douglas-fir in combination with European beech (*Fagus sylvatica*) or Norway spruce (*Picea abies*) is common in central Europe. When Douglas-fir is spaced at no less than 2- by 2-m intervals, the trees yield a continuous harvest of greenery until they are pruned. Best yields require even lighting on all sides of the trees; foliage remains dark green without yellowing. Harvesting for greenery begins in the fifth or sixth year after planting. The lowest branches harvested are cut at their base. Subsequent harvests of greenery come from trimming upper branches back to the first bifurcation of side branches. Thereafter, the regrowing branch produces even higher quantities of foliage for periodic harvest. Crops of greenery are harvested until age 25 when selected Douglas-fir trees are pruned and others are thinned to promote development of clearwood in the remaining trees. Where Norway spruce is grown with Douglas-fir, the spruce is removed for Christmas trees and for decorative greens. In the first 10 years, these stands may produce as much as DM6330 per hectare (undiscounted) net profit. Douglas-fir contributed about 40 percent of the net value.

This article shows some of the possibilities for more intensive, integrated management on public land using species native to the Pacific Northwest.

Keywords: Stand management, integrated management, conifer greens, timber management, Christmas trees, Germany.

Grafton, William. N.; Ferrise, Anthony; Breiding, Michael. A. [and others]. 1993. Wild plants for income. Nat. Resour. Manage. Income Oppor. Ser. R.D. 771. Morgantown, WV: West Virginia University, Extension Service. 32 p.

Covers the legal status of wild plant resources and requirements for access in West Virginia under various jurisdictions of private (rented and owner-occupied) and public (state and Federal parks and forests, Army Corps of Engineers property) lands. Laws, responsibilities, penalties, and liabilities are described. Basic information is provided on the advantages and disadvantages of business enterprises (sole proprietorship, partnership, corporation), taxation, business licenses, insurance, and labor and wage laws. Special mention is made of regulations regarding American ginseng (*Panax quinquefolius*), endangered species, and commercial activities in wetlands, Federal wildernesses, and designated wild and scenic rivers. Additional information includes marketing laws, regulations, and quarantines, and a list of addresses of pertinent government offices in West Virginia.

This document provides a template for state and local publications that seek to inform people of the business and legal aspects of small businesses involved with nontimber forest products.

Keywords: Access, endangered species, land tenure, legal regulations, marketing, quarantines, West Virginia.

Greber, Brian. 1993. Economic evaluation of options. In: Forest Ecosystem Management Assessment Team. Forest ecosystem management: an ecological, economic, and social assessment. Portland, OR: U.S. Department of Agriculture; U.S. Department of the Interior [and others]. [Irregular pagination]. Chapter 6.

Summarizes the potential economic role of nontraditional “special” forest products in the Pacific Northwest based on the work of Schlosser and Blatner. Four major segments of the industry exist: floral greens, Christmas ornamentals, wild edible mushrooms, and edible and medicinal wild plants. Current data and projections are uncertain because of inaccurate pricing and a lack of record keeping. For southwest British Columbia and western Oregon and Washington, US$42 million in greens (including moss) were harvested from forests in 1989. Over US$11 million was paid to mushroom harvesters in 1992. Mushroom harvests occur in spring in northern California and eastern Oregon and Washington; fall mushroom harvests occur west of the Cascade Range.

Western hemlock (*Tsuga heterophylla*) vegetation zones have the greatest potential for production of special forest products. The mountain hemlock (*Tsuga mertensiana*) zone is important for harvests of valuable beargrass stocks. Silvicultural management is important for enhancing yields of special forest products. Floral greens are most lucrative in forests where mid- to late-seral forest stages with partially closed canopies are maintained. Tables of harvest volumes for floral greens and Christmas ornamentals and preliminary estimates of edible wild mushroom by species are provided. The author advocates that land management agencies take a more active role in managing harvests. Standards and guidelines for harvesting need to be established with appropriate fee schedules. Product quality is very important to price level. Setting harvest fees for mushroom is highly

risky because size of the crop differs by location and by year. Work is needed to assess sustainable supplies of products and their future role in the Pacific Northwest economy.

Keywords: Pacific Northwest, economic value, floral greens, conifer greens, wild edible mushrooms, wild edible plants, medicinal plants.

Grochowski, W.; Ostalski, R. 1981. Recherches sur les productions spontanées des étages inférieurs de la forêt de Pologne=Research concerning the non-timber product production in forest understories of Poland. In: Productions spontanées; 17-20 June 1980; Colmar, France. Les colloques de l'INRA 4. Paris: Institut National de la Recherche Agricole: 39-48 p. In French.

Describes inventory research conducted in Poland as part of a national program for augmenting production of berries and mushrooms. Inventorying economically useful plants and fungi is an integral part of forest management and part of a broader research agenda to ensure that increasing production occurs without jeopardizing the overall productivity of the forest environment. The Forest Production Cooperative, LAS, oversees these research and production programs. A national inventory tracks the quantity and value of existing secondary forest products, provides data for determining the productivity class, helps to calculate potential production based on quantity and quality of yield, and defines environmental and economic constraints. Policymakers can perform economic analyses to determine whether increased investments are warranted to protect stands and to establish an operational infrastructure for research and commercial collection. State forests are inventoried every 10 years from fixed-point plots. The inventory determines the number of fruits or fungi required to maintain the population of the secondary resource, whether harvested commercially or not. Particular attention is paid to recording the quality of the fruit or fungi products in conjunction with quantitative data about forest conditions. An example of the inventory method is given by using whortleberry (*Vaccinium myrtillus*), the most important economic berry species in Poland. Empirical data are used to estimate an abundance class and to derive a regression equation of potential whortleberry production per hectare for an ecoregion. Available labor, the mode of harvesting, and market conditions define the real harvest, however. This article demonstrates the practicality of including nontimber forest products in programs for forest ecosystem inventory and monitoring and provides an outline of policies and practices based on inventory data.

Keywords: Inventory, potential yield, site classification, berries, wild edible mushrooms, wild edible plants, Poland, cooperative.

Grochowski, Wieskew. 1966. Les productions forestières secondaires en Pologne=Minor forest products in Poland. Revue Forestière Française. 18(3): 160-170. In French.

Makes the case for managing secondary forest products to prevent their overexploitation and to promote greater forest productivity. Management has been based on intensifying use without overexploitation since World War II and has been guided by three basic principles: inventorying potential production, applying techniques to increase production, and organizing commercial use of products.

Short- and long-term planning, long-term investments, trained forestry personnel and gatherers, coordinated research, and elimination of waste by closely linking collecting and marketing are all important.

The state cooperative LAS was founded in 1945 (and nationalized in 1950 as part of the Ministry of Forestry and Forest Industries) to promote the collecting of forest fruits, edible mushrooms, medicinal plants, resins, snails, and honey, and the maintaining of osier willow (*Salix* spp.) and staghorn sumac (*Rhus hirta*) plantations, fruit orchards, and Christmas tree farms. A total of 5,500 collection points are found throughout the country, and processing plants are found in each of the forest administrative units. Whortleberries (*Vaccinium myrtillus*) are the most important fruit with many other species contributing to the national harvest. Production data at LAS are given for 1947 to 1964. Exports of whortleberries are substantial to western Europe and the United States.

The king bolete (*Boletus edulis*) is the principal wild mushroom gathered, but it is not well adapted to commercial use owing to its fragility and irregular fruiting. Golden chanterelles (*Cantharellus cibarius*) are more easily prepared for fresh, canned, or dried markets. Switzerland and Germany are prime markets. Data for mushroom production at LAS is given for 1945 to 1964. Development of an herbal medicine industry is not anticipated in the near future.

Major centers of research in secondary forest products are at the forestry faculties in Warsaw, Poznan, and Krakow. Direction of research concentrates on phenological studies, characterization of chemical compounds, and new uses.

Keywords: Berries, wild edible mushrooms, wild edible plants, basketry, weaving, Poland, cooperatives, economic development.

Grünwald, Jörg. 1994. Europe: phytomedicines, market growth and investment opportunities. In: Proceedings, Drug discovery and commercial opportunities in medicinal plants; 19-20 September 1994; Arlington, VA. Southborough, MA: International Business Communications. [Not paged].

Describes recent market conditions for phytomedicines in Europe. Germany, France, and Italy have the strongest markets. European Economic Union nations comprise the largest block of sales in herbal medical sales, totaling US$2.5 billion annually, followed by continental Asia and Japan at US$2.3 and US$2.1 billion, respectively. Forecasts of annual growth in sales by region range from a low of 8 percent in western Europe to 15 percent in Japan, India, and Pakistan. In recent years, pharmaceutical companies in the United States have been buying up small, traditional phytomedicine manufacturers in Europe.

Keywords: Medicinal plants, sales volume, phytomedicine, Europe, Asia, Japan.

Gunatilake, H.M.; Senartne, D.M.A.H.; Abeygunawardena, P. 1993. Role of nontimber forest products in the economy of peripheral communities of Knuckles National Wilderness Area of Sri Lanka: a farming systems approach. Economic Botany. 47(3): 275-281.

Describes cultivation of cardamon (*Elettaria cardamomum*) and shifting cultivation in forest understories above 3500 m in Sri Lanka. Restrictions on cultivation of

nontimber forest products in agroforestry settings may induce economic hardship on families living in and near the wilderness area. A structured questionnaire was given to 18 percent of households in three villages; one-third of the households were randomly selected for detailed interviews (n=20). The role of nontimber forest products in the local rural economy was examined by using a farming systems approach with base data analysis. Different components of the agroforestry farming system were identified, a list of products identified, and income estimated (less transport costs). Market prices or price of substitutes were used to value products. Accuracy of data is a problem because the marginal costs of extraction and values of medicinal plants and buffalo forage were difficult to calculate. All the respondents in the survey gathered nontimber forest products. The products comprised, on average, 5.3 percent of cash income and 16.2 percent of total value income to households in the region. Cardamon agroforestry provides, by contrast, 49.8 percent of the cash income and 26.0 percent of the total value income to households. With increasing affluence, however, the proportion of income derived from nontimber forest products declined from 30 percent for the poorest to 10 percent for the wealthiest.

This article outlines research methods for an economic analysis of household incomes that could be adapted and applied to the Pacific Northwest.

Keywords: Economic valuation, social surveys, Sri Lanka, spices, shifting cultivation, conservation, resource conflicts.

Gunatilleke, I.A.U.N.; Gunatilleke, C.V.S.; Abeygunawardena, P. 1993. Interdisciplinary research towards management of nontimber forest resources in lowland rain forests of Sri Lanka. Economic Botany. 47(3): 282-290.

Examines deficiencies of forestry planning on the national level in Sri Lanka for traditional forest uses of nontimber resources, such as resin tapping and collecting of medicinal plants, food, and rattan. Reasons for the disregard of nontimber uses are a lack of understanding of the social significance of nontimber resources to rural economies and the dearth of adequate quantitative information about nontimber forest products and their ecology. Socioeconomic, biological, and silvicultural information is needed. Nontimber forest products are one option for protecting forests by maintaining forest structure in conjunction with continuing economic outputs. Studies from the Sinharaja rain forest have shown that the products with the highest market value (less labor extraction costs) are fuelwood, and syrup and alcoholic beverages from the palm *Caryota urens*. Gaps in integrated research are identified that would facilitate improved forestry policy for managing these biologically rich forests.

Keywords: Economic analysis, Sri Lanka, rural development, conservation.

Gunther, E. 1973 (1940). Ethnobotany of western Washington: the knowledge and use of indigenous plants by Native Americans. Seattle: University of Washington Press. 71 p.

First published in 1940, this ethnographic decription of the use of plants among the Native Americans inhabiting the western coast of Washington has recently been reissued in response to an upsurge of interest in the uses of wild plant species.

Information was gathered from the following tribes: Chehalis, Cowlitz, Green River, Klallam, Lower Chinook, Lummi, Makah, Nisqually, Puyallup, Quileute, Quinault, Samish, Skagit, Skokomish, Snohomish, Snuqualmi, Squaxin, and Swinomish. The information is arranged by botanical family, and the uses of each species amongst the various tribes is provided. A chart of the plants used by each tribe is particularly useful in describing the variety and extent to which plants were part of these cultures.

Keywords: Indigenous knowledge, ethnobotany, western Washington, Chehalis, Clallam, Cowlitz, Green River, Klallam, Lower Chinook, Lummi, Makah, Nisqually, Puyallup, Quileute, Quinault, Samish, Skagit, Skokomish, Snohomish, Snoqualmi, Snuqualmi, Squaxin, Swinomish.

Gupta, Tirath.; Guleria, Amar. 1982a. Non-wood forest products of India. CMA Monogr. 87. New Delhi: Oxford and IBH Publishing Company. 147 p.

Studies the potential production, employment, and revenues from nontimber forest products in India under the premise that forests are primarily managed for maximizing timber and fuelwood production. The contribution of forests to the gross domestic product is considered low because consumption of nontimber forest products has not been appropriately identified and valued, most of the consumption occurs locally, and few efforts are underway to manage known nontimber resources because of the primacy of timber production. From 1968 to 1977, the role of nontimber forest products rose from 30 to 40 percent of the revenues from the forestry sector and contributed disproportionately to annual foreign exchange earnings (>70 percent) from that sector. The foreign trade potential for these products is yet to be fully realized. Major product groups include fibers and flosses, grasses, bamboo, essential oils, industrial lubricants, tans and dyes, gums, drugs, spices, tendu (*Diospyros melanoxylon*) leaves, and food. Little investment has been put into development of processing facilities; most products are exported in raw form.

Current employment is believed to be 1.6 million person years with potential to grow to 4.0 million person years with increased rural development of nontimber products. Full-time employment amounts to only 68,000 positions currently. Spring gathering of products competes with labor required for farming operations and therefore may be suboptimal. Competition for rural labor is viewed as desirable because dependence on agriculture is reduced and encourages improvements in productivity per unit of land and labor employed. Nontimber forest products are an important means for employing otherwise unskilled workers.

Development of nontimber resources must safeguard the interests and rights of people in and near forests for reasons of social justice and maintaining the cultural links of stewardship for the forest. Programs have been hindered by scanty, conflicting, and out-of-date information. This book necessarily makes untested assumptions regarding some of the hypotheses and projections made. A national inventory carried out by a proposed national survey unit at regular intervals could provide the basic data for better scientific management.

Keywords: India, employment, forest revenues.

Gupta, Tirath; Guleria, Amar. 1982b. Some economic and management aspects of a non-wood forest product in India: tendu leaves. CMA Monogr. 88. New Delhi: Oxford and IBH Publishing Co. 119 p.

Studies in depth a single nontimber forest product in India. The book provides details about collecting, processing, grading, and foreign and domestic trade in tendu (*Diospyros melanoxylon*) leaves. Tendu leaf collection is regulated by individual Indian States. Contrasting regulations and practices are described for Maharashtra and Orissa. Management systems for production and marketing are analyzed in reference to revenue generation, labor wage rates, and revenue sharing among different levels of government. Annual production fluctuates significantly. Gross and net revenues have continued to increase, but slowly. Sealed bids are used in awarding tendu product sales to prevent collusion. Better data are needed to estimate price trends, production costs, and overhead. Recommendations are made for greater central control in the production and trade of tendu leaves. Such actions would generate more revenue to the government and concentrate the responsibility for production and marketing of tendu leaves as a way to gain greater quality control, cost reductions, and coordination among government agencies.

This book is a model for the multifaceted form it adopts in investigating the natural production, product processing, and socioeconomic benefits of a valuable nontimber resource.

Keywords: India, tendu leaves, regulation, management systems.

Haglund, John; Lankford, Nancy; Sullivan, Molly [and others]. 1994. Go native!: a summary of native plant projects on the Mt. Hood National Forest. Document R6-MTH-TP-04-94. Gresham, OR: U.S. Department of Agriculture, Forest Service, Mount. Hood National Forest. 18 p.

Outlines current projects for seed and plant collections, propagation efforts, revegetation and restoration, and plant inventorying in the Mount Hood National Forest. Many of the plants propagated are native fruit-producing species. Beargrass (*Xerophyllum tenax*) and kinnikinnick (*Arctostaphylos uva-ursi*) are used in erosion control.

This booklet provides information about existing sources of economically valuable nontimber species in Forest Service nurseries and describes a spectrum of projects for reintroducing important nontimber forest products in the forest landscape.

Keywords: Inventories, nurseries, plant collection, restoration, revegetation, seed collection, Mount Hood National Forest.

Hall, Ian R.; Brown, Gordon. 1989. The black truffle: its history, uses, and cultivation. Wellington, New Zealand: Ministry of Agriculture and Fisheries. 73 p.

Analyzes the economic feasibility of adapting black truffle (*Tuber melanosporum*) mycoforestry into New Zealand forest plantations. A prototype model predicts the

production function of truffles in a domesticated “truffière.” Two scenarios, one high yield and the other low yield, are presented during the first 35 years of the truffière. Projected annual yields are translated into dollar values and compared with assumed costs of material, labor, and management to determine the internal rate of return for each scenario. Initial investment costs are high. Returns are based on extrapolation of European yields to New Zealand without experimental verification. This method has potential application for calculating the feasibility of more intensive management of native truffle species in the Pacific Northwest. The need to process truffles efficiently for quality is emphasized. Mycoindustrial production of truffles in New Zealand would represent a significant departure from the time-honored traditions of direct contact among truffle growers and collectors and the buyers in southern Europe.

Keywords: New Zealand, truffles, cultivation, economic analysis.

Hall, Pamela; Bawa, Kamaljit. 1993. Methods to assess the impact of extraction of nontimber tropical forest products on plant populations. Economic Botany. 47(3): 234-247.

Distinguishes between economic sustainability and ecological sustainability as a first step in assessing harvests of nontimber forest products. The authors describe efficient methods for sampling different vegetation layers within large, heterogeneous landscapes by using combinations of transects and plots. In addition, information on topographic features, soil conditions, habitat changes, and signs of harvesting should be recorded. Initial data provide information on population structure of economic species and on relations of population age and density to habitat types if the habitats are distinctly demarcated in recorded data. Attention to sample size for statistical significance is important for undersampled habitat types. Inventory information also identifies poorly represented age cohorts in the life history of plants sampled and can provide the first evidence of loss of reproductive capacity or presence of variable recruitment of new individuals over time. These patterns may be the result of ecosystem events or anthropogenic disturbances such as harvesting. Having control sites where no human harvesting occurs is important for detecting whether human impacts are a significant cause of age-class distributions of economically valuable species.

Sampling design also must be appropriate to the species. Procedural details are given for annuals, herbaceous perennials, and woody perennial species. Short-term and long-term effects on population structure can be monitored from the data. Rapid assessment for short-term effects focuses on the life stage of the species being harvested. Rate of mortality, recruitment of new individuals, and growth need tracking. Basic equations are provided for calculating rates. Long-term assessment involves complex interactions among plants, people, and other fauna in an ecosystem. Marking trees, establishing permanent plots, and long-term institutional commitment to record keeping and analysis are essential to the complete understanding of demographic development of economically important nontimber forest species.

Keywords: Sampling techniques, economic sustainability, ecological sustainability, monitoring.

Härkönen, Marja. 1988. Training people to collect and sell natural products in Finland. Acta Botanica Fennica. 136: 15-18.

Reports on a program begun in 1969 by the Finnish Department of Forestry Education to train mushroom advisors and pickers in mushroom harvesting techniques. The purpose of the program was to facilitate better use of mushrooms resources at the commune level. The average edible mushroom yield in Finland is estimated to be 1.5 billion kg, of which only 1 percent is collected. Courses are taught at forestry schools throughout the country by mushroom inspectors, who are usually affiliated with universities. Participants are given a commercial mushroom advisor certificate at completion, and are authorized to train commercial pickers in their districts. Commercial mushroom pickers who go through the 1-day training given by the advisors receive a card indicating that they have some knowledge of mushroom picking. Many of the larger retail outlets require this card to improve the likelihood that the products brought to them are of good quality. Mushroom sales are regulated by a variety of laws, including a decree of the Commerce and Industry Board, that specifies which mushrooms may be sold. The list of commercial mushrooms includes 15 wild species and 5 cultivated and imported species of mushrooms.

Wild herb collection is less common than mushroom collection, largely because the “every person’s rights” that allow people to gather mushrooms and wild berries on private lands do not apply to herbs. Finland has no specific laws governing wild herbs, but the herb trade is regulated by various laws governing food, health, and marketing. The National Board of Vocational Education is beginning a program to train wild herb advisers in the same kind of format as that for mushrooms. Wild berries also are commonly collected for home consumption and for export. The quality of berries tends to be uneven, however, and exports have declined. A berry-picker certification program was scheduled to begin in 1987 with a focus on quality control.

Keywords: Finland, training, harvesting techniques, licensing, regulation, wild edible mushrooms, herbs, berries, wild edible plants.

Härkönen, Marja; Järvinen, Irma. 1993. Evaluation of courses for mushroom advisors in Finland. Aquilo Ser. Bot. 31: 93-97.

Evaluates both basic and advanced courses for county mushroom advisors from the National Board of Vocational Education in Finland for 1989 and 1990. Advisors in turn train commercial mushroom pickers to identify, pick, and prepare for sale one to three mushroom species per 1-day course. The mushroom advisors also furnish information to local residents about mushrooms during nature walks and mushroom shows and in marketplaces.

Students in county mushroom education classes were presented with 30 to 50 fresh mushroom species, which are viewed for 1 minute each at the beginning and end of each course. They also filled out a brief questionnaire that asked for self-evaluation of their expertise in mushroom identification, personal consumption of mushrooms, sources of their knowledge of mushrooms, previous course work about mushrooms, kinds of information about mushrooms shared with the public, and personal involvement with commercial picking.

The authors propose additional curriculum to cover a broader range of species for interested advisors who have already mastered the commercial species and their marketing. This article provides information helpful to establishing rural extension programs for potential commercial mushroom pickers.

Keywords: Wild edible mushrooms, education, extension, Finland, mushroom advisors.

Härkönen, Marja; Saarimaki, Tiina; Mwasumbi, Leonard [and others]. 1993. Collection of the Tanzanian mushroom heritage as a form of developmental cooperation. Aquilo Ser. Bot. (31): 99-105

Documents initial work in ethnomycology in Tanzania undertaken jointly by the Universities of Helsinki and Dar-es-Salaam. In many cases, knowledge of the original importance of mushrooms and traditions of use have been lost. North American and European researchers have incorrectly assumed that mushrooms are not much used in East Africa. Researchers accompanied mushroom gatherers and observed methods of food preparation and the mushroom species being sold at roadside stands or in markets. A collection of color photographs of more than 30 species was assembled to show to people to elicit vernacular names and opinions regarding the species.

Interviews were conducted in Swahili or English among different ethnic groups. Questions consisted of personal information about the person and specific questions about mushroom collection, consumption, acquisition of knowledge about mushrooms, and determining important species. Preliminary results from interviews are reported.

Keywords: Ethnomycology, wild edible mushrooms, social survey, Tanzania.

Hartwig, V. 1977. Der gegenwärtige Weihnachtsbaum- und Schnittgrünmarkt und die Möglichkeiten der Einnahmensteigerung bei diesen Nutzungen aus der Sicht der Landesforstverwaltung Hessen=Current markets for Christmas trees and decorative greens and the possibilities for increasing income from them from the point of view of the Hessian State Forest Administration. Allgemeine Forstzeitschrift. 32(46): 1136-1138. In German.

Proposes that decorative greens and Christmas trees can provide an income source to breach the negative balance, present since 1966, in the difference between annual returns and expenditures in forest management in the Hessian State Forest Administration. From 1966 to 1976, returns increased 55 percent in value but management costs increased 84 percent. Data about demand for decorative greens are virtually nonexistent. The major cause is the seasonality of the harvest and the large number and diversity of suppliers. Expenditures of retail horticultural firms and foreign trade data also has been lacking. To remedy the information gap, a national research center, the German Central Agricultural Marketing Corporation, has been established. It receives government funding for advertising, market research, market strategic development, and research and development of forest products.

Decorative greens garnered only minuscule amounts in the total revenue from forest products in 1972: DM70,500 from Hessian state forests, DM134,500 in Hessian private industrial forests, and DM14,000 from private nonindustrial forests. In 1976, returns had risen 30 percent over 1972 levels in state forests, 21 percent in private industrial forests, and 200 percent in private nonindustrial forests. Since 1976, new directives have given more discretion in marketing and sales to local forest districts, simplified the process of awarding permits to established purchasers of greens and trees, promoted better market linkages to the floral and horticultural sectors for guaranteeing supply amounts, coupled prices more closely to local demand, and shifted silviculture in state forests to produce more true firs (*Abies* spp.), including exotics, and Douglas-fir (*Pseudotsuga menziesii*) as a way to meet increasing consumer demands for quality. Projections of the share of decorative greens and Christmas trees in the total forest product economy predict a rise from 0.4 perent to 2 to 3 percent of the total value of receipts. This forecast contrasts greatly with the situation in Denmark; in the Århus State Forest District, for example, 36 percent of total receipts were derived from the sale of nontimber forest products (including Christmas trees).

Intensification of forest management for nontimber forest products without an increase in management personnel is impractical. Foresters view additional workload for producing greenery as burdensome and unproductive. Work increases especially in the weeks before Christmas and includes weekends. Temporary assignment of forest personnel to the districts that produce abundant greenery and Christmas trees helps to relieve some of the workload. Pensioners and people participating in government job programs can gather and resell greens and trees to supplement their incomes. If forests are to meet a growing demand for decorative greens, forest districts will have to rely on purchasers with consistently larger orders over the long term. Of particular importance to purchasers is the organization of transport from forests to markets, but proximity of forests to urban areas is no longer essential to marketability.

Keywords: Conifer greens, Christmas trees, revenue generation, Germany.

Hawboldt, L.S. 1965. The future of Christmas trees, maple syrup, charcoal, and blueberries. Forestry Chronicle. 41(1): 34-51.

Reviews the development since 1950 of the lowbush blueberry (principally *Vaccinium angustifolium* and *V. myrtilloides*) industry in eastern Canada. Widespread burning to promote blueberry crop production was largely stopped by 1945. Land use has shifted from wild blueberry production to timber, and many major sources of wild blueberries have declined. At the same time, blueberry production with clonal stocks has shifted to otherwise low-productivity farmland. Data from 1952 through 1963 from the Atlantic provinces show national production of lowbush blueberries. Quebec and Nova Scotia have been major producers. Production has differed considerably from year to year but averaged 19,246 tons over the study period.

Keywords: Berries, eastern Canada, burning, production.

Hayden, Brian. 1992. Complex cultures of the British Columbia plateau: traditional Stl'atl'mx resource use. Vancouver, BC: University of British Columbia Press.

Heckman, Hazel. 1951. The happy brush pickers of the high Cascades. Saturday Evening Post. 4: 35-40. [October 6, 1951].

Describes the working conditions of “brush pickers” in the Pacific Northwest in the early 1950s and the historical origins of the industry. Advantages for the labor force are freedom from supervision and taxes, low investment costs and overhead, and the choice of work hours and seasons. Daily wages ranged from US$18 to US$40 a day with maximum weekly earnings as much as US$400. The industry is believed to have originated as early as 1915. Major products are evergreen huckleberry (*Vaccinium ovatum*), western swordfern (*Polystichum munitum*), and salal (*Gaultheria shallon*). Refrigerated transport of fern material began in 1926. In the early 1940s, the workforce in the floral greens sector was more than 2,000 people. More than 90 percent of the greens used by florists in the United States come from the 150-mile-wide, 600-mile-long area from the Canadian border to Crescent City, CA. The industry is labor intensive with manual picking, sorting, washing, and packing. Many pickers combine harvest work with other sporadic or seasonal occupations such as logging and fishing. Descriptions are given of payments to landowners, work hours, and working conditions.

Keywords: Floral greens, salary and wages, working conditions, Pacific Northwest.

Hergert, Herbert L. 1983. The tannin extraction industry in the United States. Journal of Forest History. 27(2): 92-93.

Surveys the development of the use of plant extracts for the tanning industry in the United States. Before the American Revolution, tanning was a cottage industry, but then became increasingly industrialized as the demand for leather rose during the 1800s. Bak of various species, including black oaks (*Quercus* spp.) and eastern hemlock (*Tsuga canadensis*), were the main sources of tannic acid. By the end of the 1800s, the major tanning company of the era, United States Leather Company, had obtained control of most of the hemlock stumpage in its headquarter State, Pennsylvania. The quantities of bark required were large: almost 1.2 million cords of hemlock bark were produced in 1900, comprising 72 percent of the Nation’s total tannin production. Tanning also was a major industry on the Pacific coast, where the major source of tannin was tanoak bark (*Lithocarpus densiflorus*). As both sources of hemlock and tanoak bark dried up, the industry switched to chestnut (*Castanea dentata*) wood chips as the source of tannin. This source dried up in the 1930s with the chestnut blight, and imported tannin replaced domestic supplies. By 1960, the two remaining domestic tannin producers had shut down. Attempts by Rayonier Incorporated to use hemlock tannins for well-drilling fluids met with moderate success until another less costly source was discovered. The author concludes with the observation that increased interest in renewable resources may eventually revive interest in tannin as a raw material.

Keywords: Tannin, resource history, United States, technological advances, industrial restructuring.

Hévin, H. 1980. Les champignons sylvestres comestibles: aspects économiques= Edible forest fungi: economic aspects. Revue Forestière Française. 32(3): 305-315. In French.

Reviews the economic importance in France of edible forest mushrooms. Data about wild mushrooms are inexact and identify only orders of magnitude of harvests. Harvests also fluctuate considerably from year to year as the result of variability in temperature and rainfall. Data for commercial harvests from eight departments and their total value are provided for 1965 through 1977. For the study period, between 5 and 6 thousand tonnes were collected annually. Average market price per kilogram was F14-15 in 1977 with total national value amounting to F70-75 million. These data do not include information about recreational or subsistence harvests. Harvesting is concentrated in the south-central part of France and in Lorraine. Regional trends in harvest levels are not clear at present.

Trade data indicate that the French imports of chanterelles (*Cantharellus* spp.) and boletes (*Boletus* spp.), fresh or refrigerated, has generally increased, but the annual amounts imported, their values per kilogram, and the countries of origins differ greatly from one year to another. Trade data are given for 1968 through 1978. Exports of chanterelles and boletes are stable, averaging 50 tonnes annually. Switzerland is the major and most reliable foreign market. Exports sales in 1978 commanded an average of F3115/kg, while imports to France for the same category of products cost on average only F733. The different mix of chanterelle and bolete species is believed to cause the difference in price data. French imports of “mushrooms preserved without acetic acid” have ranged from 85 to 435 tonnes annually for the period, with Spain and Morocco being the major source countries; French exports have been on the decline. Exports of preserved mushrooms, particularly to Germany, have declined precipitously since 1976 as prices have risen.

French production of canned mushrooms has risen fourfold to fivefold since 1968. The quantity of canned boletes and morels (*Morchella* spp.) has increased tenfold. Boletes comprise a stable 30 percent of the canned market; *Lactarius* mushrooms and yellow slippery jack (*Suillus luteus*) are increasing their market share, and the percentage of canned *Tricholoma* species is falling. This article demonstrates the volatility of mushroom markets internationally and provides a level of detail not generally available in the United States.

Keywords: Wild edible mushrooms, France, harvest volume, economic value, canned mushrooms, trade data.

Hinesley, L. Eric; Snelling, Layne K. 1992. Yield of decoration greenery from Fraser fir Christmas trees. HortScience. 27(2): 107-108.

Proposes dedicating small parts of Fraser fir (*Abies fraseri*) Christmas tree plantations to intensive production of decorative greenery. A sample (n=126) of conventionally grown and managed Fraser fir from western North Carolina was used. No sideshearing occurred in the harvest year. Commercially valuable greenery was defined as symmetrical, nonsheared, and fully foliated branch segments with 1- and 2-year internodes, 18 to 30 cm long, and twig basal diameter less than 7 mm. The usable proportion for decorative greenery for each tree was calculated as the usable weight in a foliage subsample from the tree, divided by the total subsample weight, and multiplied by the total branch weight. Regressions were developed to estimate total fresh weight of branches and usable greenery. Explanatory variables included commercial height of the tree, crown density, and crown taper. During the last half of a 10-year Christmas tree rotation, production

of commercial grade greenery per tree averaged 4.0 to 4.5 kg per year and 1.9 to 2.3 kg per year for the entire rotation. These figures coincide with yield studies from Denmark and the Pacific Northwest.

This methodology and collected data can help to estimated potential yields of decorative greenery and determine required land area to produce a specified quantity of greenery over the course of a Christmas tree rotation.

Keywords: Conifer greens, shearing, yield estimates.

Holstener-Jørgensen, H. 1972a. Afgrødeanalyser i pyntegrøntbevoksninger af *Abies nobilis*=Chemical analyses of produce from decoration green stands of *Abies procera*. Forstlige Forsøgsvaesen i Danmark. 33(1): 51-73. In Danish with English summary.

Holstener-Jørgensen, H. 1972b. Gødskningsforsøg i pyntegrøntbevoksninger af *Abies nobilis*=Fertilizing experiments in decoration green stands of *Abies procera*. Forstlige Forsøgsvaesen i Danmark. 33(1): 77-82. In Danish with English summary.

Holstener-Jørgensen, H. 1973a. Gødskning og herbicidanvendelse i klippebevoksninger af *Abies nobilis*=Fertilizing experiments in decoration green stands of *Abies procera*. Forstlige Forsøgsvaesen i Danmark. 33(3): 281-287. In Danish with English summary.

Holstener-Jørgensen, H. 1973b. Gødskningsforsøg i *Abies nobilis*-klippebevoksninger 1967-1971=Fertilizing experiments in *Abies procera* decoration-greenery stands 1967-1971. Forstlige Forsøgsvaesen i Danmark. 33(3): 289-301. In Danish with English summary.

Holstener-Jørgensen, H. 1975. Gødskningsforsøg i 7 kulturer af *Abies nobilis*: udslag på højdevaeksten=Fertilizing experiments in 7 plantations of *Abies procera*: effects on height growth. Forstlige Forsøgsvaesen i Danmark. 34(3): 293-306. In Danish with English summary.

Holstener-Jørgensen, H. 1978. Vedmassefaktorer i gødede og ugødede nobilis kilppebevoksninger=Volume factors in fertilized and nonfertilized decoration-greenery stands of *Abies procera*. Forstlige Forsøgsvaesen i Danmark. 36(2): 205-219. In Danish with English summary.

Holstener-Jørgensen, H. 1986. Gødningsforsøg i nobilis bevoksninger til grøntproduktion=Fertilization experiments in noble fir [*Abies procera*] stands for greenery production. Forstlige Forsøgsvaesen i Danmark. 41(1): 36-40. In Danish with English summary.

Holstener-Jørgensen, H.; Johansen, V. 1975. Vanding af nobilis-klippebevoksninger=Irrigation of decoration-greenery stands of *Abies procera*. Forstlige Forsøgsvaesen i Danmark. 36(3): 307-316. In Danish with English summary.

Holstener-Jørgensen, H.; Stope, E. 1985. Et gødskningsforsøg i *Chamaecyparis lawsoniana* på Aalholm skovdistrikt=A fertilizer experiment with *Chamaecyparis lawsoniana* at the Aalholm Forest District. Forstlige Forsøgsvaesen i Danmark. 40(1): 77-84. In Danish with English summary.

Reports on a block-design experiment to compare the effects of differing levels of fertilization of Port-Orford-cedar (*Chamaecyparis lawsoniana*) in plantations grown for production of floral greenery in Denmark. Two fertilizer treatments were applied in 1972 without control: 275 kg NPK per ha and 550 kg NPK per ha. Yields of cut boughs under the heavier application are not statistically significantly greater than in the lower fertilizer treatment, and costs of the extra fertilizer do not pay for the added yield. Trees pollarded to a height of 5 m provided high yield per tree, but excessive harvesting of boughs may have caused increased mortality in one plot. In plots with less fertilizer applied, averages of individual tree production ranged from 13.5 to 21.5 kg per tree with the 3-year cutting cycles.

Keywords: Conifer greens, fertilization, production, Denmark.

Hosford, David; Molina, Randy; Pilz, David; Amaranthus, Michael. 1995. Ecology and ecosystem management of the commercially harvested American matsutake mushroom. 18 p. Draft manuscript. On file with: Randy Molina, Pacific Northwest Research Station, Forestry Sciences Laboratory, 3200 SW Jefferson Way, Corvallis, OR 97331.

Charts a course for future management to sustain harvests of the American matsutake (*Tricholoma magnivelare*), the most valuable mushroom, by weight, in the Pacific Northwest. Most of the crop, harvested from northern interior British Columbia to northern California, is exported to Japan where demand for the Japanese matsutake (*T. matsutake*) and related species has increased greatly over the last 30 years. Management of matsutake is difficult because the fruiting bodies are ephemeral, patchy in their distribution, and highly variable in their annual productivity. Survey methods and training to inventory fungi are urgently needed. Improved grading and increased attention to presentation and marketing of American matsutake will improve the image of the mushroom in Japan. Descriptions of current management of Japanese red pine (*Pinus densiflora*) forests in Japan give details of site selection for mushroom tending (stands 40 to 50 years old on southwest slopes or ridgetops) and management practices (stand thinning, removal of understory vegetation and litter). These details may provide guidelines for adapting management practices to American matsutake, although the extent to which Japanese practices apply to Pacific Northwest conditions is not known. Questions remain about the active human introduction of matsutake into stands where they have not previously existed.

The authors outline social and economic considerations affecting commercial harvest in the Pacific Northwest. Resource managers must consider the diverse social backgrounds and attitudes of mushroom harvesters. Harvesting for

economic profit generates costs, such as providing necessary camping and sanitation amenities, litter accumulation, and fire danger. Harvesting also engenders conflicts with other resource interests. For example, conflicting goals between timber production and matsutake production are complex and unique to specific sites. Law officers are required for patrols to enforce new regulations. Human impacts on local matsutake productivity will differ by soil type and effects of trampling intensity. As yet, there are no good economic analyses of matsutake harvests or the structure of the matsutake industry in North America.

The authors recommend adaptive management to detect and monitor matsutake populations, to evaluate site and populations for harvest suitability, and to continually revise harvest levels on the basis of monitoring and experimental research data. In this way, risk and uncertainty are diminished with the orderly accumulation of ecological knowledge and managerial experience. Existing research on the long-term effects of harvesting on matsutake populations is already underway in British Columbia and Oregon.

Keywords: Edible wild mushrooms, Pacific Northwest, management, cultivation, resource conflicts, social considerations, economic considerations, adaptive management.

Howell, Sharon. 1991. The brush business. Philomath, OR: The Ruralite. 38(4): 6-11.

Provides background history of nontimber forest products in central western Oregon. Diverse nontimber forest products industries have been active for more than a 100 years. Since the 1880s, people have been cutting cascara bark (*Frangula purshiana*) and digging Oregongrape (*Mahonia* spp.). Gathering conifer cones was commercially important in the 1920s. Some medicinal plants such as British Columbia wild ginger (*Asarum caudatum*) and American false hellebore (also called skunk cabbage, *Veratrum viride*) are no longer in demand because synthetically produced substitutes have been found. The growth of the wild edible mushroom industry in the last 20 years has been impressive. Other foods include western brackenfern (*Pteridium aquilinum*) fiddleheads, juniper berries (*Juniperus* spp.), blackberries (*Rubus* spp.), and huckleberries (*Vaccinium* spp.). Native mosses growing on bigleaf maples (*Acer macrophyllum*) are very popular in the floral industry. Wholesalers purchase moss from collectors for about US$0.30/lb. Among currently collected medicinal plants, both native and exotic plants found in the Pacific Northwest are significant; they include mullein (*Verbascum* spp., introduced), prince's-pine (*Chimaphila umbellata*), aspen (*Populus tremuloides*), purple foxglove (*Digitalis purpurea*), Oregongrape (*Mahonia* spp.), Douglas-fir (*Pseudotsuga menziesii*) , Pacific yew (*Taxus brevifolia*), wild cherry (*Prunus* spp.), and cascara (*Frangula purshiana*).

One processing company purchases, on average, 1,000 fern bunches and 1,800 salal (*Gaultheria shallon*) bunches daily from 25 to 50 pickers during the summer. Winter months find fewer willing pickers, but the best picking time for floral greenery is from July to May. Seasonal items include Port-Orford-cedar (*Chamaecyparis lawsoniana*), western redcedar (*Thuja plicata*), conifer boughs, and mistletoe (*Phoradendron* spp.). Successful pickers must be familiar with the ecology and distribution of their product and know how to harvest it without damaging wild populations.

Work in inclement weather and lack of employment benefits for pickers are balanced with the freedom of setting their own hours and workload. Permits are required for any commercial forest harvesting. Dealers in special forest products must be vigilant about maintaining strict control over product quality and take an active role in training and advising new pickers.

Keywords: Floral greens, conifer boughs, medicinal plants, processing, central western Oregon, edible wild mushrooms, berries, edible wild plant.

Huber, Dean W. 1992. Utilization of hardwoods, fuelwood, and special forest products in California, Arizona, and New Mexico. Gen. Tech. Rep. RM-218. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station.

Argues that special forest products collectively represent a large percentage of annual value on forest lands and that they can provide economic diversification opportunities for rural communities. Notes that in ignoring hardwoods, people have ignored the importance of special forest products, which are primarily derived from hardwoods. The authors attribute the lack of a viable hardwood industry to a number of factors, including negative attitudes about the industrial profitability of hardwoods, the difficulty of managing mixed stands, the low timber value of hardwoods relative to softwoods, high harvesting costs, and the difficulties of drying hardwoods. The fragmented nature of industries that use special forest products from hardwoods, the difficulties of marketing products from highly fragmented, unorganized cottage enterprises, and the lack of technical information on how to use hardwoods have made managing for hardwoods difficult for forest managers.

The authors note that, historically, nonlumber uses of hardwoods have been critical to southwestern economies. Bark from the tanoak (*Lithocarpus densiflorus*), for example, supported extensive tanneries in California as early as the 1850s. At the present time, hardwoods are in high demand as fuelwood, and in some National Forests such fuelwood sales provide a significant percentage of total forest income. Special products derived from hardwood species also are sold in many southwestern forests. One difficulty in setting up special forest product sales, is that unit measures differ by product. Most are sold through small contract sales and are registered under the “nonconvertible” sales category. Data on such sales from five southwestern National Forests indicate that in areas where softwoods are limited, special forest products form as much as 46 percent of the total value of products sold.

The author observes that although special forest products are unlikely to form the basis of a major industry, they are an important source of economic diversity for rural communities. He describes and compares three paradigms for conceptualizing the relations between harvesting and land management practices: (1) “cut-n-convert” industries, which rely on killing and then replacing the root stock that the product comes from; (2) “cut-n-reuse” industries, which harvest the bole in ways that allow the tree to develop from root sprouts; and (3) “retain-n-reuse” industries, which harvest products on an annual or short-term cycle. He argues that the retain-n-reuse paradigm fits many special forest products, where various tree parts or plants are collected without destroying the source tree or plant. The author notes

that the three paradigms exist on a gradient in terms of impact on the land and capital intensiveness, with the cut-n-convert being on the high end of the scale and the retain-n-reuse at the low end.

The author notes that the strengths of the retain-n-reuse paradigm are that the small scale of special forest product sales allows foresters to keep “resource use in closer balance with resource management,” thereby creating a “vested local interest in the land base and its management.” He argues that this advantage also extends into the processing realm where the cottage industry nature of special forest product processing “contributes to the diversity of industry and thus economic stability of rural communities.” He provides several examples of how special forest product harvesting contributes to the maintenance of ecosystem conditions as well. The author notes that a better understanding of special forest product industries is needed if management objectives include community development and stabilization.

Keywords: California, Arizona, New Mexico, tanning, rural development, community stabilization, economic diversification, regulation, government policy.

Hultkrantz, Lars. 1991. National account of timber and forest environmental resources in Sweden. Arbetsrapport 130. Garpenberg, Sweden: Swedish University of Agricultural Sciences, Faculty of Forestry, Department of Forest Economics. 35 p.

Outlines a process for determining the net national product from national income accounting of Swedish forest resources for 1987. Production of nontimber forest products are included in the accounting, and recreation and aesthetic amenities are omitted. Because Swedish law permits open access for its citizens to private forest land, there are no exclusive property rights assigned to berries, and berry picking for personal use is widespread. Most of the volume of berries (predominantly whortleberries [*Vaccinium myrtillus*] and lingonberries [*V. vitis-idaea*]) is not marketed but is instead consumed by pickers. Only a small amount of the marketed crop, totaling SKr100 million, appears in the national accounting, but the estimated market value of the entire crop is six times the value reported in the national account. After accounting for production costs, profits are estimated at SKr500 million.Similarly, the mushroom crop for 1987 is estimated to be SKr550 million, consisting mostly of morels (*Morchella* spp.) and chanterelles (*Cantharellus* spp.). The net value of berry and mushroom crops in Sweden equaled nearly 6 percent of the net Swedish timber product value in 1987.

Keywords: Net national product, economic value, wild edible mushrooms, berries, Sweden.

Hultman, Sven G. 1983. Hur mycket bär och swamp plockar vi egentligen?= How many berries and mushrooms do we actually pick? Vår Föda. 35: 284-297. In Swedish with English summary.

Reports results of a survey of household use of wild edible berries and mushrooms in Sweden in 1977. A thousand questionnaires were sent to a random population between 16 and 74 years old. Response rate was 84.1 percent. Data were checked and corrected through followup telephone interviews. Fifty-four percent of

households picked wild berries and 32 percent picked wild edible mushrooms. The most popular berry species were whortleberries (*Vaccinium myrtillus*), lingonberries (*V. vitis-idaea*), and red raspberries (*Rubus idaeus*). Average amounts picked per person were calculated. Berry picking is more widespread in northern Sweden and mushroom picking is more widespread in central and southern Sweden. Combining national inventory data of berry and mushroom stocks, the authors estimate that 7 percent of berries and 3 percent of mushrooms are picked nationally. Demographic productivity by human age class and preferences are calculated. Women pick slightly more than men; more educated people pick more wild mushrooms and fewer berries than the rest of the population. Berry and mushroom picking may not become a major industry but is important for subsistence in rural areas where sources of income are scarce and as a recreational opportunity for other groups.

Keywords: Social survey, berries, wild edible mushroom, harvestings, households, Sweden, subsistence, recreation.

Hunn, Eugene S.; Norton, Helen H. 1984. Impact of Mt. St. Helens ashfall on fruit yield of mountain huckleberry, *Vaccinium membranaceum*, an important Native American fruit. Economic Botany. 38(1): 121-127.

Proposes that volcanic activity may severely reduce resource yields on which hunters and gatherers depend but that reductions are usually of short duration and highly variable impact. Much depends on the timing of the eruption and the resource under consideration. The original indigenous subsistence economy was based on fishing, root-digging, and montane berry collection. Blue huckleberry (*Vaccinium membranaceum*), an important food species to the Yakama and other native peoples, is gathered in August at high elevations in the Cascade Range.

Following the eruption of Mount St. Helens in May 1980, 64 plants from seven sites with heavy ash depositions and 54 plants from six sites with only traces of ash were sampled for numbers of berry fruits per square meter of berry crown area. Yield at sites (after outliers were removed) with minimal ash averaged 3.7 times greater than at sites with plentiful ash. The timing of the eruption coincided with the huckleberry flowering and the apparent mortality of pollinator bees. The authors speculate that the extensive network of social relations among Native groups, with generous reciprocal exchanges of food and their reliance on multiple food resources in a subsistence economy were strategies to minimize risk of starvation during earlier volcanic eruptions in the region.

Keywords: Berries, ash, productivity, Mount St. Helens.

Hunn, Eugene S.; Turner, Nancy J.; French, David. [In press]. Ethnobiology and subsistence. In: Walker, Deward, ed. Handbook of North American Indians, volume 12. Washington, DC: The Smithsonian Institution.

Hunter, J. Robert. 1981. Tendu (*Diospyros melanoxylon*) leaves, bidi cigarettes, and resource management. Economic Botany. 35(4): 450-459.

Proposes that nonwood forest products have economic significance for populations where population density is high, wages low, and returns from agriculture

are uncertain. Where deficits exist in subsistence or mixed economies, nonwood products can improve well-being. The economic structure of the market in Madhya Pradesh, India, for leaves of the tendu tree (*Diospyros melanoxylon*) as wrappers for bidi cigarettes illustrates problems arising from development of nonwood forest products. Tendu leaf collection comes during the dry season when new branching and leafing from burnt stumps occurs and when local women and children have few other opportunities to earn cash. Pickers earn on average US$0.77 per day. Their wage scale and social status are the lowest in the region.

The system for payment of rights to leaf collection is complex. Competitive bidding is open to tendu leaf purchasers and bidi manufacturers for collection rights in specified areas. The highest bidder incurs risk by paying the state government before the harvest begins. In 1979, state revenues amounted to US$40 million. Indigenous residents receive only a small fraction of the US$12.5-15 million subsequently paid by the state to labor contractors for manual harvesting. Manufacturers do not believe that labor wages can be increased because their gross profit remains at US$0.003 per package, less than 4 percent of total sales. Remaining royalties to the state cover increasing budget deficits in public health, public works, education, and so forth. Little money is reinvested in the forests or the indigenous communities. Current extraction levels cannot be sustained. To prevent ecological collapse, a coordinated planning effort is needed to integrate the social welfare of the indigenous people into regional development plans, devise a sustainable forest management and harvesting schedule based on research and monitoring, and provide adequate funding for forest management to maintain and improve economic productivity.

Keywords: India, resource management, market structure, ecological sustainability, economic productivity.

Hvass, Jens. 1964. Pyntegrønt-produktion=Production of evergreen branches for decoration. Norsk Skogbruk. 10(1): 10-13. In Norwegian.

Introduces Danish forest practices for production of decorative conifer boughs to Norwegian foresters. Major commercial species from the Pacific Northwest grown in Denmark are noble fir (*Abies procera*), Douglas-fir (*Pseudotsuga menziesii*), and Port-Orford-cedar (*Chamaecyparis lawsoniana*). Noble fir competes for highest prices with Caucasian silver fir (*A. nordmanniana*). Minor Northwest species planted in Denmark are western hemlock (*Tsuga heterophylla*), western redcedar (*Thuja plicata*), and Sitka spruce (*Picea sitchensis*). Grand fir (*A. grandis*) also has limited use. Guidelines for pruning boughs and bundling are given as well as grading criteria and average prices. The author also outlines general silvicultural practices regarding spacing and species composition. Conditions in southern Norway are similar enough to Denmark to initiate parallel forestry practices.

Keywords: Conifer boughs, silviculture, production, Denmark, Norway.

Iqbal, Mohammad. 1993. International trade in non-wood forest products: an overview. Rome: United Nations, Food and Agricultural Organization. 100 p.

Surveys many nonwood forest products and their commercial production worldwide. Of particular importance to the Pacific Northwest is the discussion of production of wild mushrooms from other regions, which might compete with products from the Pacific Northwest. Total world production of morels (mostly *Morchella* spp.) annually is estimated at 150 tonnes (dry). Pakistan and India are the main producers, with 50 dry tonnes each, produced annually for export. The market structure is briefly described. France, Switzerland, and Germany are the major importer of morels, and total annual imports to western Europe amount to 100-120 tonnes with a rising trend. Morels in Pakistan cost about US$117-133/kg, and collectors receive about half to two-thirds of the export price. Morels imported to western Europe frequently are reexported to the United States. Profits are considered high. Processing and packaging in the countries of origin would be profitable as long as USDA and FDA standards could be met economically. Limits to market growth in Asia include unsustainable collecting practices, unhygienic methods of storing and drying, and the lack of a good market information system. Industrial cultivation of morels does not appear to be feasible any time soon.

Truffle (*Tuber* spp.) production is concentrated in France and Spain. Most of the 15 to 30 tonnes of truffles harvested in Spain are exported to France. French production of truffles in 1988 was 5 percent of the level 95 years ago. The United States imported 5.4 tonnes of fresh or refrigerated truffles in 1989 at a cost of US$1.48 million or US$273/kg. Efforts to incorporate truffle production into afforestation programs have already begun in New Zealand.

Yellow slippery jacks (*Suillus luteus*) appear in the 4th year of Monterey pine (*Pinus radiata*) plantations and have peak production in year 7. Chile exported 943 tonnes in 1981 at a value of US$2.03 million or US$2.15/kg. The United States, France, and Peru were the major importing countries. More recent data are not available.

Trends, prospects, and constraints to development of special forest products are discussed in the concluding chapter. Nonwood timber products tend to fluctuate considerably in availability. Serious attention to sustainability of supplies needs to compliment research efforts in market development. Domestication and cultivation require advance investment in the biology and breeding of target species. Development of nonwood forest products seems to occur in countries where labor is cheap and in ample supply. The commercial feasibility of most nonwood forest products is limited in highly developed countries. Integration of nonwood products with incomes early in timber rotations may in some cases make slower but more sustainable rates of timber extraction more attractive. Economic data are usually obtainable only for export products, and the quality of data differs considerably from one country to another. The study concludes with recommendations that call for policy reorientation, knowledge acquisition, programs for product improvement, improved marketing, and coordination among international agencies in the United Nations and regional trade organizations.

Keywords: Truffles, wild edible mushrooms, international trade, policy, United Nations, Pakistan, Chile, France, Spain.

Ismail, A. 1981. Introduction to growing blueberries in Maine. In: Productions spontanées: Colloque sur les productions spontanées; 17-20 June 1980; Colmar, France. Les Colloques de l'INRA 4. Paris: Institut National de la Recherche Agricole: 205-208.

Describes the blueberry industry in Maine where 15 to 20 percent of the North American blueberry crop is harvested. The field cash value of the crop is US$9-10 million. Management of wild populations consists of pruning, fertilizing, pollinating with bees, irrigating, regulating soil acidity, and controlling insects, disease, and weeds. Most lowbush blueberry fields are burned after every harvest (every 2nd year) or after every second harvest (every 4th year). Major species are *Vaccinium angustifolium* and *V. myrtilloides*.

Keywords: Berries, Maine, economic value, management.

Ito, Takeshi; Ogawa, Makoto. 1979. Cultivating method of the mycorrhizal fungus, *Tricholoma matsutake* (Ito et Imai) Sing. II: Increasing the number of shiros (fungal colonies) of *T. matsutake* by thinning the understory vegetation. Journal of the Japanese Forestry Society. 61: 163-173.

Iwamura, Mitimasa; Nishida, Teruaki; Ishikawa, Tatsuyoshi. 1966. Analysis of environmental factors in Japanese red pine forest producing the fruit body of matsutake. I: The change of forest composition, light-intensity and the yield of fruit body in the treated matsutake forest. Scientific Reports of the Faculty of Agriculture 27. [Okayama, Japan]: Okayama University: 17-26. In Japanese with English summary.

Reports on a nonreplicated experiment to test the response of mushroom fruiting bodies to manipulation of forest understory vegetation and soil to increase the production of matsutake (*Tricholoma matsutake*) in a Japanese red pine (*Pinus densiflora*) forest. Plots 20 m^2 were compared. In the control plot, all vegetation was maintained. In the treatment plot, understory trees and shrubs were reduced to 33 percent of the levels in the control plot. The surface soil also was raked. Numerous environmental factors were altered in the treatment plot: ambient temperature, soil temperature, humidity, and light intensity. During the season studied, matsutake yield in the plot with cleared and raked understory was different; in general, the regression for production of matsutake fruiting bodies against fairy ring diameter had a higher average and a greater variance than did the population of matsutake growing under natural stand conditions.

This article relates the trial experiment for management of matsutake that might have experimental relevance for management of the American matsutake (*T. magnivelare*) in the Pacific Northwest.

Keywords: Wild edible mushrooms, productivity, forest composition, Japan.

Jacobsen, Jens Søgaard. 1994. Foraedling af nobilis klippegrønt=Product improvement for *Abies procera* boughs. Pyntegrøntsektionen Nåledrys. 10(19): 43-46. In Danish.

Jansen, A.E; de Vries, F. 1988. Mushrooms decline in 10 of 18 countries. Mushroom, the Journal: Summer: 7-10.

Summarizes the results of a survey conducted by the European Committee on the Protection of Fungi on the status of macrofungi in 19 European countries. A distinct decline of macrofungi was observed in 10 countries; either no decline or insufficient data were reported for the remaining 9 countries. The declines were generally attributed to human activities resulting in the degradation, destruction, and elimination of habitats. Intensive picking of edible mushrooms was cited as a possible cause of decline in Italy and Czechoslovakia, but a study in the Netherlands indicated that changes in the soil from natural succession or air pollution were responsible for the decline there. Regulatory protection of fungi and research on changes in distribution patterns were limited to only a few countries.

Keywords: Wild edible mushrooms, Europe, productivity, monitoring.

Jäppinen, Juk-Pekka; Hotanen, Juha-Pekka; Salo, Kauko 1986. Yields of wild berries and larger fungi and their relationship to stand characteristics on MT and VT-type mineral soil sites in Ilomantsi, eastern Finland, 1982-84. Folia Forestalia. 670: 1-25. In Finnish with English summary.

Investigates annual variation of wild berries and edible fungi on upland sites. Mean yields of whortleberries (*Vaccinium myrtillus*) were highest in mature mixed-species stands and young pine stands; 1983 was a good year, 1982 a poor year. Frost and drought during the flowering period caused the poor yields in 1982. Other berry species (*V. vitis-idaea*, *V. uliginosum*, *Empetrum nigrum*, and *Rubus saxatilis*) had much smaller crops. Annual variation among crop yields prevented finding a significant regression equation to predict yield from one year to the next.

Moist uplands generally had higher yields of mushrooms than drier sites. Smallest yields were found in clearcut sites, and the largest yields were in spruce stands ready to be harvested. The commercial mushroom yield, however, is higher on dry sites than moist sites.

Keywords: Berries, wild edible mushrooms, productivity, Finland.

Johnson, James Holbrook. 1992. The secret harvest. American Forests. 65: 28-31.

Describes current issues in the special forest products industry. Small landowners in the Pacific Northwest are deriving additional income from special forest products from such diverse species as willows (*Salix* spp.), roses (*Rosa* spp.), beard moss (*Usnea* spp. and *Alectoria* spp.), and Oregon white oak (*Quercus garryana*). The global scope of potential markets for nontimber products from forests of the Pacific Northwest is described. The special forest products industry involves sales of US$130 million a year and employs 10,000 people nationwide, but the dearth of knowledge about the industry is troubling. Recent harvesting of beargrass (*Xerophyllum tenax*) and Pacific yew (*Taxus brevifolia*) demonstrate how quickly and unexpectedly market demands for special forest products develop. National Forest Service staffs have had to acquire expertise quickly to manage newly

evolving resources in a vacuum of information. The USDA Forest Service, for example, has no data on yew stocks or models to project sustainable harvests.

The author also addresses equity issues about distribution of income within the special forest product industry. Pickers receive perhaps one-eighth of the price that wholesalers and value-added processors receive. “Underground” traditions of the industry and the lack of regulation and information prevent restructuring the industry to help rural communities.

Firtech, an emerging broker of special forest products, is profiled, and problems the company has experienced due to variations in permit procedures and costs are highlighted. Suggested solutions to the dilemmas facing the special forest product industry are increased research and commitment to special forest products by land management agencies, wider use of stewardship agreements, and promotion of user groups for each type of special forest product to develop effective harvesting techniques and user ethics.

Keywords: Pacific Northwest, harvest volumes, equity, management, Firtech.

Kalamees, Kuulo; Silver, Silja 1988. Fungal productivity of pine heaths in northwest Estonia. Acta Botanica Fennica. 136: 95-98.

Examines the fungal productivity of two types of pine heaths in the Nova and Vihterpalu Forest Districts in northwest Estonia from 1978 to 1981. The authors established seven permanent plots in an 80-year-old Scotch pine (*Pinus sylvestris*) heath, a 100-year-old pine heath, and a 25-year-old pine wood. All the fruiting bodies of edible macrofungi in these plots were harvested, sorted, counted, and weighed. In addition, fruiting bodies of inedible and poisonous fungi were recorded. Data are provided on species composition, the average number of fungal bodies per hectare, the average production of fungal fruiting bodies, the annual variation in production, the extent of worminess, and other characteristics of the three forest types. The results are compared to previous studies.

Keywords: Wild edible mushrooms, productivity, pine heaths, Estonia, experimental design, age class.

Kalotas, Arpad C. 1993. Recording and applying aboriginal botanical knowledge in Western Australia: some recent examples and future prospects. In: Williams, Nancy M.; Baines, Graham, eds. Traditional ecological knowledge: wisdom for sustainable development: Based on the traditional ecological knowledge workshop; 18-29 April 1988; Canberra, Australia. Canberra: Australian National University, Centre for Resource and Environmental Studies: 94-103.

Reports on methods used to record Aboriginal botanical knowledge in Western Australia. This knowledge holds promise for innovations in domestication and development of previously uncommercialized natural resources, particularly in nutritional and medical sciences. There is lack of integration between historical records of information and present uses and practices by Aboriginal peoples in the region. Cooperative and complementary efforts to blend Western science and technology with Aboriginal botanical knowledge can be beneficial to all

Australian society. Transmission of cultural knowledge also has important roles in primary and secondary educational systems, ecosystem management, resource conservation, employment, and economic development in Aboriginal communities. This knowledge is crucial for non-Aboriginal people in Australia to gain a broader perspective in national political decisionmaking.

Economic justice requires thorough consideration of intellectual property rights. Recognition of the value of indigenous knowledge to the rest of society is essential to the fair economic exchange among coexisting cultural groups. Collaboration between scientists and indigenous people can organize information about the ecological requirements and horticulture of traditionally valuable plants, expand the range of human economic uses, strengthen traditional uses by ensuring sustainable supplies of plant materials, and derive additional sources of income for Aboriginal communities. Resource managers have an obligation to inform Aboriginal people about real and potential problems for resource management, and ethnobotanists have an ethical obligation to make the people they work with aware of the value of Aboriginal knowledge to the rest of society.

This essay outlines important issues confronting comparable efforts in the Pacific Northwest to expand ecosystem knowledge and options for economic development of native plant resources.

Keywords: Indigenous knowledge, collaboration, domestication, horticultural plants, cultural patrimony, intellectual property rights, Australia.

Kantor, Sylvia. 1994. Local knowledge and policy development: special forest products in coastal Washington. Seattle: University of Washington. 46 p. M.S. thesis.

Examines the role that local knowledge plays in state and Federal special forest products policy processes in the State of Washington, and identifies constraints and barriers to local participation in policymaking. Interviews were conducted with 24 individuals, including land managers and owners, tribal members, buyers, and harvesters involved in the special forest product industry in coastal Washington. Information was collected on perceptions and views related to the sources of knowledge about special forest products, and the kinds of knowledge used in making policy decisions, the ways in which various stakeholders communicate with each other, the barriers and opportunities to communication, the degree to which various stakeholders participate in decisionmaking, and whether and how they think forums for participation should change.

Some of the obstacles to communication and participation included language differences, ethnic differences, class differences, physical distance between those who make policy and those who live near and depend on special forest product resources, and cultural isolation. Interactions among the various kinds of stakeholders were mapped, and a diagram of those interactions indicates that agency land managers and buyers serve as communication nodes. Land managers receive most of their information from other agencies or buyers and reported very little reliance on pickers and tribal members. In general, tribes fell outside the communication loops among stakeholders.

Major communication barriers identified included mutual distrust, particularly among managers and pickers; lack of resources and initiative on the part of resource agencies to seek information from unorganized groups; and unwillingness on the part of pickers to share knowledge with other stakeholders. The media, which have tended to overdramatize the conflicts occurring around special forest products, are viewed as obstacles to better understanding.

Kantor suggests several strategies for addressing communication and participation barriers, including additional research on how communication networks are structured among special forest product stakeholders, the use of a variety of communication and participation forums including workshops and public meetings that encourage interaction among harvesters and land managers in which the participation of harvesters might be subsidized, and identification of ethnic-based and other harvester associations that can serve as a point of contact between harvesters and managers. Key difficulties that need to be considered are how to develop processes that enable previously unheard voices to enter policy dialogues, and how to structure research that breaks down, rather than creates, barriers to genuine knowledge sharing.

Keywords: Local knowledge, communication networks, barriers, policy development, Washington.

Kardell, Lars. 1980. Forest berries and mushrooms—an endangered resource? Ambio. 9(5): 241-247.

Chronicles public concern over the perceived conflict between the use of Swedish forests for timber production and for other products, principally berries and mushrooms for recreational picking. Swedish public perception, in part reinforced through the country's largest daily newspapers, is negative toward herbicide applications. Herbicide applications coincide with mushroom or berry collection times. Historically, berries and other edible wild plants were never a major feature of Swedish diets, but the supply of wild foods at times enabled people to survive famines. Berries acquired greater significance in Sweden after 1900 with improvements in transportation and storage and development of large urban markets. Wild mushroom consumption is a phenomenon of the late 20th century.

Berry and mushroom gathering are important recreational activities among Swedes, 80 percent of whom gather berries and 50 percent of whom gather mushrooms every year. Both are open-access resources on both private and public land. In recent years, tension between timber harvesters and berry and mushroom gatherers has increased as the latter object to spraying operations that take place during the gathering season. Berries and other wild plants have long provided vitamins otherwise lacking in the Swedish diet. The most important berries are whortleberry (*Vaccinium myrtillus*), lingonberry (*V. vitis-idaea*), cloudberry (*Rubus chamaemorus*), and red raspberry (*Rubus idaeus*). The four species are found in very different forest environments.

Berries first entered the market in large quantities in the latter portion of the 19th century, when railroads permitted shipments to city markets. Export markets opened up around 1900 and increased the demand for forest berries. In the last 30 years, however, berries have become more important as a recreational

resource than as a commercial resource. A study conducted in the mid-1970s indicates that Swedes consume an average of 125 l of berries and 100 l of mushrooms per capita per year. In 1977, 80 million l of berries and 23 million l of mushrooms were gathered for domestic consumption. Annual production of fresh-weight forest berries and edible wild mushrooms averages 1000 million l and 480 million l, respectively, based on inventories of mushrooms and berries conducted by the Swedish National Forest Survey between 1974 and 1977 on 29,000 test plots.

Forest inventories indicate that the effects of clearcutting differs with the berry and mushroom species. Morel (*Morchella* spp.) and whortleberry take years to recover, lingonberry bounces back after just a few years, and red raspberry produces more after the forest canopy is removed. The authors conclude that spraying does not affect a significant amount of berries and mushrooms, given their relative abundance. They believe that the antispray campaign is fueled more by feelings of powerlessness than by actual declines in available resources. They recommend political, rather than technical solutions, but do not specify the nature of those solutions.

Keywords: Resource conflicts, Sweden, Scandinavia, joint production, berries, wild edible mushrooms, herbicides, policy.

Kardell, Lars; Carlsson, E. 1982. Hjorton, tranbär, lingon: förekomest och bärproduktion i Sverige, 1978-1980=Red raspberry, whortleberry, and lingonberry: distribution and berry production in Sweden, 1978-1980. Rapport 25. Garpenberg, Sweden: The Swedish University of Agricultural Sciences. 139 p. In Swedish.

Kauppi, M. 1979. The exploitation of *Cladonia stellaris* in Finland. Lichenologist. 11(1): 85-89.

Analyzes the economic use of lichen (*Cladonia stellaris*) in Fennoscandia for reindeer forage, floral decorations, and architectural models. Weights and values of exports from Finland, Norway, and Sweden, the major exporting nations, are given for 1970 through 1975. The major destination is Germany for 83 percent of the harvests. Denmark is a distant second at 10 percent. In Finland, the lichen processing industry is centered in Oulu, the Norwegian industry in Lillehammer, and the Swedish industry in Sveg. Lichens are collected between May and November, dried into easy-to-handle blocks, and then packed into transport trays. Annual income from lichen in a productive forest is usually greater than the value of timber from the same forest.

The industry began in 1910; national regulation began in 1931. Current employment in the Finnish lichen industry is estimated at 500 people working full-time for 5 months a year. Additional people work temporarily during the summer when school is out. People on the island of Hailuoto, off Oulu, derive one-third of their income from lichens. Overharvesting, gravel quarrying, clearcutting, and trampling have been major causes of deterioration of site and lichen product quality. Research indicates that only 20 percent of the lichen cover should be picked at a site and picked only at 5- to 6-year intervals.

Keywords: Lichen, Finland, Norway, Sweden, trade, processing, conservation.

Kauppi, Matti. 1993. The gathering of lichens as a trade. Aquilo Ser. Bot. 31:89-91.

Describes the market for *Cladonia* (=*Cladina*) *stellaris* supplied from Sweden, Norway, and Finland for wreaths, floral decorations, and architectural models. Germany has been the major importer from 1910 to the present. An inspection law for controlling lichen exports was introduced in 1931. Little of the volume destined for export is rejected. Most lichen is exported dry; moist lichens are exported only in autumn and comprise only 10 percent of the total crop. Major collection areas are just south of the reindeer herding region in xeric Scotch pine (*Pinus sylvestris*) woodlands.

Lichen gathering can be of considerable economic importance locally in Finland. In Hailuoto, one-third of all income is based on lichen gathering in productive years and often is more valuable than the standing tree volume. About 8,000 person days are required to harvest and handle lichen exports.

Total exports of *C. stellaris* from Fennoscandia amount in recent years to 2000 tonnes annually. Since 1988, Sweden has exported more lichen than Finland, but the Finnish product remains more valuable. Finnish exports alone peaked in 1970 with 2000 tonnes then fell dramatically to under 1000 tonnes in 1974, and since 1987 to under 500 tonnes. Harvest reductions are the result of reduced foreign demand and fall in prices.

Other important economic lichens are *Evernia prunastri* and *Pseudevernia furfuracea* from France, the southern Balkans, and Morocco. In southern France, 10 000 tonnes of dry lichens are processed annually.

Keywords: Lichens, trade, collection, processing, Finland, Sweden, France, Morocco, the Balkans.

Kemp, R. 1992. The conservation of genetic resources in managed tropical forests. Unasylva 169(43): 34-40.

States that genetic conservation must be an integral part of overall national development policies. Although the goal may be to preserve particular target species, successful preservation will depend on maintaining essential functional components of ecosystems, which in practice is likely to mean conserving whole communities. In situ conservation of forest resources should be an integral part of production forests.

Keywords: Conservation, genetic resources.

Kerr, K. 1991. The economic potential of handicrafts enterprises in rural development: focus on Indonesia. Unasylva. 42(165): 31-36.

King, Steven R. 1991. The source of our cures. Cultural Survival Quarterly. 15(3): 19-22.

Reports that a wide variety of popular drugs derived from plants were first recognized and used by indigenous peoples. Tropical areas contain a huge number of

plant species (at least 90,000 of the world's 250,000 species), but only a few have been investigated by scientists for their medicinal properties. Indigenous peoples, on the other hand, have catalogued and continue to use many of these species for various medical purposes. The high cost of biotechnology has led many drug firms to shift back into research and development of naturally occurring compounds. This shift could potentially result in the destruction of large numbers of genetic resources in the tropics.

The author notes that many drug patents are linked more to who has the power to control and protect discoveries than to the right of first discovery. The author argues for the development of joint ventures between Western drug research companies and indigenous peoples, in which there would be "a new set of reciprocal obligations and a more global and ecologically sensitive orientation." He provides an example of one such company, Shaman Pharmaceuticals, which works in conjunction with a nonprofit conservation organization to support knowledge sharing with indigenous people and sustainable production and marketing institutions that are more beneficial to indigenous people. New harvesting techniques and purchasing and scheduling techniques are also being developed. The Periwinkle Project of the Rainforest Alliance also is conducting research on medicinal plant and conservation issues.

Keywords: Medicinal plants, intellectual property rights, joint ventures, market expansion.

Kinugawa, Kenjiro; Goto, Toranobu. 1978. Preliminary survey of the "matsutake" (*Armillaria ponderosa* [=*Tricholoma magnivelare*]) of North America. Transactions of the Mycological Society of Japan. 19: 91-101.

Summarizes the phenology, distribution, and consumption of the American matsutake (*Tricholoma magnivelare*) by Japanese residents in the Pacific Northwest. The authors document new collection sites, particularly in association with western hemlock (*Tsuga heterophylla*). Besides ponderosa pine (*Pinus ponderosa*), other associated species include Douglas-fir (*Pseudotsuga menziesii*) and lodgepole pine (*Pinus contorta*).

Keywords: Distribution, wild edible mushrooms, tree mycorrhizal associates, *Tricholoma magnivelare*.

Kisgeci, Jan. 1989. Historical background and tradition of medicinal plants in Yugoslavia. Acta Horticulturae. 249: 15-19.

Reviews sources on the production, processing and trade of aromatic and medicinal plants and spices in Yugoslavia dating back to Slovenian monastery records of the 8th century. Describes Yugoslavia's geography and climate as ideal for the production of a diverse array of medicinal plants and provides lists of species of wild and cultivated medicinal plants for six climatic zones.

Keywords: Medicinal plants, Yugoslavia.

Kjersgård, O. 1982. Gødskning i en *Chamaecyparis lawsoniana* bevoksning= Fertilization in a *Chamaecyparis lawsoniana* stand. Forstlige Forsøgsvaesen i Danmark. 38(3): 331-335. In Danish with English summary.

Kjersgård, O. 1983. Gødskning i en *Abies nobilis* bevoksning på Boller Statsskovdistrikt=Fertilization in an *Abies procera* stand at the Boller State Forestry District. Forstlige Forsøgsvaesen i Danmark. 38(4): 383-388. In Danish.

Kjersgård, O.; Gøhrn,V. 1978. *Abies grandis* provenienser i Danmark=*Abies grandis*, a provenance test in Denmark. Forstlige Forsøgsvaesen i Danmark. 36(2): 267-287. In Danish with English summary.

Klausen, Kenneth. 1990. Nobilis reaktion på pyntegrøntklipning—en undersøgelse af klippemetodens betydning for udbyttet=Response of *Abies procera* to bough harvests—a study in the effect of bough cutting methods on production. Pyntegrøntsektionen Nåledrys. 6(11): 24-26. In Danish.

Kloppenburg, Jack. 1991. No hunting! biodiversity, indigenous rights, and scientific poaching. Cultural Survival Quarterly. 15(3): 14-18.

Describes the development of a new technology to manipulate genes in ways useful to humans that has created a new resource: genetic diversity. Nature has favored the Third World with a large and diverse gene pool, and thus gene “hunters” from the developed countries, which possess the technology to manipulate genes, are very active in those regions. Little of the value of those resources is captured by local populations. The author notes that this phenomenon parallels that of food crops, most of which were derived from Third World countries. He sees indigenous knowledge as a critical factor of production that the food and biotechnology industries have been able to acquire cheaply because local people do not have access to the markets or the technology required to add value to their knowledge resources. He likens this knowledge extraction to a reverse foreign aid program where resources are transferred from the poor to the rich.

To offset this knowledge and power imbalance, Kloppenburg argues for a policy of building awareness among local peoples and nongovernment organizations. One possibility is to develop bilateral agreements between indigenous peoples and outside researchers. He cites the example of the Kuna in Panama, who established a forest reserve of 60 000 ha in 1983 for wildlife protection and scientific study with support from the Smithsonian Tropical Research Institute. In 1988, the Kuna developed a set of rules regulating scientific activities and laying out knowledge transfer and compensation rules. Professional societies also have begun to develop codes of conduct for their researchers. Multilateral agreements, such as the International Undertaking on Plant Genetic Resources (IUPSR) developed by the United Nations Food and Agriculture Organization (FAO), are another option. The IUPGR states that farmers have a right to compensation for protection and encouragement of genetic resources, just as plant breeders have a right to compensation for the varieties they develop. To provide compensation, FAO has initiated the International Fund for Plant Genetic Resources. Such

mechanisms are the first step to adequately compensate holders of valuable knowledge for their contribution.

Keywords: Biodiversity, indigenous knowledge, intellectual property rights, genetic resources, policy.

Knudson, Ruthann. 1980. Fish, roots, game, and trade in the Columbia Plateau. Journal of Forestry. 78(8): 542-556.

Provides a historical account of Columbia Plateau Native Americans who relied heavily on fish and roots for survival. Both of these food supplies were highly predictable. Of the roots, camas (*Camassia quamash*) and cous biscuitroot (*Lomatium cous*) were the most important. Camas tends to grow in wet meadows and was abundant prior to disturbance by farming and logging. Cous biscuitroot is found in dry rocky slopes. Both camas and cous are highly nutritious. The two provided 90 percent of the vegetable diet for certain plateau groups. These staples were supplemented by berries rich in vitamins and sugar. Groups developed kinship, friendship, and residence ties across the plateau to have access to all the vegetable foods they required.

The author also describes the social organization of food collection on the plateau. Groups concentrated in villages during the winter and then dispersed into small task groups in spring and summer. Camas meadows and fishing grounds were apportioned and shared. Collection tended to be linked to major social events such as horse racing, gambling, trading, and marriages.

Principles of crossutilization and stewardship governed the system. Crossutilization is defined as “the right of any individual to exploit any resource needed, whether or not within the territory of one’s own group” (p. 545). Thus the prevailing tenure mode was not “exclusive ownership” but rather relatively open access. Claims to resources were tempered by the principle of stewardship so that “by improvement and regular and wise use of the resource locality, an individual gained a right to determine who used the improvements and disposed of the resource gathered there” (p. 545). Decisionmaking over the management of these resources was largely consensus based, and warfare was not a typical mechanism for controlling resources or territory. Groups relied heavily on trading and marriage partnerships to structure access to resources.

Keywords: Social organization, resource tenure, resource management regime, Columbia Plateau tribes, Oregon, Washington, edible wild plants.

Koch, N. Elers. 1978. Et plantetidsforsøg med nobilis (*Abies procera* Rehd.)= A planting time experiment with noble fir (*Abies procera* Rehd.). Forstlige Forsøgsvaesen i Danmark. 36(2): 313-340. In Danish with English summary.

Koistinen, Riitta. 1993. The cultivation of edible mushrooms in Finland today. Aquilo Ser. Bot. 31: 127-129.

Estimates data on consumption patterns of wild and cultivated mushrooms by Finns. Of the 2 to 5 billion kg of mushrooms produced in Finnish forests annually,

only 606 400 kg are harvested for domestic markets. Commercial collecting is most widespread in eastern Finland. Wild mushroom harvests compete most strongly with cultivated mushrooms in the late summer and early autumn when native species are collected. The author predicts that the relative importance of cultivated mushrooms, currently estimated at 34 percent of the domestic market, will dominate mushroom consumption in Finland and that trade in wild mushrooms will decline.

The perception in Finland that cultivated mushrooms will supplant wild mushrooms might be applicable to conditions in the Pacific Northwest.

Keywords: Cultivated mushrooms, market share, wild edible mushrooms, Finland.

Kostov, P.P.; Stojanov, D.T. 1985. Rational utilization of blueberry finding places in Bulgaria and their cultivation. Acta Horticulturalis. 165: 281-285.

Reports on the national inventory for wild berries, principally lingonberry (*Vaccinium vitis-idaea*) and whortleberry (*V. myrtillus*), and their use in Bulgaria. Both recreational and commercial harvests are widespread. Lingonberries are the major export with most going to Austria, Germany, Canada, and the Netherlands. Export data are given for 1980 through 1983. Profits realized from berry harvests range from 10 to 40 percent. National inventorying began in 1976, and data are collected for phenology, ecology, and aboveground biomass. Managers use these data to determine protection and usage of berry fields. Management practices used to favor berry production include reducing the stand overstory density, delaying the time of tree planting after clearcut harvest, and controlling grass growth. Access to sites is limited to improve site quality and quantities of commercial harvest by forestry enterprises. Breeding selection has begun for native species, and cultivars of North American species (particularly *V. corymbosum* and *V. ashei*) have been introduced since 1983.

Keywords: Inventory, berries, Bulgaria, trade, management, cultivation.

Kravchenko, Aleksey. 1993. The effect of human recreation activity on some berry-producing ericaceous dwarf shrubs. Aquilo Ser. Bot. 31: 107-110.

Reports on studies conducted in 1981-89 in southern Karelia to measure damage to berry-producing shrubs as the result of recreational berrypicking. A five-stage scale of recreation damage was used. Shoot system damage and regeneration were evaluated on 4-m^2 plots on which a predetermined number of steps were calculated depending on species. Species under consideration were whortleberry (*Vaccinium myrtillus*), lingonberry (*V. vitis-idaea*), and kinnikinnick (*Arctostaphylos uva-ursi*). Trampling in all situations caused meadow and weed species to increase as the shrub species decreased. In stands with heavy recreation use, the distribution of age and vigor of the plants changed. Plants bore fruit at a later age and senescence and death occurred earlier. Overall, vitality and the population age declined. The timing of trampling (early June vs. early August) determined the type of regeneration sprouting response in the species.

Keywords: Recreational harvesting, wild edible plants, ecological impacts, berries, Russia.

Krochmal, Arnold; Krochmal, Connie. 1982. Uncultivated nuts of the United States. Washington, DC: U.S. Department of Agriculture, Forest Service. 89 p.

Provides descriptions of American nut plants, their phenology, habitat, and nut palatability. Recommended edible species from the Pacific Northwest include beaked hazel (*Corylus cornuta*) and golden chinkapin (*Castanopsis chrysophylla*). Pine species bearing seeds large enough to be edible are whitebark pine (*Pinus albicaulis*) and sugar pine (*P. lambertiana*). Tanoak (*Lithocarpus densiflorus*) is recommended when tannins are removed by leaching. Native Americans ate fresh and roasted nuts of California laurel (*Umbellularia californica*). A table of nutritional values also is provided.

Keywords: Nuts, nutrition, distribution.

Kuhnlein, Harriet V. 1989. Factors influencing use of traditional foods among the Nuxalk people. Journal of the Canadian Dietetic Association. 50(2): 102-108.

Calls attention to the importance of research on traditional food systems to improve existing community health and sense of cultural and environmental awareness. Such research provides rural people with new knowledge of useful foods and an information base for the potential development of new food products to society as a whole. Interviews were conducted in British Columbia with 61 Nuxalk female heads of households in three age classes: grandmothers, mothers, and daughters. Multiple regression analysis was used with interview data to correlate factors of taste appreciation, availability, and harvest times to total use by the Nuxalk. Of 70 traditional foods studied, 22 were berry species, 17 were vegetable and root species, and 5 tea and tree foods. Use of berries, greens, and roots for food has declined at a slower rate than for other traditional plant foods. Most commonly used plant foods were strawberries (*Fragaria* spp.), red raspberries (*Rubus idaeus*), whitebark raspberries (*R. leucodermis*), thimbleberries (*R. parviflorus*), salmonberries (*R. spectabilis*), russet buffalo-berries (*Shepherdia canadensis*), blueberries (*Vaccinium* spp.), red huckleberries (*V. parvifolium*), and thimbleberry shoots. Dietary changes since 1920 have resulted from legislation restricting traditional and subsistence food resources, demographic changes, availability of new foods from home gardens and food stores, images of social acceptability or modernity brought through education, social contact, media, changes in employment and leisure time, and breakdown of knowledge transfer from one generation to the next.

Keywords: Nuxalk, British Columbia, social survey, indigenous foods, wild edible plants, berries.

Kuhnlein, Harriet V.; Turner, Nancy J. 1987. Cow-parsnip (*Heracleum lanatum* Michx.): an indigenous vegetable of Native people of northwestern North America. Journal of Ethnobiology. 6(2): 309-324.

Kuhnlein, H.V.; Turner, N.J.; Kluckner, P.D. 1982. Nutritional significance of two important “root” foods (springbank clover and Pacific silverweed). Ecology of Food and Nutrition. 12: 89-95

Provides nutritional data from samples of silverweed (*Argentina egedi*), springbank clover (*Trifolium wormskioldii*), and potato (for comparison). Both native species had much higher levels of the macronutrients calcium and magnesium and of the micronutrients iron, copper, and zinc than did the potato. Clover was slightly more palatable to people than silverweed. The authors suggest that these native plants would be good candidates for reintroduction into the diets of native peoples in coastal British Columbia.

Keywords: Nutritional analysis, wild edible plants, traditional foods, native people, nutrition, British Columbia.

Kujala, Matti. 1988. Ten years of inquiries on the berry and mushroom yields in Finland, 1977-1986. Acta Botanica Fennica. 136: 11-13.

Gives a synopsis of national estimates and forecasts of wild berry and mushroom yields. The study was financed by the Ministry of Agriculture and Forestry, supported by trade organizations, and conducted by the Marketing Research Institute of the Pellervo Society. Three estimates of yields were made during the harvest season (July to September) plus another at the end of the season. Prices were tabulated at the same time to obtain regional and national average prices and total incomes. These so-called Marsi inquiries relied on data provided by 200 local reporters and furnish the basis for estimates released to the mass media.

Traditionally lingonberries (*Vaccinium vitis-idaea*) were the most important crop but whortleberries (*V. myrtillus*) have become more significant. Estimates for home use of berries are about 10 times greater than the commercial volume. Annual yields during whortleberry and lingonberry seasons vary by a factor of ten. Commercial value of berries is greater than for mushrooms. Milk caps (*Lactarius* spp.) are the most important mushrooms for domestic consumption. Commercial picking of mushrooms and berries is most extensive in northern and eastern Finland.

Keywords: Berries, edible wild mushrooms, yields, economic survey, subsistence, Finland.

Kurtz, W.B.; Garrett, H.E.; Kincaid, W.M., Jr. 1984. Investment alternatives for black walnut plantation management. Journal of Forestry. 82(10): 604-608.

Sets forth economic considerations in a multiresource agroforestry system with black walnut plantations in Missouri. Sixty-year rotations on medium- and high-quality sites were examined for application on privately owned lands. Proposed regimes were compiled from multiple sources and remained hypothetical because entire rotations were yet to be completed and evaluated. Early financial returns from intercropping and grazing helped to offset initial stand establishment costs. The most complex regime incorporated production of nuts, wheat, soybeans, fescue hay, and grazing. As complexity in management increased, greater labor and materials per acres are needed, and there is often greater risk. Forage yields for the first 15 years were higher under the walnut canopy; grazing began in the 16th year. Present net value and internal rate of return were calculated at a 7.5-percent interest rate by using actual or projected prices of products and inputs. Different products had relatively greater importance depending on site productivity. Nut production was more important to stand value on less productive sites; nuts

provided a continuous stream of stable returns early in the rotation (beginning at year 20).

Black walnut agroforestry systems from the Midwest suggest that creative diversification of multiple products could be created in the Pacific Northwest on public and private lands as a means to intensify land use and increase economic productivity per unit of area. Examples of useful economic analyses were provided as a guide.

Keywords: Agroforestry, nuts, multicropping, product diversification.

LaChance, L. 1981. Le bleuet nain au Québec: façons culturales et intervention de l'État =The wild blueberry in Quebec: cultural techniques and government policy. In: Productions spontanées: Colloque sur les productions spontanées: 17-20 June 1980; Colmar, France. Les colloques de l'INRA 4. Paris, France: Institut National de la Recherche Agricole: 210-224. In French.

Describes the cultural practices and government measures to promote wild blueberry (*Vaccinium* spp.) collecting in Quebec. During a 4-week period in summer, hundreds of people cover fire-prone sites to collect millions of kilos of blueberries for industrial production of jellies and jams. Widespread collecting began after massive forest fires in 1870. Government officials realized the market demand and value of blueberries and instituted organized exploitation. Beginning in the 1960s, the government invested funds to study the cultural requirements and management of native blueberry species. Details of Canadian government projects for rural development involving blueberries are provided. Blueberry fields were leased to 16 producer cooperatives and three private corporations on the condition that they be used for producing blueberry crops according to tested methods. The government also built a processing plant for blueberry preserves in the 1960s that handles 70 percent of blueberries collected from forests and 90 percent of the blueberries grown in plantations. There are 16 plantations but they supply only 20 percent of the blueberries in Quebec.

Blueberries are grown on sites with recent fires or clearcuts. The principal species are *Vaccinium angustifolium* and *V. myrtilloides*. Since 1968, a thousand hectares have been burned annually to maintain land area for blueberries. Blow torches with cones to direct the flames are mounted on chassis drawn by tractors. Beehives are introduced to increase the rate of pollination, and nitrogen fertilizers are applied. Blueberry combs are used to improve harvests, but leaves and twigs still must be removed from fruits.

Annual crops since 1941 have ranged from less than 1 million to more than 10 million kg. Only experienced blueberry pickers make a profit from blueberry picking. In years when blueberries are abundant and the price is high, pickers travel widely in family or clan groups, camping out, and setting up "territories." A 1971 study found that more than 800 families participated in the harvest, with each family averaging 3 to 4 pickers picking 6 to 7 hours a day for 14 days. Average daily harvest was 80 to 150 kg, and family revenues ranged from Can$1,500-3,000.

Keywords: Government policy, management practices, social surveys, clearcutting, berries, burning, rural development, Quebec, Canada.

La Pierre, Yvette. 1994. Illicit harvest. National Parks. May/June: 33-37.

Defines illegal mushroom harvest as a part of wild plant poaching activities that pervade national parks. A survey conducted in 1992 of the national parks in the United States indicated that 37 park units reported plant poaching in 1990 and 41 reported cases in 1991. Few cases result in arrests, and most thefts occur in the Southeast, Pacific Northwest, and West. American ginseng (*Panax quinquefolius*), which is exported as a medicinal plant to the Far East, is the major plant sought. Others, such as showy lady's slipper (*Cypripedium reginae*) and rhododendrons (*Rhodendendron* spp.), are destined for gardens. Park officials attribute the increased incidence of theft to the growing value of these plants and the low cost of the fines relative to potential benefits. The park service lacks the staff to enforce regulations. In response, park rangers have formed an independent nonprofit organization to support resource protection: The National Park Ranger Resource Protection Fund. This fund was organized in November 1993, has about 5,000 members, and is supported by the park service. The fund is used to provide investigative equipment to parks, support ranger training, provide a reward system for tips leading to the apprehension of plant thieves, finance a toll-free hotline, and educate the public on the costs of plant poaching.

The parks have adopted policies to enhance interagency collaboration to address the problem of plant poaching. Parks adjacent to Forest Service land have been setting up collaborative arrangements with Forest rangers to prevent illegal collection on park lands. Public-private partnerships also have been initiated. Recently, Acadia National Park allied itself with the Garden Club Federation of Maine to protect sealavender (*Limonium* spp.). The federation initiated public outreach to stop its members from collecting and has placed pressure on the clothing manufacturer, L.L. Bean, to pull sealavender from its catalog.

Keywords: Government policy, poaching, law enforcement, interagency collaboration, public-private partnerships, Maine, horticultural plants, medicinal plants.

Largent, David L.; Hewlett, Sally; Sime, A. David. 1994. Influence of environmental factors on fruiting of edible, mycorrhizal mushrooms. 32 p. Unpublished manuscript. Prepared for: California Department of Forestry and Fire Protection, 1416 9th Street, Sacramento, CA, 95814.

Largent, David L.; Sime, A. David. 1995. A preliminary report on the phenology, sporulation, and lifespan of *Cantharellus cibarius* and *Boletus edulis* basidiomes in Patrick's Point State Park. In: Adams, David H.; Rios, Jesse E.; Storer, Andrew J., eds. Symposium: Proceedings, 43d annual meeting of the California Pest Council; 1-17 November 1994; Rancho Cordova, CA. Sacramento, CA: California Department of Forestry and Fire Protection: app. 32-46.

Larrère, Raphael; de la Soudière, Martin. 1985. Cueillir la montagne: plantes, fleurs, champignons en Gévaudan, Auvergne et Limousin.=Harvesting the forest: plants, flowers, and mushrooms in Gévaudan, Auvergne, and Limousin. L'Homme et la Nature. Lyon: La Manufacture. 251 p. In French.

Provides a detailed look at the social organization of nontimber forest product harvesting in the Massif Central region of France. This study is a rare example of an ethnographic study of nontimber forest product harvesters in a postindustrial society and describes the production, labor markets, harvesting techniques, and product markets for three major crops, or “seasons”: lichens, chanterelles (*Cantharellus* spp.), and narcissus (*Narcissus* spp.). Three harvester categories are discussed: those who take part in several seasons, those who take part in only one season per year, and amateurs, who sell products only occasionally. The harvesting population is extremely heterogenous in terms of gender and age; harvests are conducted as individuals and in groups.

A historical overview of nontimber forest product harvesting in the region also is provided. Once important resources of the rural community, nontimber forest product harvesting fell into disrepute with the rise of the market economy and industrialized farming and manufacturing. Harvesting historically was done collectively, mainly by nomadic gatherers. In recent years, it has become individualized and sedentary. Lichen and narcissus are still in demand as ingredients in perfume, and the demand for edible mushrooms and berries has risen since the 1960s.

The authors describe the marketing networks and the relations that exist among harvesters, local middlemen, wider ranging buyer-dealers, and wholesalers. They note that often the lower organizational levels exhibit some loyalty to a parent company, but that price wars result in a shift to other dealers. Gathering is portrayed as far more than an economic activity. The authors note that it remains one of the few economic sectors that is largely unregulated. Participation in the harvest thus serves both to augment incomes and to establish resistance aganst the encroachment of the state and corporations.

Recently, conflicts have emerged between local and nonlocal harvesters where the outside harvester is viewed as a symbol of dispossession and a scapegoat for anger. The authors note that the professinal harvesters are best equipped to resist the encroachment of outside harvesters; it is the occasional local harvesters who are hurt most by competition from outsiders. They note that current efforts to promote nontimberforest product markets and rationalize nontimber forest product harvesting and marketing resemble efforts to professionalize and industrialize agriculture. In agriculture, industrialization had negative consequences for the less well-to-do farmers; the authors caution that a similar outcome also could result from attempts to industrialize nontimber forest product production.

Keywords: France, horticultural plants, edible wild mushrooms, lichens, social conflict, ethnography, harvest practices, economic structure.

Larsen, J. Bo. 1985. Økofysiologiske og morfologiske undesøgelser af foreskellige *Abies procera* provenienser med hensyn til deres egnethed til pyntegrøntproduktion=Ecophysiological and morphological investigations of different *Abies procera* provenances in relation to greenery producion. Forstlige Forsøgsvaesen i Danmark. 40(2): 173-199. In Danish with English summary.

Lawrence, Brian H. 1979. Commercial production of non-citrus essential oils in North America. Perfumer and Flavorist. 3: 21-23.

Describes existing essential oil producion industries of native plants from the eastern and midwestern United States. Many of these plants have congeners in the Pacific Northwest. Important aromatic conifer species from eastern North America are found among the genera: *Abies*, *Juniperus*, *Picea*, *Thuja*, and *Tsuga*. Other genera worthy of investigation are *Betula*, *Conyza*, *Gaultheria*, and *Solidago*.

Keywords: Essential oils, native plants, eastern United States, midwestern United States.

Lawrence, Brian H. 1985. A review of the world production of essential oils (1984). Perfumer and Flavorist. 10(5): 1-16.

Reveals that there is very little commercial development of native plants for essential oils at present in North America, although an extensive industry in exotics (mints and citrus) is very productive. Native plants historically harvested for use as essential oils include species of *Abies, Betula, Conyza, Gaultheria, Juniperus, Picea, Tanacetum,* and *Tsuga*.

Keywords: Essential oils, native plants, North America.

Lawrence, J.H.; Hardesty, L.H.; Chapman, R.C.; Gill, S.J. 1992. Agroforestry practices of non-industrial private forest landowners in Washington State. Agroforestry Systems Journal. 19(1): 37-55.

Reports on a statistically designed survey to characterize agroforestry practices in the State of Washington among nonindustrial private forest landowners. Three areas of the state were sampled: the north Cascade and east Puget Sound region, the northern tier of counties east of the Cascade Range, and inland, nonmontane, southwest Washington counties. Respondents received a questionnaire developed from previous scoping that inquired about land tenure, land management practices, reasons for practicing agroforestry, socioeconomic profiles, and information needs. Chi-square tests of significance were used to detect statistically different responses. Special forest products were considered overall as an important income source to 14.6 percent of respondents. Differences in special forest products did not vary statistically among agroforesters and nonagroforesters statewide; however, the percentage of people involved in commercially gathering special forest products was significantly higher west of the Cascade Range (20.2 percent vs. 8.2 percent for the east side). Respondents overall (66.8 percent) cited technical assistance and educational support for agroforestry as the major obstacle to practicing agroforestry. Collecting special forest products accounted for 12 percent of agroforestry systems and was concentrated primarily in western Washington where most high-value special forest product plant species are found.

Keywords: Agroforestry, Washington, industrial forest owners, income, survey.

Lepofsky, Dana; Turner, Nancy J.; Kuhnlein, Harriet V. 1985. Determining the availability of traditional wild plant foods: an example of Nuxalk foods, Bella Coola, British Columbia. Ecology of Food and Nutrition. 16(3): 223-241.

Determines the availability during summer 1981 of 42 of the 135 plants traditionally used by the Nuxalk people. Estimates of accessibility and harvest yields were made by using nonrandom plot censusing techniques for herb, shrub, and tree layers. Sampling intensity depended on variability of vegetation cover. Data on species were collected for coverage, frequency, and accessibility. The time required to harvest 250 ml of food by one person and the area needed to collect the amount also were recorded. Much of the landscape has 60-degree slopes and access was impractical for food collecting.

Twenty species had high availability and deserve further nutritional research, and 14 of those species required less than 10 minutes to harvest 250 ml of food. Results of this study did not present a complete picture of the supply of foods available throughout the year. In other years, changing cover types and annual variations in growing conditions for individual species might give different results. Burning, used to stimulate berry growth in particular, has decreased in the area. Logging has in part replaced burning as a disturbance to encourage berries. The authors propose a selective logging program to promote growth of desirable berry species in accessible locations.

The potential for increased human use of traditional foods and the adaptation of the plants to horticulture deserve research. People can devise systems to manage forest vegetation that increase the availability of traditional foods in Pacific Northwest forests. Research of this type may lead to enhancing the diet and health status of rural people by encouraging use of nutritionally rich indigenous foods.

Keywords: Availability, indigenous foods, Nuxalk, British Columbia, burning, logging, wild edible plants.

Leung, Albert Y. 1977. Cascara sagrada: new standards are needed. Drug and Cosmetic Industry. 121(6): 42-44, 143-145.

Describes the use and economic value of cascara sagrada (*Frangula purshiana*), points out the lack of adequate standards and controls on production, and suggests corrective measures. Cascara sagrada, also known as sacred or chittem bark, is the most prescribed, naturally derived laxative, with a retail value of US$75 million in the United States. The author describes the chemistry of cascara bark and the variation in active ingredients in cascara extracts resulting from differences in processing. He suggests quality control procedures for evaluating the active principles in cascara extracts.

Keywords: Medicinal plants, processing, United States, economic value.

Lewington, Anna. 1993. A review of importation of medicinal plants and plant extracts into Europe. Gland, Switzerland: WWF/International Plant Program/ IUCN. 37 p.

Analyzes the trade in medicinal plants in western Europe and gives an overview of market structure in the sector. The focus of the analysis is on Germany and the United Kingdom. The categories provided by trade statistics are not helpful for sorting data on medicinal plant imports because the categories are too broad, and plants with multiple economic uses (for example, linden [*Tilia* spp.] flowers, rose

[*Rosa* spp.] hips, licorice [*Glycyrrhiza glabra*]) are not distinguished by their end uses. Reticence among brokers and purchasers to discuss types, quantities, and sources of medicinal plants impedes collecting information about the industry. Trade catalogues provide some information on products available. Plants constitute important sources for the three major medical traditions (Western allopathic medicine, Chinese herbal medicine, and Ayurvedic medicine) and numerous indigenous systems in Africa and Latin America. Recent reemphasis on the herbal basis for medicine has encouraged pharmaceutical companies to expand from the singular focus of drug synthesis as a source for new drugs. In many cases, plants remain the least expensive producers of needed drugs; industrial synthesis often is too costly.

During the 1980s in western Europe, medicinal plant consumption doubled. This occurred despite the generally dismissive attitudes by public and government agencies in the United Kingdom regarding phytomedicines. French and German governments have prepared definitions and standards for 250 and 170 medicinal plants, respectively. These countries also are the major importers of medicinal plants in the European Community. Hamburg is the center of the European medicinal trade, and 500-600 species of medicinal plants are imported. To control quality and assure supplies, many importers contract with growers in countries of origin. Cycles of scarcity and oversupply cause prices to fluctuate greatly. The major source country for medicinal plants is India. Argentina, China, Poland, Bulgaria, and the former Yugoslavia also are important sources. Very little cultivation of medicinal plants occurs within Germany.

Attitudes in Germany are very positive about herbal medicines: 90 percent of people surveyed considered herbal medicines as good or better than chemical medicines. Herbal medicines constitute 15 percent of all medicines on the German market. A product from *Gingko biloba* is the most widely used herbal prescription. German and Swiss firms are major suppliers of finished plant-based pharmaceutical products. The German market for herbal medicines in 1989 was estimated to be US$1.7 billion. Between 1980 and 1990, the share of imports of medicinal plants to the United Kingdom from the United States increased 12-fold although the market share remains small compared to India.

Consumption of medicinal plants in western Europe is believed to be increasing. Trends toward domestication of plants will aid in conserving wild stocks. Presently many species originate sourced from both cultivated and wild population (for example, American ginseng [*Panax quinquefolius*] and eastern purple coneflower [*Echinacea purpurea*] in North America). Most medicinal plants imported by Germany are believed to be from wild stocks. Asian consumers prefer to purchase wild American ginseng and will pay three times the price offered for cultivated varieties. Overcollection of wild stocks often occurs because of price signals to local gatherers. Poverty and low wages encourage collectors to harvest entire populations without thought for conservation and sustainability.

The author recommends studying German trade in medicinal plants for information on species and their import volumes, the status of rare plant imports, the proportions of wild and domesticated stocks, and the degree of species misidentification. Consumers, traders, and collectors are encouraged to initiate conservation

programs, ecological assessments, sociological and health studies, and guidelines for sustainable harvest.

Keywords: Medicinal plants, herbal medicine, phytomedicine, survey, attitudes, market structure, economic value, sustainability, Germany, United Kingdom, Europe, trade.

Liegel, L. 1992. Concerns and issues for special forest products research in the Northwest. 2nd draft. 6 p. On file with: Leon Liegel, Pacific Northwest Research Station, Forestry Sciences Laboratory, 3200 SW Jefferson Way, Corvallis, OR 97331.

Summarizes the research priorities and management recommendations of the Western Oregon Special Forest Products Council, which is composed of Federal and state land managers, industry, and academic and conservation interests. The council identified five major research issues for special forest products harvested in Washington and Oregon: (1) synthesis of existing information, (2) description of critical biology and management unknowns, (3) development of appropriate inventory and monitoring techniques, (4) determination of economic and marketing forces, and (5) identification of relevant policy considerations. The paper provides background information, information needs, and potential implementation steps for each of the research categories. In addition, six major recommendations are summarized.

Keywords: Research priorities, management recommendations, Western Oregon Special Forest Products Council, Washington, Oregon.

Lipske, Mike. 1994. A new gold rush packs the woods in central Oregon. January: 35-45.

Portrays the harvest of American matsutake mushrooms (*Tricholoma magnivelare*) in the Winema and Deschutes National Forests. Price wars, shortages of mushrooms, ethnic tensions, weapons, and high profits characterize the developing fungus bazaar in Crescent Lake, Oregon. Local residents fear the influx of migrant collectors who harvest the majority of matsutake fruiting bodies and leave little financial benefit to local communities. Concern about excessive and careless harvesting may be undermining forest health and productivity. In the Chemult Ranger District, Winema National Forest, 3,000 picking permits were sold in 1993, and a daily picker population averages 800 to 1,200 persons. The District netted US$65,000 from 25 tons of mushrooms. Controlling illegal picking in the nearby Crater Lake National Park is a major undertaking for law enforcement. The network of mushroom harvesting, purchasing, processing, shipping, and export in the Pacific Northwest is diagramed. This article is one of the few documents available about the matsutake harvest in the Pacific Northwest.

Keywords: Wild edible mushrooms, Winema National Forest, Deschutes National Forest, Oregon, resource conflicts, economic value, market structure.

Love, T.; Molina, R.; Liegel, L.; Cromack, K. 1993. Biological, socioeconomic and managerial concerns of harvesting edible mushrooms on the Olympic Peninsula and in the southern Appalachians. Washington, DC: U.S. Department of State; U.S. Man and the Biosphere; U.S. MAB Temperate Ecosystems. 21 p. [plus appendices].

Points out that forest management plans and nontimber development strategies are being developed with little or no information on production levels of special forest products, sustainable harvest levels, and special forest product harvesters. This study attempts to address these information needs by evaluating production of golden chanterelle (*Cantharellus cibarius*) mushrooms on various plots in the forests of the Olympic Peninsula, by developing socioeconomic and cultural profiles of mushroom harvesters, and by integrating these research results with the technical expertise of local land managers and harvesters to develop management plans. In addition, the net present value of golden chanterelle and Douglas-fir (*Pseudotsuga menziesii*) harvests will be evaluated and compared. An initial evaluation of the mushroom industry will be conducted in the southern Appalachians, which contain a Man and the Biosphere Reserve and where the small, fragmented forested tracts provide an interesting comparison to the large, extensive forested tracts of the Olympic Peninsula. Research products include a preliminary operational field guide for managing chanterelle production on the Olympic Peninsula. The proposal contains a discussion of the issues and concerns surrounding special forest products, a detailed research plan, and an extensive bibliography.

Keywords: Wild edible mushrooms, social organization, productivity, test plots, economic value, southern Appalachians, Olympic Peninsula.

Love, Thomas. 1991. A system of sustainable development “extractive” reserves for the Pacific Northwest temperate rainforest. Paper presented at the annual meeting of Oregon Academy of Sciences, 23 February 1991, Monmouth, OR. 7 p. On file with: Tom Love, Sociology and Anthropology Department, Linfield College, McMinnville, OR 97128.

Suggests that the total value per acre of minor forest products may be three times that of the logging value, and that minor forest product harvesting is generally beneficial or neutral to the target species and to the integrity of the forest ecosystem. At the same time, the increasing development of large-scale commercial harvesting is threatening the traditional smaller scale, family labor, long-term management system. To protect the interests of the smaller harvesters and their sustainable resource management system, Love proposes an extractive reserve model similar to that created by the Brazilian and Peruvian governments in the Amazon for rubber (*Hevea brasiliensis*) tappers, Brazil nut (*Bertholletia excelsa*) collectors, and other harvesters. The paper describes the historical evolution of extractive reserves in Amazonia, and analyzes the applicability of the model to the Pacific Northwest.

Keywords: Pacific Northwest, Amazon, extractive reserves, harvesters, sustainability, nuts, resins, Brazil, Peru.

Love, Thomas; Denison, William; Donoghue, John; Zasada, John. 1992. Nontimber forest products extraction in the Pacific Northwest: Who is involved, and how widespread is this activity? Paper presented at the 4th North American symposium on society and resource management, 17-20 May 1992, Madison, WI. 10 p. On file with: Tom Love, Sociology and Anthropology Department, Linfield College, McMinnville, OR 97128.

Describes six images of special forest product harvesters held by the general public and the professional forestry community. The lack of knowledge about harvesters, such as ethnicity, gender, age, size of harvesting group, and local culture, is a serious impediment to successful resource management. This lack of scientific interest in social issues is attributed not only to the false images of the harvesting activity as minor or marginal but also to the supplementary, seasonal nature of harvesting, which makes it difficult to study and monitor. Surveys on the scale of harvesting within the 22 Ranger Districts in National Forests of western Oregon contrast the best estimates by special forest product officers of harvests (including illegal harvests) with official permit and contract data, and reveal substantial underreporting of actual harvest levels. The authors fear that the actual contribution of special forest product harvesting to community stability is being prematurely dismissed and conclude that much basic social science work is urgently needed to better understand the significance of special forest product harvesting for households and local communities.

Keywords: Social organization, harvesters, survey, household, rural development, Pacific Northwest.

Macdonald, B. 1989. Ornamental native plants of British Columbia: their selection, propagation, and introduction. Combined Proceedings of the International Plant Propagators' Society; [date of meeting unknown]; [location of meeting unknown]. Wooster, OH: Collier Pub. Co. 39: 243-249.

Presents native plants of the Pacific Northwest considered by the University of British Columbia as suitable for further selection and introduction into nursery production for use as ornamental plants. The article covers distribution, phenology, and directions for seed storage, germination, and vegetative reproduction. The list of plants includes *Cornus nuttalli, Arbutus menziesii, Amelanchier alnifolia, Paxistima myrsinites, Vaccinium ovatum, Ribes sanguineum, Philadelphus lewisii, Potentilla fruticosa, Arctostaphylos uva-ursi, Rosa woodsii*, and *Shepherdia canadensis*. Numerous other members of the Ericaceae family have great horticultural value as well: *Andromeda polifolia, Arctostaphylos columbiana, Cassiope mertensiana, Elliottia pyroliflorus, Gaultheria ovatifolia, Kalmia polifolia* (=*K. microphylla* ssp*. occidentalis*), *Menziesia ferruginea, Rhododendron macrophyllum*, and *Phyllodoce empetriformis*. After consultations with the floral industry, the university has decided to research market introductions for the following herbaceous perennial plants: *Anemone multifida, Douglasia laevigata, Dryas* spp*., Lupinus* spp*., Penstamon* spp*., Polemonium* spp., and *Phlox* spp. Economic emphasis will be on plants suitable for use in highway mass plantings, garden center retail sales, and exports to the United States.

Most of these species are native to the Pacific Northwest and represent plant species resources available for product development within the region as well.

Keywords: Horticultural plants, cultivation, economic development, British Columbia.

Mack, Cheryl A. 1992. In pursuit of the wild *Vaccinium*-huckleberry processing sites in the southern Washington Cascades. Archaeology in Washington. 4: 3-16.

Magdanz, James. 1990. Cooperation in the production of wild food. Juneau, AK: Alaska Department of Fish and Game, Division of Subsistence. 4 p.

Analyzes the complex system of interactions among households to distribute wild foods, including berries and edible greens, in the predominantly Inupiat Eskimo community in northwest Alaska during 1984. Cooperation is extensive within Native Alaskan communities. Productivity of an individual food gatherer is a function of knowledge of the target food species, skill, good equipment, location, and luck. Food gatherers acquire prestige through their generous donations of food, particularly to elderly people. Kinship is a basic organizing principle for distribution. Attempts to legally regulate subsistence use might disrupt community function and increase government costs.

Keywords: Alaska, community organization, cooperation, kinship, subsistence, indigenous food, wild edible plants, berries.

Magherini, Romano; Giannini, Piera; Menghini, Alessandro [and others]. 1988. Schede delle principali piante medicinali e aromatiche=Schedules for the principal medicinal and aromatic plants. Italia Agricola. 125(3): 153-225. In Italian.

Consists of descriptions of the uses, botanical features, pharmocognosy, chemical composition, active compounds, and horticultural details of major medicinal and aromatic plant species grown commercially in Italy. Details of plants native to the Pacific Northwest include common yarrow (*Achillea millefolium*), field horsetail (*Equisetum arvense*), and cascara (*Frangula purshiana*). Commercially introduced and now wild in the Pacific Northwest are greater burdock (*Arctium lappa*), oneseed hawthorn (*Crataegus monogyna*), purple foxglove (*Digitalis purpurea*), English ivy (*Hedera helix*), and common St. Johnswort (*Hypericum perforatum*). The Pacific Northwest has species in the following genera for which congeners are important in Italian markets: *Angelica, Arnica, Artemisia, Betula, Fraxinus, Gentiana, Iris, Juniperus, Linum, Mentha, Pinus, Quercus, Ribes, Rosa, Salix, Sambucus, Satureja, Sorbus, Vaccinium*, and *Valeriana*. This work is important as an introduction to potential further development of native and introduced species in the Pacific Northwest as medicinal and aromatic plant crops.

Keywords: Aromatic plants, horticultural plants, Italy, medicinal plants.

Mann, H.-J. 1990. Reinertrag im kleineren Privatwald Niedersachsens=Net profit from a small privately owned forest in Lower Saxony. Forst und Holz. 45(21): 627-630. In German.

Presents a case study of a private, nonindustrial forest in Germany for demonstrating the role of minor forest products (hunting fees, Christmas trees, and

decorative greens) in the total forest economy. Stands of Douglas-fir (*Pseudotsuga menziesii*) at least 8 to 10 years old are used for production of decorative greens. One-meter lengths are cut from the largest branches so that thick foliage can be obtained. Buds from the uncut parts of the branch serve as stems for later harvests. Spacing between trees must be wide enough to allow new foliage growth amounting to 1 to 2 kg per tree per harvest, thus yielding up to 9000 kg/ha per cut and a total of 12 000 kg/ha on average for an entire rotation. Total management cost for greenery production is DM280-350 per tonne and returns amount to DM600-800 per tonne, for a net profit of about DM5000/ha. Value-added tax must be deducted from this amount. Exotic conifers also are grown for sale as Christmas trees and for sale to garden centers. Blue spruce (*Picea pungens*) plantations managed only for decorative greenery and Christmas trees, for example, yield a net profit of DM1650 ha/yr as compared to the timber production from Douglas-fir (DM569 ha/yr) and Sitka spruce (*Picea sitchensis*; DM712 ha/yr) on 80-year rotations from the best sites. These figures presume the absence of catastrophic infestation and disease.

Keywords: Management practices, economic valuation, conifer boughs, economic value, Germany.

Mannozzi-Torini, Lorenzo. 1968. Sulla disciplina della raccolta e del commercio del tartufi freschi e conservati=Regulation in the harvest and trade of both fresh and processed truffles. In: Atti del I congresso internazionale sul tartufo; 24-25 May 1968; Spoleto, Italy. [Location of publisher unknown]: [Publisher unknown]: 1-10. In Italian.

Describes the origin and evolution of a proposed national law in Italy governing harvests and trade of truffles (*Tuber* spp.). The problems in regulating the truffle industry are complex and large. Lawmakers believe regulation of the truffle industry is essential to prevent fraud, bolster the reputation of the product and the industry, and educate the public about collection practices that do not damage the productivity of truffle areas. The law is to cover the two premier species among the five commercial Italian species in the genus *Tuber*: *T. melanosporum* (black truffle) and *T. magnatum* (white truffle).

Proprietorship of subsoil resources such as truffles in Italy belong to the land-owner. Unless the landowner posts his or her lands with signs forbidding the collection of mushrooms or truffles, however, the public has free access to collect them. Monetary penalties are to be set for infractions based on damages incurred. Truffle harvesters must have a dog or pig to assist in the detection of truffle to avoid undue soil disturbance in the truffle-growing area. Holes must be filled after the truffle is removed. The law establishes fixed harvest seasons for each species. Truffles are salable when they have been cleaned, selected for freshness, and sorted by species.

Use of inferior truffle species is allowed only in pâtés sold in quantities greater than a kilogram and must be labeled with the scientific and popular name of the truffle(s) in the pâté. Processing standards for canned truffles are given. The Italian law is compared with parallel French laws. The article also includes a description of the five commercial truffle species, their grades, and grading criteria.

Regulations concerning collection of truffles and other fungi in the United States are not developed. As the markets for American species develop and the values for certain species rise, concerns for harvest sustainability and resource conservation will increase. An examination of legal issues regarding similar valuable species in other countries can help to clarify options for resource protection in the United States.

Keywords: Truffles, regulation, processing, Italy.

Markstrom, Donald C.; Donnelly, Dennis M. 1988. Christmas tree cutting: demand and value as determined by the travel cost method. Western Journal of Applied Forestry. 3(3): 83-86.

Lays out the structure of an economic analysis by using the travel cost method. The method is appropriate to determining the value of nontimber forest products where the true value of the products may not be expressed by market values. The following data were collected from cars exiting a Christmas tree sale area in the Roosevelt National Forest, Colorado: number of adults and children, automobile license numbers, number of Christmas trees, and tree length. A demand curve was developed by converting travel distance and time to a single travel cost figure. Cost of travel time was based on simplifying assumptions about median wage, average travel speed, relative adult and child time values, and number of adults and children per vehicle. Distances were calculated by using “most logical” routes from population centers of each of the surrounding 15 counties, and an average variable travel cost was assumed.

Dependent variables were the per capita vehicle visits and the natural log of per capita vehicle visits. Seven variables and their natural logs were used as independent variables—four relating to travel costs, and one each for per capita income, median age, and percentage of urban population in the originating counties. The t-statistic, F-ratio, and r^2 values were used to evaluate regression relations. A sensitivity interval for average consumer surplus per vehicle was determined by substituting the 95 percent confidence interval limits for the cost coefficient. This serves as a relative index of variation in consumer surplus. The dollar value of Christmas tree cutting is site-specific. It depends on the characteristics of the site, the options for substitutes, the size of the market population, the location of the market area for the cutting site in question, and substitute cutting sites.

Keywords: Travel-cost method, regression, economic value, consumer surplus, Christmas trees, Colorado.

Maser, C.; Trappe, J.M.; Nussbaum, R.A. 1978. Fungal-small mammal interrelationships with emphasis on Oregon coniferous forests. Ecology. 59(4): 799-809.

Examines the roles of small mammals in the dispersal of fungi, and the implications for timber management. The stomach contents and fecal pellets of over 400 small mammals were examined, and fungal spores were classified and volumes estimated. Of the over 1,000 fungal sporocarps found, 88 percent originated from

hypogeous fungi, with little preference shown for particular species. The majority of spores were associated with ectomycorrhizal fungi (79 percent) or vesicular-arbuscular-endomycorrhizal fungi (10 percent). The role of small mammals in dispersal is species-dependent; the contribution by established forest dwellers may be repeated inoculation of hypogeous fungi on host plant roots rather than dispersal to new habitats, while deer mice and chipmunks deposit spores in adjacent nonforested areas. Fungal taxa frequency, fungal content and mycophagy frequency are analyzed for 31 small mammal species, and the relation between plant succession and population changes of two vole species is explored. The authors advocate a clearer understanding of the interrelations of ecosystem components, such as trees, fungi, and small mammals, in the development of forest management strategies.

Keywords: Mammals, dispersal, fungi, management.

Mater, Catherine. 1993. Minnesota special forest products: a market study. St. Paul, MN: Minnesota Department of Natural Resources, Division of Forestry. 100 p.

Focuses on the market demand for special forest products from Minnesota and provides one approach for analyzing the development of nontimber forest products. The author attributes the past lack of attention to special forest products in Minnesota to the poor and fragmentary knowledge about the industries. Special forest products are attaining greater significance now because of the growing constraints on timber production and the need to obtain economic value from renewable forest resources more quickly. Six major categories of special forest products are discussed in reference to their market potential and at various geographic scales: cones, decorative greenery, dried flowers, herbs and medicinals, decorative woods, and smoking and flavoring woods. Species and products with the best development potential were selected for closer examination.

Obstacles to development of both traditional and nontraditional products also are outlined, and policy recommendations based on interviews with people involved in the business of special forest products or in the management of the plant resources are summarized. These recommendations include better coordination of timber harvest activities and foraging activities for related special forest products; reduced inefficiency through commercial use of biomass conventionally left unutilized or unrecycled; expanded development and management of agroforestry systems with multiple forest product outputs; developing product cooperatives for market expansion; developing value-added manufacturing and processing jobs; and establishing programs for nontimber products research. Considerable expansion might best be explored in the decorative greenery industry. Numerous strategies are suggested for improving returns for the major product groups. Greater exploitation of plant resources entails concerted management for sustainability and regulation of foraging.

Keywords: Economic development, market potential, Minnesota, management recommendations, policy recommendations, floral greens, cones, medicinal plants, conifer boughs.

Mater, Catherine M. 1994. Factors affecting special forest products marketing and business management throughout North America. 7 p. Unpublished manuscript. On file with: Mater Engineering Ltd., 101 SW Western Blvd., Corvallis, OR 97333**.**

Synthesizes observations about obstacles to full development of special forest products based on research throughout North America. Response to market demand must not substitute for evaluation and understanding of site-specific product quality. This observation is especially important in the development of oil extracts and medicinal plants as local forest products. Missing opportunities for developing new products is widespread; for example, in the Pacific Northwest, foresters have been trying to eradicate salal (*Gaultheria shallon*) rather than managing its harvest to provide another source of forest income.

Among National Forests in the United States, those in Oregon and Washington have taken the lead in establishing baseline inventories and procedures for subsequent annual monitoring. National emphasis has been concentrated on lower value products (cones and boughs) and not on higher value products (medicinal plants, floral greens). Most National Forests did not know the magnitude of commerce in special forest products locally. Loss in potential permit fees might be as much as 90 percent. Public awareness and information is even lower for state forests and forest lands in Canada.

The author proposes nine key actions: (1) develop value-added processing locally; (2) identify multiple markets from single resources; (3) create public-private partnerships; (4) implement agroforestry and land stewardship principles for product cultivation; (5) convert “waste” biomass to marketable products; (6) apply new technologies; (7) manage the business of special forest products more diligently; (8) stay attuned to demographic changes in needs, tastes, and preferences; (9) and be aware of global markets.

Keywords: Monitoring, marketing, economic development, policy.

Mater Engineering, Ltd. 1992. Analysis and development of a conceptual business plan for establishing a special forest products processing plant. Corvallis, OR: Oregon State University Press. 234 p. [plus appendices].

Is a report commissioned by the Sweet Home Ranger District in the Willamette National Forest, western Oregon. It explores the potential of establishing a special forest products processing plant in Sweet Home, which would use products harvested in the Willamette National Forest and other surrounding forests within a 50-mile radius. Pro forma income projections indicated profitable operations in the first year, US$2.3 million in sales once full production is achieved, and an initial focus on huckleberry (*Vaccinium* spp.), western swordfern (*Polystichum munitum*), beargrass (*Xerophyllum tenax*), and Christmas boughs. The marketing and engineering evaluation involved the following steps:

1. Estimating abundance, distribution and quality of selected special forest product species in the target area. Estimates were based on analysis of 70 randomly sampled potential commercial harvest sites.

2. Evaluation of special forest product market opportunities, including a broader array of products than those selected for initial focus. Products evaluated include

floral greens, Christmas greens, medicinals, and fungi. Major market categories and trends are analyzed and individual products are described, including an assessment of use, market history, land tenure and economic issues, and regulatory and conservation issues.

3. Evaluation of appropriate species-specific, environmentally sound harvesting methods.

4. Evaluation of appropriate management policies and administrative issues, including a discussion of permits, fees, and enforcement of special forest product harvests in National Forests, state forests, and private lands. Information was based mainly on a telephone survey. Several recommendations are offered to address the management issues identified.

5. Feasibility study of a processing facility, including pro forma income and cash flow projections for the startup year and a full production year. Five spread sheets are used: product purchase and sales income, volume calculations and space requirements, labor and payroll calculations, capital construction requirements, and a pro forma analysis. A sensitivity analysis and identification of critical areas of concern also is undertaken.

6. Opportunities for growth and diversification through emerging and niche markets. Various product and customer trends are identified.

7. Identification of potential funding sources. A variety of different public and private financing sources, mechanisms and strategies are reviewed.

8. Development of an implementation plan.

Exhibits include a schedule of fees for special forest products, a summary of National Forest special forest products permit and enforcement policies, and a summary of various states' special forest products permit and enforcement policies. In addition, there are numerous tables and charts throughout the report, which summarize information on consumption and prices of selected special forest products.

Keywords: Wild edible mushrooms, medicinal plants, floral greens, conifer boughs, rural development, harvesting, processing, marketing, economic feasibility, Oregon.

Mater Engineering, Ltd. 1993a. North Fork value-added and special forest products market research project. Corvallis, OR: Mater Engineering Ltd; phase 1 final report. 119 p.

Gives details of research to identify species and potential markets for special forest products such as dried florals, ornamental evergreen foliage, forest medicinal and food plants, seeds, nuts, and cones in North Fork, California, near the Sierra National Forest. Species selected for consideration were indigenous within a 50-mile radius of North Fork and need to be managed for sustainable regeneration and restoration in the event of overharvest. Interviews from around the country and abroad about special forest products revealed information about availability and access, consumer buying trends, factors affecting product distribution, and issues of product design and packaging. Recommendations are made to maintain the genetic integrity and diversity of natural plant populations, to establish a system of permits and fees that also tracks harvest quantities, and to forego propagating and sustaining exotic plants in the Sierra National Forest.

Targeted plants with attractive flowers for potential product development in floristry and horticulture that also are found in the Pacific Northwest include yarrow (*Achillea millefolium*), brodiaea lilies (*Brodiaea* spp.), mariposa lilies (*Calochortus* spp.) larkspur (*Delphinium* spp.), western pearly everlasting (*Anaphalis margaritacea*), wild buckwheats (*Eriogonum* spp.), *Phlox* spp., blue flax (*Linum* spp.), Pacific dogwood (*Cornus nuttallii*), and deergrass (*Muhlenbergia* spp.). Trees for preserved foliage markets include Oregon white oak (*Quercus garryana*) and quaking aspen (*Populus tremuloides*). Manzanita (*Arctostaphylos* spp.) branches are important in twig and branch craft products. Important herbal plants include skullcap (*Scutellaria* spp.), California laurel (*Umbellularia californica*), chickweed (*Stellaria* spp.), Pacific dogwood (*Cornus nuttallii*), stinging nettles (*Urtica* spp.), *Artemisia* spp., prince's-pine (*Chimaphila umbellata*), western brackenfern (*Pteridium aquilinum*), and yarrow. Sugar pine (*Pinus lambertiana*) provides prized cones, and native oaks produce acorns for subsistence use.

Information is presented on domestic and global consumption patterns of fresh cut flowers, dried and preserved flowers, medicinal and herbal plants, and morels. Abundant data also are displayed for exotic plants that could be grown in local private nurseries for national distribution.

Several factors are key to sustaining enterprises based on special forest products: awareness of global demands, matching harvest supplies to demand, extracting maximum value from sustainable harvests, assessing new marketing opportunities, improving technology to become competitive, assuring consistency of the labor supply with good wages and opportunities for training, consistency of product quality, and increasing marketing information and networks.

Following this study, two business strategies are presented that include options for cooperative development, sources of public and private funding, and necessary infrastructure for a manufacturing and processing facility for value-added production. The authors suggest establishing a dried florals cooperative and a special forest products manufacturing center.

Keywords: Economic development, market potential, management, policy, floral greens, horticulture, medicinal plants, trade, feasibility study, cooperative, processing, California.

Mater Engineering, Ltd. 1993b. Special forest products market analysis for Saskatchewan Timberlands Division. Weyerhaeuser Canada, Ltd. Project 3017. Prince Albert, SK: Forestry Canada. 16 p.

Studies the feasibility of expanding special forest product production and marketing in Saskatchewan. The study was conducted for Weyerhaeuser Canada and the Saskatchewan Department of Agriculture and Food in 1993. Data on special forest products were gathered for inclusion into Weyerhauser's existing forest inventory database and were used to guide efforts to diversify rural economies while managing forests sustainably.

On the basis of some 200 interviews with buyers and sellers about the market potential of about 40 special forest products, the researchers discovered that interest for certain products, including moss, branches, tree tops, and birch bark, was already high, and immediate demand for these products is in the US$1.5

million range. Markets in Europe and Mexico were felt to offer viable expansion possibilities. Oil extracts from conifer oils were considered as having high market potential, as were cones and decorative woods. Market demand is likely to expand for other resources as demand for medicinals and flavorings for beverages, such as gourmet teas and coffees, increases. Subsequent sections address product prices, concerns about reliability and quality issues, and options for value-added manufacturing.

A survey of Canadian and U.S. government agencies indicated that inventories of special forest products were essentially nonexistent. New Brunswick, however, is presently expanding its forestry extension services to incorporate special forest product management. Officials noted that the recently passed Environmental Access Act could potentially jeopardize the ability of harvesters to remove plants from forest sites. Current regulations are described as nonexistent or minimal. In the United States, special forest product inventories and regulations have just recently begun to emerge. The researchers cite efforts by Ranger Districts in the Pacific Northwest to develop inventory methods for special forest products as an example of the enhanced interest in these products on the part of the Federal government. They note that both the Bureau of Land Management and the Forest Service are developing regional and national strategies for special forest product management.

Keywords: Market potential, rural development, sustainable development, regulation, value-added, survey, feasibility study, Saskatchewan, Canada.

Mattsson, Leif; Li, Chuan-Zhong. 1993. The non-timber value of northern Swedish forests: an economic analysis. Scandanavian Journal of Forest Research. 8: 426-434.

Mattsson, Leif; Li, Chuan-Zhong. 1994. How do different forest management practices affect the non-timber value of forests?—an economic analysis. Journal of Environmental Management. 41: 79-88.

Accounts for the total value of nontimber commodities from forests, including harvesting of berries and mushrooms, which are viewed as leisure activities. A contingent valuation survey was mailed to 800 randomly selected individuals in the county of Västerbotten, Sweden; 436 replies were received. The questionnaire presented four photographs representing different stages of stand development and then asked about people's forest visits, preferences for tree species, and personal information to construct a market scenario. Both continuous and discrete choice formats were used in questionnaires. Probit analyses and nonlinear optimization provided maximum-likelihood estimates of forest composition and age class for the combination that produced the highest nontimber commodity value nationally. A decrease of clearcutting with artificial regeneration increases the nontimber value. Presentation of even more options into the survey format raises the value to society but becomes computationally difficult to reckon. Dividing the original sample of respondents into subsamples maintains double objectives of simplicity and detail.

Keywords: Contingent valuation, external effects, forest practices, nonlinear optimization, nontimber commodity value, probit analysis, berries, wild edible mushrooms.

May, P.H. 1991. Building institutions and markets for non-wood forest products from the Brazilian Amazon. Unasylva. 165(42): 9-16.

Effective use of nonwood products in sustainable development strategies depends on the existence of the necessary institutional framework, for product development, production, and marketing. Attempts in the Brazilian Amazon to create this framework are described. The process cannot begin without secure land tenure, accomplished in Brazil through the use of extractive reserves, among other mechanisms. Markets were expanded and strengthened through local organizing efforts and through an alliance with Cultural Survival, an indigenous support group that screened forest products for viable market opportunities. Relations were then forged with progressive North American and European businesses and consumers. May cautions that expanding markets for nonwood timber products has its risks, including the encouragement of cultivation of specific products at the expense of natural vegetation, the capture of new market opportunities by large landowners and merchants, and overdependency of forest dwellers on particular products and newly obtained market goods.

This article is relevant in the Pacific Northwest. Vertical and horizontal integration in the industry is producing "superregional" special forest product processors that outcompete small, community-based companies, with serious implications for the link between nontimber forest product harvesting and community development.

Keywords: Amazon, land tenure, extractive reserves, market development, Cultural Survival.

McCutcheon, A.R.; Ellis, S.M.; Hancock, R.E.W.; Towers, G.H.N. 1992. Antibiotic screening of medicinal plants of the British Columbian native peoples. Journal of Ethnopharmacology 37: 213-223.

Gives results of screenings of 100 methanolic plant extracts for antibiotic activity against 11 bacterial strains. Details of extraction and disc preparation for disc diffusion assays of the bacterial strains are described. The authors found that 95 percent of plants targeted as possible antibiotics, based on uses by British Columbian indigenous peoples, demonstrated significant antibiotic activity. Extracts with the broadest range of activity against bacteria (10 out of 11) were red alder (*Alnus rubra,* bark and catkins), beach strawberry (*Fragaria chiloensis,* leaves), single delight (*Moneses uniflora,* aerial parts), and smooth sumac (*Rhus glabra,* branches). Species with extracts effective against 9 out of 11 strains were kinnikinnick (*Arctostaphylos uva-ursi,* branches and roots), Louisiana sagewort (*Artemisia ludoviciana,* aerial parts), arrowleaf balsamroot (*Balsamorhiza sagittata,* aerial parts and roots), western cordilleran bunchberry (*Cornus unalaschkensis,* aerial parts), largeleaf avens (*Geum macrophyllum,* roots), roundleaf alumroot (*Heuchera cylindrica,* roots), common juniper (*Juniperus communis,* branches), western larch (*Larix occidentalis,* branches), fernleaf biscuiroot (*Lomatium dissectum,* roots), and redflower current (*Ribes sanguineum,* branches).

The authors warn that limiting the size of the screen to only five bacteria would have doubled the number of plants found to be inactive and would have resulted in failure to uncover important medical properties.

Keywords: Medicinal plants, antibacterial potency, indigenous use, British Columbia.

McRae, Michael. 1993. Mushrooms, guns, and money. Outside. 18(10): 64-69, 151-154.

Reports on the robbery and murder of a wild mushroom harvester in northeastern Oregon during spring 1993. Wide availability of firearms and territoriality among pickers have led to anger and violence. Violence has increased the call for regulation of mushroom harvesting. The author describes the business relations at a La Grande, Oregon, mushroom processor. Business transactions are virtually all cash-based, armed guards are necessary, and only the buyers are becoming wealthy. Conflicts in work customs and ethics between local residents and Asian immigrant mushroom pickers are creating resentment. Rumors of Canadian mushroom brokers who help launder Asian crime syndicate money are repeated.

Unemployment and poverty in the Northwest are listed as reasons for seeking employment in mushroom collecting. For rural people and immigrants with low incomes, mushroom picking is one of a portfolio of seasonal activities by which they make ends meet and maintain personal freedom.

Keywords: Wild edible mushrooms, resource conflict, Asian immigrants, Oregon.

McRobert, Gussie. 1985. A walk on the wild side. Oregon Business. October: 105-106.

Discusses the rapid increase in wild mushroom harvests in the Pacific Northwest, which is estimated to have tripled in 5 years and to yield estimated annual industry sales of US$21.4 million. Industry trends and issues are reviewed, including foreign investment, lack of financing, the development of the cultivated mushroom market and conflicts among resource users. Provides vignettes of emerging companies involved in buying, processing, and selling mushrooms.

Keywords: Wild edible mushrooms, Pacific Northwest, economic value.

Midwest Research Institute. 1992a. Aromatics. MRI Tech. Pap. Kansas City, MO. 16 p.

Discusses important essential oils including oil from western redcedar (*Thuja plicata*), which is native to the Pacific Northwest. Oil is produced from branch ends and leaves and is used in embalming fluids, microscope slide specimens, room deodorants, cleaning fluids, perfumes, and salves. Most production of western redcedar comes from British Columbia. Another native species, Canadian horseweed (*Conyza canadensis*), is a weedy species, widespread in the Pacific Northwest, that also produces economic quantities of erigeron oil.

Most consumers of essential oils live in developed industrial countries. China, eastern Europe, and Russia are potential major competitors supplying similar products from many species. Important factors to consider before large-scale investments are made in aromatic oil production include good yield of high-quality oil; availability of large enough volumes for economies of scale; cost-efficient distillation technology; and available capital to produce at least a 6-month supply without sales. Small-scale operations can engage in distillation operations for tourist sales

with considerable value-added by bottling in small volumes, but sales to volume buyers require considerable investment to assure a dependable supply and product purity.

Keywords: Essential oils, Pacific Northwest, production.

Midwest Research Institute. 1992b. Berries and wild fruit. MRI Tech. Pap. Kansas City, MO. 16 p.

Important species mentioned that are found in the Pacific Northwest are the introduced Himalayan blackberry (*Rubus discolor*), Oregongrapes (*Mahonia* spp.), Saskatoon serviceberry (*Amelanchier alnifolia*), and wild huckleberries (*Vaccinium* spp.). Berries often serve as a draw for tourism and recreation, local confection industries, and local festivals (for example, blueberries (*Vaccinium* spp.) in the upper Midwest and in the East). Although closely related to blueberries, huckleberries have different management requirements. Huckleberry fields become established after subalpine forests burn, but huckleberry management does not profit from subsequent burnings. Removing individual trees is the best control of overstory trees. Requirements for less risk prone landscapes for consistent huckleberry production are discussed: natural sites for recreational picking, a mix of ecological sites for berry production, and sites located within 30 miles of a tourist destination and within $^{1}/_{2}$ mile of a road.

A profile is included of a successful Idaho firm that sells value-added huckleberry products from berries purchased for US$2/lb during the 4-week harvest season in adjacent National Forests.

Keywords: Berries, stand management, market development, burning.

Midwest Research Institute. 1992c. Cones and seeds. MRI Tech. Pap. Kansas City, MO. 15 p.

Major decorative cone species in the Pacific Northwest are Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), ponderosa pine (*Pinus ponderosa*), lodgepole pine (*P. contorta*), sugar pine (*P. lambertiana*), and western white pine (*P. monticola*). Cones of different species are generally readily substitutable. Western hemlock cones and scales from noble fir (*Abies procera*) are mainly used for potpourri. Important sources are Federal lands, large industrial forest landowners, seed companies, and seed tree nurseries. In general, the market for seed cones is very small as compared to the market for decorative cones.

The decorative cone market is not stable but has greatly increased over the last 2 years. There are four major decorative cone markets in the United States: Tennessee, Minnesota, the East Coast, and California. The German market is estimated, however, to be 10 times that of the United States. Foreign competitors include Guatemala and other Latin America sources. The wide distribution of lodgepole pine makes its cones one of the most marketed worldwide.

Wildcrafters are advised to sell to brokers or wholesalers rather than to manufacturers. Red alder (*Alnus rubra*), western redcedar, and incense-cedar (*Calocedrus decurrens*) are the most valuable cones per pound, based on a 1991 cone price list

from an Oregon firm, and the sugar pine cone is the most valuable individual cone in the Rogue River National Forest, Oregon. Information is provided about distribution, packaging, equipment needs, costs, and suppliers. The business of a decorative cone collector from Oregon is profiled.

Keywords: Cones, United States.

Midwest Research Institute. 1992d. Forest botanicals. MRI Tech. Pap. Kansas City, MO. 40 p.

Potential botanicals include redroot amaranth (*Amaranthus retroflexus*), western brackenfern (*Pteridium aquilinum*), henbit deadnettle (*Lamium amplexicaule*), pepperweeds (*Lepidium* spp.), *Allium* spp., and *Viola* spp. Also having agroforestry potential are field horsetail (*Equisetum arvense*), immature maple (*Acer* spp.) seeds, miner's lettuce (*Claytonia perfoliata*), nettles (*Urtica* spp.), wood sorrels (*Oxalis* spp.), prickly pears (*Opuntia* spp.), salmonberry (*Rubus spectabilis*) shoots, smooth sumac (*Rhus glabra*) for tea, and willow (*Salix* spp.). Botanicals with commercial potential are listed as well. Those species from the Pacific Northwest include California laurel (*Umbellularia californica*), cascara (*Frangula purshiana*), Arctic sweet coltsfoot (*Petasites frigidus*), devilsclub (*Oplopanax horridus*), kinnikinnick (*Arctostaphylos uva-ursi*), American false hellebore (*Veratrum viride*), Pacific mistletoe (*Phoradendron villosum*), hollyleaved barberry (*Mahonia aquifolium*), prince's-pine (*Chimaphila umbellata*), blue skullcap (*Scutellaria lateriflora*), and British Columbia wild ginger (*Asarum caudatum*).

In general the market for the harvest and sale of wildcrafted fresh greens is more limited than for fresh edible wild mushrooms because of perishability. Entry for new products into medicinal plant markets is fairly easy. Producers need to be familiar with Federal and state regulations for health products. Making medical claims requires extensive testing and certification.

The author advises growers and gatherers to deal with brokers rather than buyers, do a feasibility study, provide samples, make the effort to establish an ethical reputation, and learn the trade and business thoroughly. Details of harvesting, drying, storage, packaging, distribution, equipment needs, supplies, and costs are discussed. Aspects of resource conservation of wild stocks and measures for self-policing in the industry are described. An extensive bibliography and lists of pertinent professional organizations, resources, journals, videos, wholesalers, and resource people are given.

Keywords: Wild edible plants, medicinal plants, economic development, United States.

Midwest Research Institute. 1992e. Greenery, transplants, and floral products. MRI Tech. Pap. Kansas City, MO. 74 p.

Describes the Pacific Northwest as the most active region in the United States for providing decorative floral greenery, transplants, and horticultural greenery. Important floral greens are beargrass (*Xerophyllum tenax*), which is also used for making baskets, western swordfern (*Polystichum munitum*), evergreen

huckleberry (*Vaccinium ovatum*), salal (*Gaultheria shallon*), and many moss species. Prominent uncultivated nonnative plants of economic value are scotch-broom (*Cytisus scoparius*) and babysbreath gypsophila (*Gypsophila paniculata*). Tree species used for decorative boughs include Pacific silver fir (*Abies amabilis*), subalpine fir (*A. lasiocarpa*), noble fir (*A. procera*), lodgepole pine (*Pinus contorta*), western white pine (*P. monticola*), Douglas-fir (*Pseudotsuga menziesii*), western juniper (*Juniperus occidentalis*), incense-cedar (*Calocedrus decurrens*, western redcedar (*Thuja plicata*), and Port-Orford-cedar (*Chamaecyparis lawsoniana*). In addition, broadleaf cattail (*Typha latifolia*), deer fern (*Blechnum spicant*), manzanitas (*Arctostaphylos* spp.), boxleaf myrtle (*Paxistima mysinites*), western pearly everlasting (*Anaphalis margaritacea*), and willows (*Salix* spp.) are widely collected. Major horticultural transplant species in the Pacific Northwest are mountain hemlock (*Tsuga mertensiana*), lodgepole pine, subalpine fir, noble fir, vine maple (*Acer circinatum*), beargrass, and cattail.

People interested in harvesting wild floral products are cautioned to calculate time and expense for harvest, drying, processing, packaging, and distributing products. Considerations for rural development suggest that education about different uses of native plants is important. Cultivation of commercial species on private lands will become increasingly important. Cooperatives and stewardship contracts are two institutions that could transform the structure of floral products marketing and cultivation. The appendix includes an extensive bibliography and lists of trade journals and buyers. Conditions for obtaining permits for forest greens and boughs from the Randle Ranger District (Gifford Pinchot National Forest, Washington) are given as well as the contents of a 1983 manual with guidelines for picking greenery in western Washington, a list of buyers, and texts of pertinent laws.

Keywords: Floral greens, conifer boughs, horticultural plants, rural development, cooperatives, stewardship contracts.

Midwest Research Institute. 1992f. Honey. MRI Tech. Pap. Kansas City, MO. 16 p.

Major sources of honey in spring are alders (*Alnus* spp.), willows (*Salix* spp.), maples (*Acer* spp.), and serviceberries (*Amelanchier* spp.). *Rubus* spp. are important for summer nectar flow, and goldenrods (*Solidago* spp.) and asters (*Aster* spp.) are the major autumn nectar species. The Apalachicola National Forest in Florida yields substantial quantities of tupelo (*Nyssa sylvatica*) honey. Major international competition comes from China, Argentina, Mexico, and Canada. Other important byproducts are bee pollen and beeswax. Commercial beekeepers may decide to move mobile hives close to nectar plants currently in flower. Generally the value of the bees as pollinators is much greater than the value of the honey product. Details of packaging, distribution, equipment needs, supplies, and costs are provided. An overview of bee management also is included. The appendix contains a bibliography and lists of relevant periodicals, professional associations, extension resources, USDA research facilities, and sources of apiarist supplies.

Keywords: Honey, bee pollen, beeswax, United States.

Midwest Research Institute. 1992g. Mushrooms. MRI Tech. Pap. Kansas City, MO. 34 p.

Discusses the growth of the market for wild edible mushrooms in the Pacific Northwest. The initial surge began with the canning of golden chanterelles (*Cantharellus cibarius*) for European markets. Other commercially important species are morels (*Morchella conica* and *M. esculenta*), American matsutake (*Tricholoma magnivelare*), king boletes (*Boletus edulis*), and hedgehog mushrooms (*Dentinum repandum*). Details of annual harvest volumes, prices, and regulations in the Pacific Northwest are provided. Important information on distribution, packaging, equipment needs, and costs for forest harvesting is given. Issues of resource conservation, harvest regulation, links to forest management practices, social conflicts among harvesting groups, and options for permits and licenses also are analyzed. The appendix includes a bibliography and lists of resource experts, professional associations, periodicals, suppliers, and buyers.

Keywords: Wild edible mushrooms, Pacific Northwest.

Miller, Melanie. 1977. Response of blue huckleberry to prescribed fires in western Montana larch-fir forest. Res. Pap. INT-188. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 33 p.

Reports on results from treatments with prescribed fire on blue huckleberry (*Vaccinium membranaceum*). Fire intensity accounted for differences in sprouting response. Nine spring burns and eleven autumn burns were conducted on $^{1}/_{3}$-acre sites in Douglas-fir (*Pseudotsuga menziesii*) / western larch (*Larix occidentalis*) stands near Missoula, Montana. Data on shrubs were collected on 26 1-m^2 quadrants within each burn plot. Fuel loadings, fuel and duff moisture content, and environmental variables were statistically related to the number of stems recorded 1 and 2 years after the fires.

Plants burned in the fall did not produce sprouts from released buds until the following spring. Spring fires typically resulted in more sprouts than were found in sites before the fire. These fires removed senescing stems but caused minimal damage to the rhizome. Fall fires were more intense and often reached below the depth of all rhizomes. Fall rains raised the moisture content of fine fuels and duff but did not seem to soak through to soil layers. Little or no sprouting occurred on many of the plots 1 year after the autumn burns, but numbers of total stems increased over the prefire conditions in eight of the plots by the end of the second year. In general, plant numbers increased from prefire conditions if stems were burned off above ground level. When heat penetrated to deeper levels, sprout density was low; however, fall fires in areas with light fuel loadings, wet duff, and fine fuels rarely killed rhizomes. Fire responses in other shrubs with sprouting root crowns, such as Saskatoon serviceberry (*Amelanchier alnifolia*), may be quite different because of differences in the form, size, and location of sprouting sites. Management practices to promote single species may be quite different as well.

Keywords: Burning, sprouting, productivity, berries.

Miller, Richard Alan. 1988. Native plants of commercial importance: the nomadic life of the professional forager. Grants Pass, OR: OAK, Inc.

Minore, Don. 1972. The wild huckleberries of Oregon and Washington—a dwindling resource. Res. Pap. PNW-143. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. 20 p.

Summarizes the status of huckleberries (*Vaccinium* spp.) in the Pacific Northwest, management considerations, and techniques. Huckleberries are found on at least 160,000 acres in Oregon and Washington. The economic importance of berry fields can be considerable. Very productive fields near Trout Lake, Washington, yielded up to US$300 per acre in 1969. Often the most productive fields are in poor timber-growing zones. The cluster-fruited species, *V. uliginosum* and *V. ovatum* are more productive than single-fruited species, but the berries are not as choice. The three red-fruited species (*V. parvifolium, V. scoparium*, and *V. myrtillus*) are either tart or produced in insignificant quantities. Of the remaining species, blue huckleberry (*V. membranaceum*) is the most widely picked.

Huckleberry fields depended originally on wildfire for establishment and reinvigoration. Lodgepole pine (*Pinus contorta*), western mountain ash (*Sorbus sitchensis*), and beargrass (*Xerophyllum tenax*) are the most vigorous competitors with *Vaccinium* species. With wildfires suppressed and with more intensive reforestation, huckleberry areas appear to be declining in size and berry output. Factors influencing huckleberry occurrence and productivity in clearcuts are not well understood. Management of berry fields has faltered because funding has been abset, and no one knows how to manage the fields for production.

By analogy, management of eastern North American *Vaccinium* species can provide some general guidelines for management in the Pacific Northwest. Management findings gleaned from studies conducted in the East are summarized. Burning prunes the old, less productive stems, stimulates new sprouting, and sometimes reduces competition from other species. Cutting rhizomes has the same effect on rowth but is more labor intensive. Fire may not promote *Vaccinium* colonization on newly cleared land. Chemical weed control is another option. Maintaining relatively low soil pH (4 to 5) may be important. Extractable iron is particularly important for plant growth. Use of phosphorus-potassium fertilizers without nitrogen improves berry production.

Selecting and propagating superior wild clones of native huckleberries may increase profitability of managed fields on public lands in the Pacific Northwest. Sheep grazing also benefits huckleberry growth. Shading may protect some plants from starting to grow too early, before the last hard freeze. The author advises a complete inventory of the huckleberry resource. Researchers have already carried out trial procedures for an inventory at the Mount Adams Ranger District, Gifford Pinchot National Forest, Washington.

Keywords: Berries, management, clearcutting, burning, herbicides, fertilizers, Gifford Pinchot, Washington, Pacific Northwest.

Minore, Don. 1983. Western redcedar—a literature review. Gen. Tech. Rep. GTR-PNW-150. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. 70 p.

Compiles comprehensive information about all aspects of western redcedar (*Thuja plicata*) and provides citations about Native American uses of redcedar bark to make baskets, ropes, blankets, mats, clothing, and thatch; branches to make baskets; twigs to make whaling ropes and arrows; and roots for fishhooks. Cedar leaf oil is used in perfumes, insecticides, medicinal and antibacterial preparations, veterinary soaps, shoe polishes, and room deodorants.

Keywords: Essential oils, ethnobotany.

Minore, Don. 1984. *Vaccinium membranaceum* berry production seven years after treatment to reduce overstory tree canopies. Northwest Science. 58(3): 208-212.

Reports on research to control the amount of overstory in subalpine blue huckleberry (*Vaccinium membranaceum*) patches. A completely randomized experimental design with five treatments replicated four times for the overstory was carried out. Treatments consisted of overstory cut and burn, 2,4-D frill, 2,4-D spray, *Phellinus weirii* inoculation, and a control. Berry production was sampled every other year from 1975 through 1981. The 2,4-D frill treatment provided significantly higher berry production in 1981. Elimination of overstory shade without disturbing understory vegetation appeared most effective for berry production. The response of berry productivity to fire was slower than expected.

This article is important as one of the very few controlled experiments conducted in the Pacific Northwest about management options for nontimber forest products. It also suggests a method to calculate ripe weight of berries from data sets of picked berries.

Keywords: 2,4-D, berries, girdling, huckleberry, productivity, fire.

Minore, Don; Dubrasich, Michael E. 1978. Big huckleberry abundance as related to environment and associated vegetation near Mt. Adams, Washington. Res. Note PNW-322. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. 8 p.

Reports on results of research on blue huckleberry (*Vaccinium membranaceum*) ecology and management conducted between 1972 and 1977 in the Gifford Pinchot and Mount Hood National Forests. Huckleberries cover an estimated 100,000 acres in Washington and Oregon. Many of the fields have originated from wildfires occurring above 3,000-ft elevation. As much as 100 gal/acre were harvested at one high-quality site in 1976; in 1977 production fell to 77 gal/acre. Berry prices averaged US$10-11 per gallon at the same time. If only half the potential crop were picked, yield would exceed $300 per acre. Loss of huckleberry habitat to invading trees of low timber value may mean a loss of net value to society.

At Mount Adams, in southern Washington, randomized 120-ft^2 plots of five treatments (control, cut and burn, burn, borax application [boron fertilization], and

sheep grazing) with four replications were established in 1972. By 1977, huckleberry and beargrass (*Xerophyllum tenax*) had recovered biomass but berry production was minimal in control plots. Intensive sheep grazing reduced berry production for 2 years then increased it in the 3d year after treatment; young conifer trees were reduced in number. Borax did not affect berry production, but beargrass declined on the same plots. All treatments failed to control competing species without damage to huckleberries. Vegetation and huckleberries were sampled in 1975 and 1977 as at Mount Adams. Lodgepole pine (*Pinus contorta*) was the tree species most affected by the herbicide spray of 2,4-D; in general, overstory cover was significantly reduced. Burning reduced the huckleberry cover significantly; full recovery had not occurred in 1977. Herbicide damage from 2,4-D in the "brown" and burn treatment was less severe than in the burning treatment, and recovery appeared to be faster. Huckleberry cover on the 2,4-D frill, *Phellinus*, and control plots all increased slightly from 1975 to 1977 without statistically significant differences among treatments. Berry production remained absent in 1977 from huckleberries burned in 1975. Berry production in frilled-tree plots was significantly higher than in controls. Burning as an effective management technique probably works under conditions of high fire hazard. Killing foliage with a herbicide appears not to provide enough dry fuel to support a stand fire. *Phellinus* inoculations may achieve effects at a rate that the time frame of these experiments did not cover.

Other studies were conducted southwest of Mount Hood, Oregon. The effect of overstory removal with a bulldozer and subsequent slash burning on huckleberry growth and berry production was tested. Bulldozing occurred in 1973 and burning in summer 1974. Competing vegetation was eliminated, but fire damaged the huckleberries and reduced berry production for the subsequent 3 years as compared to control plots. On a separate plot grid, three treatments of karbutilate (5, 10, and 15 lb/acre) plus controls were randomly replicated four times in early spring. Randomized 120-ft^2 grid plots all with 30-ft buffer strips were treated one of five ways: control, cut and burn, "brown" vegetation with a low volatile ester of 2,4-D and burn, 2,4-D applications to frilled trees, and inoculation with *Phellinus weirii* (Murr.). *Phellinus weirii* was intended to thin overstory trees continuously by rotting tree root systems.

Details of rooting and germination trials are also given. Differences in timing of first flowering and rhizome formation were found among *V. membranaceum* and *V. deliciosum*. *Vaccinium deliciosum* was the most frost-tolerant species. Beargrass seeds germinated well under the identical conditions of nutrients, temperature, and photoperiod as *V. membranaceum*.

Tentative suggestions for management of ecological conditions for higher elevation huckleberry patches are made: partial shading obtained through partial overstory removal, and avoidance of shrub disturbances. Girdling of overstory trees may be more suitable than using herbicides. Sheep grazing promotes huckleberry growth, but sheep should be removed from huckleberry fields before berry picking begins. Nitrogen fertilization is recommended. Burning is useful only if a significant delay before the onset of new huckleberry crops (for example, ≥5 years) is acceptable and if the overstory trees are not of merchantable quality.

Keywords: Berries, management, Gifford Pinchot National Forest, Mount Hood National Forest, Oregon, Washington, harvest, price, yield, plots, burning, borax, grazing, karbutilate, bulldozing, fertilization, monitoring.

Minore, Don; Smart, Alan W.; Dubrasich, Michael E. 1979. Huckleberry ecology and management research in the Pacific Northwest. Gen.Tech. Rep. GTR PNW-83. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. 50 p.

For centuries, wildfires and fires set by Native Americans created and maintained open, tree-free environments above 3,000 ft which were ideal habitat for huckleberries (*Vaccinium* spp.). High berry production in these fields resulted in economic yields of over US$300 per acre (1977 dollars), and high recreation values, reflected in a tally of 163,000 visitor-days in a heavily used field in 1969. Suppression of fire in recent decades has resulted in trees invading the huckleberry fields and eventually shading out the shrubs and eliminating huckleberry production. The authors explored, through experiments in the field and the laboratory, various methods to control competing species without reducing huckleberry growth or berry production, including sheep grazing, cutting and burning, borax application, bulldozing and burning, herbicides, and biological controls. Based on the results of these experiments, herbicide use (2,4-D amine) or girdling were recommended for low tree-density areas and bulldoze-and-burn treatments were recommended for eliminating dense, unmerchantable, overstory canopies.

Keywords: Berries, economic value, herbicides, girdling, vegetation control.

Minore, Don; Weatherly, Howard G. 1994. Effects of partial bark removal on the growth of Pacific yew. Canadian Journal of Forest Research. 24(4): 860-862.

Measured growth rates of 121 Pacific yew (*Taxus brevifolia*) trees in the Cascade Range of Oregon and Washington that had been damaged from windthrow or logging activity from 3 to 92 years ago, and the growth rate of 121 undamaged trees. Results from the data indicated that yew trees survive and grow well for extended periods after partial bark removal. By inference, trees are likely to survive after partial (<50 percent) bark stripping for taxol supplies in the event of continued harvests for taxol.

Keywords: Bark removal, bark stripping, logging damage, taxol, windthrow damage.

Miyamoto, T.; Tsuzuki, K; Yoshida, M. 1985. Prediction of bed log production in [a] stand of *Quercus acutissima*. Bulletin of the Forestry and Forest Products Research Institute. 333: 173-199. In Japanese.

Uses least squares estimation techniques to predict the amount of wood volume from an oak stand for bed logs in the production of commercially grown edible mushrooms. Regression equations are used to sort logs by diameter class and length. This article is particularly valuable as a guide to planning for the production of down wood. Down wood can enhance nutrient cycling and create diverse forest habitats while producing economic value from edible wild mushrooms inoculated on the down logs.

Keywords: Bed logs, down wood, joint production, cultivated mushrooms, regression techniques, volume projections.

Möhrer, Günther. 1977. Die Praxis der Schmuckgrünwerbung und -sortierung= Gathering and sorting practices for decorative greenery. Allgemeine Forstzeitung. 32(46): 1143-1144. In German.

Analyzes the means for acquiring forest products from North Rhein/Westphalia forests in Germany for marketing. There are three major strategies: gathering greens using a firm's own personnel, contracting out for greens collection, or obtaining greens from a wholesaler. Studies show that the second method seems to be most efficient, but each forest products company needs to conduct its own analyses. The author includes discussion of ornamental trees, Christmas trees, decorative cut greens, and dried material including cones, mushrooms, and moss.

Most work is seasonal by nature with delivery for most products from October through December. Good business organization assures delivering by required dates and improves profits. Tools (scissors, packing knives, files), equipment (scales, cutting boards, carts), machinery (chainsaws, packagers), packing material (rustfree wire, cord, labels, cardboard boxes), and rainproof clothing are essential to produce the desired quantity and quality.

Average productivity per contracted worker per hour for greenery gathering ranges from 50 kg for finely branched decorative greens, such as Port-Orford-cedar (*Chamaecyparis lawsoniana*), to 150 kg for Douglas-fir (*Pseudotsuga menziesii*) and eastern white pine (*Pinus strobus*) when bundled into 5-kg packages. These figures come from stands not specifically managed for greens production alone. Workers are paid for piece work. State forest workers were 40 to 50 percent less productive than contracted workers. Customers prefer to have products in standardized 5-kg bundles except for small bunches of branches for florists, which are picked at a rate of 70 per hour (eastern white pine at 0.5 kg each) and 120 per hour (Douglas-fir and true firs at 1.0 kg each). Number of branches per bundle is more important than weight. A nationwide grading system to define and assure product quality has not been developed.

Single workers trim a block of eight rows of trees no further than 15 m from a portable scale set up between the fourth and fifth row to weigh bundles. The bundles are collected twice a day. Another system uses two workers on a block of four rows of trees who trim greenery tree by tree. While one person sorts, weighs, and bundles the greens, the other person brings the bundles to a truck pickup spot. All processing is done in the stand and there is no need for a processing center. Special considerations are needed for blue spruce (*Picea pungens*) to protect the blue color and to maintain ambient dryness. Douglas-fir needles often turn yellow after packing.

Many factors come into play when determining a harvesting schedule. Cutting should begin early in the stand rotation. Leaving the top three to four whorls alone while cutting lower branches back to leave a branch remnant capable of producing lateral branching for future greenery has proven a good practice. When trees get too tall, managers emphasize management for timber production. Frequency of harvests depends on the size of the operation. Some stands are harvested for greenery every year, others only every 2 or 3 years.

Keywords: Conifer boughs, Christmas trees, cones, wild edible mushrooms, moss, marketing, production, worker productivity, harvesting, pruning, management, Germany.

Molina, R.; Amaranthus, M.; Pilz, D.; Fischer, C. [In press]. Commercial harvest of edible ectomycorrhizal fungus sporocarps from Pacific Northwestern forests: ecological and management implications. In: Proceedings of the 4th European mycorrhiza symposium; 1994 August; Granada, Spain. [Place of publication unknown]: [Publisher unknown].

Reports on the status of commercial mushroom harvests in the Pacific Northwest, biological and management concerns, and appropriate monitoring. Decline in availability of chanterelles (*Cantharellus* spp.) in Europe and matsutake (*Tricholoma matsutake*) in Japan spurred the growth of mushrooms exports from the Pacific Northwest in the early 1980s. Presently, exports consist mostly of fresh, air-shipped mushrooms. The rapid increase in commercial mushroom harvest had raised questions about the range and productivity of major commercial species, the sustainability of current harvest levels, the effect of management practices (grazing, fertilization, and so forth) on mushroom production, the population biology, and the reproductive rates of mycorrhizal species. Three types of monitoring are proposed: detection monitoring for questions of productivity and distribution, evaluation monitoring to explain effects from forest management, and research monitoring to clarify biological and ecological phenomena.

Keywords: Pacific Northwest, wild edible mushrooms, monitoring.

Molina, Randy; O'Dell, Thomas; Luoma, Daniel [and others]. 1993. Biology, ecology, and social aspects of wild edible mushrooms in the forests of the Pacific Northwest: a preface to managing commercial harvest. Gen. Tech. Rep. PNW-GTR-309. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 42 p.

Provides an excellent review of the biology, ecology, and management issues surrounding commercial wild mushrooms in the Pacific Northwest. A primer on forest mycology is followed by brief descriptions of 12 of the most sought-after mushroom and truffle species. Major economic species discussed are *Boletus edulis*, *Cantharellus cibarius*, *C. subalbidus*, *Craterellus cornucopiodes*, *Dentinum repandum*, *Hericium abietis*, *Lepiota rhacodes*, *Morchella esculenta*, *Picoa carthusiana*, *Sparassis crispa*, *Tricholoma magnivelare*, and *Tuber gibbosum*. The descriptions include color photographs and a list of references to the technical literature on each species. Historical uses and attitudes toward fungi are described, and the variety of user groups are discussed, along with a description of the resource conflicts that exist among users and between users and landowners. The development of the commercial wild mushroom harvest is reviewed, with a focus on the history and results of the Wild Mushroom Harvesting Act in Washington State. Finally, the need for monitoring to design sustainable and equitable harvesting practices is discussed. Three kinds of monitoring systems are suggested: detection to determine mushroom production over space and time, evaluation to determine the extent and cause of any changes in production, and research on the role of fungi in ecosystem processes.

This report offers a comprehensive overview of the social and economic policy issues that confront ecosystem managers in the Pacific Northwest involved with regulating edible mushroom harvests.

Keywords: Wild edible mushrooms, harvesting, monitoring, truffles, regulation, resource conflict, Washington State, Wild Mushroom Harvest Act.

Moore, Michael. 1993. Medicinal plants of the Pacific West. Santa Fe: Red Crane Books. 360 p.

Introduces prominent medicinal plants of the Pacific States. Descriptions of species' appearance, habitat, and active compounds are given. The author emphasizes that medicinal plants should be collected only in habitats where the plants are common. Harvesters should not pick more than one-third of the plants in a stand and no more than a fourth of the foliage or twigs of a single plant, and should dig up roots of only half the visible plants, at most. Plants whose populations obviously would be harmed by collection are omitted from discussion. Techniques for plant drying and preparing salves, teas, eye washes, poultices, and herbal tinctures are detailed.

Keywords: Medicinal plants, Pacific States, conservation, ecological sustainability.

Moreno-Black, Geraldine; Price, Lisa Leimar. 1993. The marketing of gathered food as an economic strategy of women in northeastern Thailand. Human Organization. 52(4): 398-404.

Describes the economic changes that occurred as members of a Thai village began to market gathered food commercially that traditionally had been used for subsistence. Increasing participation in a cash-based economy transformed the role of women as gatherers of nonstaple wild food crops. Commercial sale of gathered foods frequently was a major income source for women who were virtually the exclusive vendors in Kalasin city markets. Surveys and interviews were conducted over 3 months in 1988. Information was collected about gathering habits and earnings, economic data for households of gatherers, the products for sale, food consumption, family histories of vendors and customers, and demographics. Interviews were done with both vendors and nonvendors. Eighteen percent of the gathered foods came from forests; 78 percent of women earned more from gathering and selling foods than the going rate for daily agricultural labor. Gathering noncultivated and nondomesticated foods for sale required less risk and less cash investment than cultivation for cash income. Women gained greater economic autonomy, could purchase more expensive material goods, made greater contributions to social and religious obligations, and improved their social status. This article describes potential approaches to sociological studies of gatherers and vendors of nontimber forest products in the Pacific Northwest to gain greater insight into the motivations and benefits of gathering products.

Keywords: Household strategies, gathering, Thailand, edible wild plants.

Morra, Francesco. 1955. La produzione ed il commercio dei tartufi=Truffle production and trade. Allionia. 2(2): 51-55. In Italian.

The best quality truffles (*Tuber* spp.) in Italy are produced in the region from the Astigiano to the Canallese Rivers in Alba. Deforestation limits the production of truffles in the area. Major collection occurs in October through December. The grading system for product quality is described, but mislabeling is common in Italy, especially out of season. The foreign market is saturated by black truffles (*Tuber*

melanosporum) from France, but markets for Italian white truffles have developed in France, Switzerland, Belgium, and South Africa. The 30 to 40 percent higher price for white truffles is an obstacle. Black truffles, which rival the best in France, are found in Italy as well.

Keywords: Truffles, grading, competition, Italy.

Murray, M.D.; Crawford, P.D. 1982. Timber and boughs: compatible crops from a noble fir plantation. In: Oliver, C.D.; Kendady, R.M., eds. Proceedings of a symposium on the biology and management of true fir in the Pacific Northwest; 24-26 February 1981; Seattle. Contrib. 45. Seattle: University of Washington, Institute of Forest Resources: 215-219.

Details a case study charting the growth and economic productivity of a 24-year-old plantation of noble fir (*Abies procera*) in western Washington. Young stands of noble fir generated incomes from the sale of boughs for ornamental uses. Noble fir accounted for about 75 percent of the true fir bough harvest in the Pacific Northwest. Desirable qualities included durability, density and color of foliage, symmetrical branching, and excellent needle retention. Although the profit potential for noble fir has not been widely publicized in the Northwest, noble fir is important in Denmark as a bough tree. Danish research has investigated yields of different cutting intensities, effects of irrigation and fertilization on bough yields, and changes in nutrient status of soils growing noble fir.

Timber production and bough harvests are compatible joint products. Bough harvests can begin when trees are just 8 years old and can be sustained for up to 25 years. On this particular shallow and rocky site, bough harvests began at a stand age of 13 years. Cutting was concentrated on dominant trees that were 2 to 3 years past breast height. Only outer parts of branches were cut so that the remaining branch part could serve as a ladder for cutters to reach higher boughs in the future. Usually at least five uncut upper whorls were left on each tree. Open-grown, sapling-sized trees had the best quality and greatest quantity of foliage. Mortality in the stand was avoided by thinning for Christmas trees. In general, harvesting for boughs was more profitable than selling Christmas trees.

Average annual harvest over the past 10 years was 1,720 lbs•ac^{-1}•yr^{-1} or for each tree about 4.4 lb/yr. Most trees had boughs removed at least twice during the period. Boughs estimated at 10,920 lb/ac and valued at US$982 per acre provided enough revenue to more than cover the cost of the thinning. A three-stage thinning procedure involved marking trees to be thinned, stripping marked trees of salable boughs, and removing stripped trees. No further bough harvests would occur after stocking control. Harvested boughs were carried to the road by hand.

Keywords: Conifer boughs, Christmas trees, harvest, pruning, thinning, Washington, joint production.

Nash, June. 1994. Global integration and subsistence insecurity. American Anthropologist. 96(1): 7-30.

Nelson, T.C.; Williamson, M.J. 1970. Decorative plants of Appalachia: a source of income. Agric. Info. Bull. 342. Washington, DC: U.S. Department of Agriculture. 31 p.

Provides descriptions of important Appalachian plant species used for decorative floral and foliage arrangements. Many of the plants mentioned have congener species in the Pacific Northwest that are not known or are underutilized in the ornamental trade. Genera to investigate include *Kalmia* spp., *Rhododendron* spp., *Phoradendron* spp. (mistletoe), *Lycopodium* spp. (clubmoss), and mosses (especially the genus *Hypnum*). Particular attention is given to conifer species that might compete with Pacific Northwest species, especially in Eastern markets. The authors also provide tips on marketing and seeking local advice and assistance in beginning a decorative plant business. Details of legal restrictions on the collection and transportation of decorative plant materials for each of the Appalachian states also are provided.

Keywords: Horticultural plants, Appalachia, regulation.

Nepstad, Daniel C.; Schwartzmann, Stephan. eds. 1992. Nontimber products from tropical forests: evaluation of a conservation and development strategy. [Advances in Economic Botany]. [9]. 146 p.

Addresses the problem of how to use forests for profit and habitat at the same time. Consists of a compilation of papers and discussions that occurred at an international symposium on extractive economies in tropical forests held in 1989. It includes chapters on the ecology of nontimber forest products, barriers to nontimber forest product expansion, strategies for expanding nontimber forest product extraction, socioeconomic case studies, and a discussion of the political context in which nontimber forest product extraction must operate. Although the focus is on nontimber forest product extraction in the Amazon, many of the principles can be applied to other forests. Two of the case studies address this issue directly: the suitability of the extractive reserve concept for Indonesia, and the history of the gum arabic (*Acacia nilotica*) trade in West Africa as it illustrates some of the ecological and socioeconomic implications of industrial extraction.

Key themes emerging from these articles include:

1. Not all forests are suitable for nontimber forest product extraction. Oligarchic forests, where relatively few species are found in dense concentrations, seem to be the most economically viable type of forest for extraction.

2. Nontimber forest product extraction is best seen as one strategy in a wide range of land management and economic development strategies.

3. Government policies need to be structured to support, rather than undermine, the social, market, and political institutions fostering sustainable nontimber forest product extraction. Currently, nontimber forest products tend to be undervalued, and the costs of logging and forest conversion tend to be underestimated. Elimination of subsidies favoring unsustainable forest use and the use of national resource accounting, which incorporates the costs of natural resource depletion into national income accounts, are suggested as mechanisms for shifting the balance in favor of nontimber forest product extraction.

4. Nontimber forest product extraction faces a number of social and economic barriers to its widespread use as a forest conservation or economic development mechanism. For example, the heterogeneity of Amazonian forests leads to high extraction costs, a problem exacerbated by weak markets and high substitution potential. Extractors tend to live on the margin of subsistence and thus have limited possibilities for engaging in conservation behavior if other, more lucrative, alternatives for making a living are available. This difficulty is enhanced by the generally low percentage of a product's market value that reaches the nontimber forest product harvester. Developing marketing systems that enhance the value that reaches harvesters, foster value-added industries in forested locations, and address the threats posed by weak markets and substitution is thus critical to the success of nontimber forest product extraction strategies.

5. Expanding economically and ecologically sustainable nontimber forest product extraction requires reconfiguring existing political and social institutions. Extractive reserves, for example, offer the possibility for providing small holders the tenure security needed to encourage sustainable extraction and discourage forest conversion. Coalitions between extractor groups and nongovernment organizations can help these groups to mobilize more effectively to demand government policies that support rural community development rather than maximizing commodity production. Such coalitions also can level the playing field between multinational corporations and small-scale producers.

Keywords: Tropical rain forest, rural development, barriers, land tenure, partnerships, market expansion, extractive reserves, political economy, sustainability.

Newton, Ivan Leon. 1957. The gathering industry west of the Cascades. Corvallis, OR: Oregon State University. 109 p. M.S. thesis.

Outlines nontimber forest products in western Oregon and Washington in detail. The author conducted nonsystematic interviews of gatherers, users, purchasers, and distributors. Problems of adequate supply and rights to access are discussed. Product groups include decorative greens, native landscaping material, medicinal plants, seeds and cones, and wild berries. The author includes a description of harvesting techniques, seasonality, range, grading features, packaging, existing processors, and current estimates of harvest levels for each noteworthy species. Decorative plant species include western swordfern (*Polystichum munitum*), evergreen huckleberry (*Vaccinium ovatum*), salal (*Gautheria shallon*), Port-Orford-cedar (*Chamaecyparis lawsoniana*), and western redcedar (*Thuja plicata*). Horticulturally valuable species are vine maple (*Acer circinatum*), hollyleaved barberry (*Mahonia aquifolium*), redflower current (*Ribes sanguineum*), Lewis' mockorange (*Philadelphus lewisii*), Pacific dogwood (*Cornus nuttallii*), pink honeysuckle (*Lonicera hispidula*), Pacific rhododendron (*Rhodedendron macrophyllum*), western azalea (*R. occidentale*), Pacific madrone (*Arbutus menziesii*), hairy manzanita (*Arctostaphylos columbiana*), maidenhair ferns (*Adiantum* spp.), and licorice fern (*Polypodium glycyrrhiza*). Major medicinal plants are cascara (*Frangula purshiana*) and purple foxglove (*Digitalis purpurea*). *Sphagnum* spp. for horticultural use and Pacific mistletoe (*Phoradendron villosum*) for holiday decorations are described as well.

Keywords: Berries, buyers, cones, floral greens, conifer greens, harvesting techniques, horticultural plants, medicinal plants, mistletoe, seeds, Oregon, Washington.

Nicolaou, K.C.; Yang, Z.; Liu, J.J. [and others]. 1994. Total synthesis of taxol. Nature. 367: 630-637.

Nicolas, Jose J. 1973. La trufa=The truffle. Boletin de la Estación Central de Ecología. 2(3): 3-28. In Spanish.

Describes native species of truffles (*Tuber* spp.), their distribution and biology, and the program of the National Institute for the Conservation of Nature in Spain to develop populations of truffle species and parallel policy measures to ensure sustainable use. In 1971, a national commission was established to study legal means to improve conservation of the most valuable truffle species, and the first formal conservation legislation was passed in 1972. Truffle consumption had remained a localized phenomenon in Spain until 1954, when black truffles began to be exported to meet growing demand in France. Truffle harvests have the potential to revitalize rural economies of oak forests in much of Spain.

The rapid intensification of truffle collection and timber felling has created a need to prevent rapid degradation of truffle habitats. Increasing value of truffles has caused landowners to limit access to commercial collectors. Recommendations for protecting truffle populations include limiting the season for collection, limiting truffle collection to trained people, requiring use of dogs (not pigs) in locating truffles, requiring replacement of soil, proper equipment, care of symbiont trees, and fire protection measures. In addition, programs for research in soil-vegetation-truffle interactions, for reestablishment of truffle populations, and in rural extension are advocated. A comparison of existing legislation in France, Italy, and Spain for the collection, marketing, and exportation of truffles is included.

Keywords: Truffles, conservation, regulation, sustainability, rural development, Spain, Italy, France.

Nielsen, Ulrik Bräuner. 1994. Breeding noble fir (*Abies procera* Rehder) and Caucasian silver fir (*Abies nordmanniana* (Stev.) Spach) for Christmas trees and greenery in Denmark. In: Lee, Steve J., ed. Progeny testing and breeding strategies: Proceedings of the Nordic group for tree breeding; 6-10 October 1993; Edinburgh. London: United Kingdom Forestry Commission: 118-127.

Nishida, Teruaki; Ishikawa, Tatsuyoshi. 1967a. Analysis of environmental factors in a Japanese red pine forest producing the fruit body of matsutake. II: The influence of light intensity on the growth of the fruit body of matsutake. Scien. Rep. Fac. Agric. 29. [Okayama, Japan]: Okayama University: 9-18. In Japanese with English summary.

Examines the role of light intensity on the production and development of matsutake (*Tricholoma matsutake*) fruiting bodies. Boxes to control light at the sites where matsutake mycelia fruit reduced light to between 5 and 6 percent of that reaching the ground in two nearby stands, one treated with overstory removal and one left as a control. Fruiting was studied during September and October in 1963-66. Humidity, but not temperature, was higher inside the boxes as well. The light control boxes did not significantly change the production of fruiting bodies or the

growth of mycelia. This work addresses light as an environmental variable possibly affecting the productivity of matsutake and provides insights to manipulations of vegetation overstory to create best light conditions for economic production of matsutake.

Keywords: Fruiting bodies, light, mycelium, wild edible mushrooms, yield.

Nishida, Teruaki; Ishikawa, Tatsuyoshi. 1967b. Analysis of environmental factors in a Japanese red pine forest producing the fruit body of matsutake. III: Soil moisture conditions and soil respiration in the fungal zone of matsutake. Scien. Rep. Faculty Agric. 29. [Okayama, Japan]: Okayama University: 19-26. In Japanese with English summary.

Analyzes properties of soil containing mycelia of matsutake (*Tricholoma matsutake*) in a pine forest. Contrasts appeared between soil inside the fairy ring, on the ring, and outside the ring. Soil moisture holding capacity was lower within the fairy ring, creating an environment unsuitable for the growth of Japanese red pine (*Pinus densiflora*). The fairy ring zone has a high rate of soil respiration as evidenced by CO_2 levels in the soil. Levels of CO_2 fall off rapidly in the soil after the growth season for matsutake fruiting bodies.

Keywords: Wild edible mushrooms, soil conditions, Japan.

Noda, Hideshi. 1988. Policy relating to special forest products. In: Handa, R., ed. Forest policy in Japan. Tokyo: Nippon Ringyo Chosaku.

Outlines Japanese forest policy on special forest products. The author notes that their contribution to forest earnings has steadily increased over time, from 3 to 4 percent in 1960 to 13 percent in 1980. Much of that growth is due to the increasing demand for edible mushrooms, particularly shiitake (*Lentinus edodes*). Edible mushroom production is important as a stabilizing factor for rural household economies, particularly during periods when timber is in decline. The author ties the interest in shiitake production by the Japanese producer to the decline in charcoal demand, previously a major income source for mountain villagers. The author notes that shiitake cultivation also allowed rural dwellers to earn income from forests that had been cut to provide timber for reconstruction, but which had not yet reached maturity for additional cutting. The Japanese forest administration has recently begun to emphasize special forest product production as a means of offsetting loss of income during the recent recession.

The author also links the rise in mushroom demand to changes in eating habits after World War II. These changes included a shift toward nonstaples, including mushrooms; a trend toward eating out; and a shift toward processed and already-cooked foods. Prior to the 1950s, shiitake mushrooms were produced largely for export to China and Southeast Asia, and domestic demand was low. Supply was kept low due to the inefficiency of the predominant method of cultivation—the so-called scarring method. After World War II, the spawning method caught on, enabling production to expand. Most of the shiitake production was dried for export, and the trade was dominated by a few wholesalers.

During the 1960s and 1970s demand for shiitake and other edible mushrooms expanded in Japan. The growth of a domestic industry was facilitated by new transportation and refrigeration processes, which allowed fresh mushrooms to be marketed. Rising interest in natural foods also contributed to increased demand for edible mushrooms, and the growth of supermarkets provided a ready outlet. To meet the demand for standardized mushrooms, small-scale producers sold to wholesale auctions, where the products were graded. They also formed producer cooperatives to offset the monopoly of the traditional wholesalers. Export production continued to expand simultaneously, and the major markets remain Hong Kong, Singapore, and China.

The author concludes with a short review of government policy in the special forest product arena. Until the 1940s, government interest in special forest products focused mainly on bamboo, resin, and wax production. In 1947, however, a shiitake development program was begun, with support in the form of technical assistance. In the late 1950s and 1960s, a system of subsidies for shiitake production started as a way to help rural households diversify from charcoal dependence. In the late 1960s and 1970s, the government provided support for the formation of producer cooperatives. In 1978, the government established a Special Forest Products Office and, in 1979, issued basic guidelines for developing special forest products as government policy.

Keywords: Wild edible mushrooms, cultivated mushrooms, Japan, policy, economic history, producer cooperative, rural development.

Norton, H.H.; Hunn, E.S.; Martinsen, C.S. [and others]. 1984. Vegetable food products of the foraging economies of the Pacific Northwest. Ecology of Food and Nutrition. 14: 219-228.

Presents nutritional analyses of 27 species of plants native to the Pacific Northwest common in the diets of Native Americans before the arrival of Euro-Americans. All foods were found by foraging, because Native American societies in the Pacific Northwest did not practice crop agriculture. Berries along with salmon were the mainstay of the diet of people living east of the Cascade Range. Important berry species are salal (*Gaultheria shallon*), salmonberry (*Rubus spectabilis*), small cranberry (*Vaccinium oxycoccos*), elderberries (*Sambucus* spp.), currents (*Ribes* spp.), Saskatoon serviceberry (*Amelanchier alnifolia*), and 12 species of huckleberries (*Vaccinium* spp.). Important root species were camas (*Camassia* spp.), western brackenfern (*Pteridium aquilinum*), Pacific silverweed (*Argentina egedi*), Oregon bitterroot (*Lewisia rediviva*), *Lomatium* spp., *Fritillaria* spp., *Erythronium* spp., *Linum* spp., *Calochortus* spp., *Brodiaea* spp., and *Allium* spp. Native Americans also ate fresh stems and sprouts, especially in the early spring when stored food was scarcest.

Samples of the food plant species were collected during their traditional collection seasons, stored at 4 °C within 48 hours of collection, and analyzed within 72 hours of collection. Samples, whether roots or berries, were weighed to 3- to 5-g samples and then dried in an oven. For each sample, there was an analysis for protein, lipids, ash, carbohydrates, kilocalories, minerals, and ascorbic acid. Nutritive contents of the foods are as good or better than cultivated berries and fruits and such staples as potatoes and sweet potatoes.

Keywords: Foraging strategies, indigenous foods, wild edible plants, nutrition.

Norton, Helen H. 1979a. Evidence for western brackenfern as a food for aboriginal peoples of western Washington. Economic Botany. 33: 384-396.

Describes Native American uses of western brackenfern (*Pteridium aquilinum*).

Keywords: Ethnobotany, ferns, indigenous use, wild edible plants, Washington State.

Norton, Helen H. 1979b. The association between anthropogenic prairies and important food plants in western Washington. Northwest Anthropological Research Notes. 13: 175-200.

Describes the unique dietary function of prairies in western Washington created by Native Americans to provide a supply of carbohydrates and vegetable protein from western brackenfern (*Pteridium aquilinum*) and camas (*Camassia quamash*) and forage for deer. Burning, regular gathering, and tilling the soil by using digging sticks shaped the prairies. Sites were located in glacial outwash plains prone to drought where trees were scarce: a few Oregon white oaks (*Quercus garryana*) and pines (*Pinus ponderosa* and *P. contorta*), atypical of most forest land in the region, were the most common species. Evidence of Native American management is inferential rather than direct. All sites have archaeological remains and are located near salmon runs.

Keywords: Ferns, burning, camas, carbohydrate source, indigenous foods, prairies, protein, Washington State, wild edible plants.

Norvell, Lorelei; Kopecky, Frank; Lindgren, Jan; Roger, Judy. 1995. The chanterelle (*Cantharellus cibarius*)—a peek at productivity. In: Schnepf, Chris, ed. Dancing with an elephant: Proceedings of a conference and exposition about the business and science of special forest products; 27-26 January 1994; Hillsboro, OR. Pullman, WA: Washington State University Cooperative Extension. 117-128.

Gives details of an experiment ongoing since 1986 to study the productivity of golden chanterelles (*Cantharellus cibarius*) in a 100-year-old western hemlock/Douglas-fir stand in the Mount Hood National Forest. Increasing commercial harvest of chanterelles and other mushroom species in the Pacific Northwest has prompted concern that harvests may jeopardize the long-term productivity of fungi populations. Ten study plots of various sizes were established and subdivided in 4-m^2 subplots to cover a single mycelial population. Plots are sampled for chanterelles sporocarps every 2 weeks for the 5-month growing season. Treatments consist of four control plots, three plots where chanterelles > 1 cm in diameter are cut, and three plots where chanterelles > 1 cm in diameter are pulled. Average summer temperature appears to affect the production of chanterelle fruiting bodies. Micrometeorological effects may be very important but are costly to investigate. Weights can be estimated only for sporocarps from the control plots. There appears to be little correlation between harvesting (cutting vs. pulling) and productivity. Overall trends are not yet apparent. Observations suggest that coarse woody debris and canopy cover are important factors in sustaining chanterelle productivity and that conservatively managed forests produce more chanterelles than do old-growth areas.

Keywords: Wild edible mushrooms, experimental design, harvesting, Mount Hood, Oregon, conservation, monitoring.

Ogawa, Makoto. 1975. Microbial ecology of the mycorrhizal fungus *Tricholoma matsutake* Ito et Imai (Sing.) in pine forests. I: The fungal colony (shiro) of *Tricholoma matsutake*. Bull. 272. Tokyo: Government Forest Experiment Station. 121 p. In Japanese with English summary.

Ogawa, Makoto. 1977a. Microbial ecology of the mycorrhizal fungus *Tricholoma matsutake* Ito et Imai (Sing.) in pine forests. III: Fungal florae in shiro soil and on the mycorrhiza. Bull. 293. Tokyo: Government Forest Experiment Station. 170 p. In Japanese with English summary.

Ogawa, Makoto. 1977b. Microbial ecology of the mycorrhizal fungus *Tricholoma matsutake* Ito et Imai (Sing.) in pine forests. IV: The shiro of *Tricholoma matsutake* in the fungal community. Bull. 297. Tokyo: Government Forest Experiment Station. 104 p. In Japanese with English summary.

Ogawa, Makoto. 1979. Microbial ecology of the 'shiro' in *Tricholoma matsutake* Ito and its allied species. IX: *Tricholoma ponderosum* [= *Tricholoma magnivelare*] in *Pseudotsuga menziesii-Tsuga heterophylla* and *Pinus contorta* forests. Transactions of the Mycological Society of Japan. 20: 370-382. In Japanese with English summary.

Ogawa, Makoto; Ito, Takeshi; Kobayashi, Fujio; Fujita, Hiromi. 1980. On the primary stage in 'shiro' formation of *Tricholoma matsutake*. Transactions of the Mycological Society of Japan. 21: 505-512. In Japanese with English summary.

Ohenoja, Esteri. 1978. Mushrooms and mushroom yields in fertilized forests. Annales Botanici Fennici. 15: 38-46.

Reports on the effects of fertilizer treatments on the production of fungi sporocarps between 1973 and 1975. Mushrooms were collected weekly from July to October and dried, counted, and weighed at room temperature. At each of six sites, sample plots of 200 m^2 for six treatments were established. Treatments included a control, 400 kg/ha urea added in 1972 only, 400 kg/ha urea in 1974 only, 600 kg/ha Oulu saltpeter in 1972 only, 600 kg/ha Oulu saltpeter in 1974 only, and 600 kg/ha Oulu saltpeter plus 200 kg/ha crude phosphate in 1972 only. The small number of experimental plots, lack of comparable results, the short duration, and the multiple factors involved prevent determination of definitive results. Wide fluctuations in weather conditions occurred over the three summers of observations. Experimental results differ from results likely obtained from economic harvests because immature sporocarps were frequently picked. Different people were responsible for picking the mushrooms at different sites, thereby creating another source of discrepancies.

Fertilization with urea was somewhat useful for sites with lower natural productivity for mushrooms. Saltpeter seldom showed improvement in yields over controls, and combining saltpeter and urea together depressed yields. Yields from fertilized plots

usually decreased in subsequent years, and the fertilization effects were not evident for long. Species benefitting most from fertilization were not prime economic species. Effects of changes in species composition and interspecific competition were not studied.

Keywords: Experimental design, fertilization, urea, saltpeter, productivity, mushrooms.

Ohenoja, Esteri. 1984. Fruit body production of larger fungi in Finland. 1: Introduction to the study in 1976-1978. Annales Botanici Fennici. 21: 349-355.

Ohenoja, Esteri. 1988. Effect of forest management procedures on fungal fruit body production in Finland. Acta Botanica Fennici. 136: 81-84.

Discusses the influence of clearcutting, thinning, afforestation with exotic species, herbicides, fertilizers, and road construction on the species composition, fruit body biomass, and the function of fungi in forests and peatlands of Finland. Finnish forests are estimated to produce 1.5 million tonnes of fruit bodies per year from about 20 million ha of forest land. Clearcutting results in the appearance of the economically significant false morel (*Gyromitra esculenta*) but also in the disappearance of many other fungus species. The author reviews the results of four studies on clearcutting, plowing, and logging waste on mushroom diversity and production in forests in Finland and Sweden.

Keywords: Mushrooms, clearcutting, thinning, exotic species, herbicides, fertilizers, road construction, Finland, Sweden.

Ohenoja, Esteri; Koistinen, Riita. 1984. Fruit body production of larger fungi in Finland. 2: Edible fungi in northern Finland 1976-1978. Annales Botanici Fennici. 21: 357-366.

Okholm, Debra; Abriel, Ray. 1994. Directory of forest and conservation tree nurseries in the United States, 1994 edition. R6-CP-TP-0294. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region, State and Private Forestry, Cooperative Programs. 99 p.

Compiles a national directory of nurseries, their addresses, contacts, and telephone and FAX numbers as a reference for foresters, nursery professionals, natural resource managers, and other interested people in the lower 48 states, Hawaii, American Samoa, and Puerto Rico. Production and potential production data are given for each nursery for bareroot and container stock. This publication lists nurseries specializing in diverse planting projects involving species producing special forest products: blister rust-resistant western white pine (*Pinus monticola*), Pacific yew (*Taxus brevifolia*), riparian species, and native shrubs. The authors give guidelines for success in planting projects.

This book also reveals local or regional gaps in production and capacity for supplying special forest product plants, which are needed for restoration and reforestation projects.

Keywords: Directory, nurseries, United States.

Olivier, J.M.; Delmas, J. 1987. Vers la maîtrise des champignons comestibles= Towards the mastery of edible mushrooms. Biofutur. 61: 23-41. In French.

Describes the recent technological advances to expand the selection of edible mushroom species available for domesticated production. Mycorrhizal species such as truffles (*Tuber* spp.) and boletes (*Boletus* spp.) are difficult to grow under nonforest conditions. Saphrophytic mushrooms such as *Pleurotus* spp. are more easily domesticated with carefully formulated substrates under controlled growing conditions. Details of genetic incompatibilty, the reproductive cycle, and commercial characteristics of *Pleurotus* spp. are given. Successful efforts in France at introducing and cropping truffles and granulated slippery jacks (*Suillus granulatus*) are described. Managing harvests has been intensive thus far, involving inoculating trees, maintaining best soil pH, fertilizing, irrigating, weeding, and maintaining phytosanitary control. Research with other bolete species has started, but it is too soon for conclusive results. Steps are underway to coordinate production of commercial mycorrhizal species more efficiently. Details are given for French production of domesticated mushrooms in 1985. Worldwide research in medicinal products of mushroom species is described briefly.

Keywords: Wild edible mushrooms, domestication, cultivation, truffles, substrates, France.

Paal, Jaanus; Paal, Taimi. 1993. Estimation of cowberry (*Vaccinium vitis-idaea*) yields. Aquilo Ser. Bot. 31: 31-34.

Provides and compares methods for estimating lingonberry (*Vaccinium vitis-idaea*) yields to provide an accurate forecast of crops. Four methods are considered: random coordinates, nearest neighbor, wandering quarter, and random cross. Random coordinates was considered the most costly and laborious with respect to field materials required and plot sizes. The wandering quarter method tended to overestimate or underestimate yields as compared to the other models. The most economical, accurate, and therefore preferred method is the random cross method. With this method, four transects pass from a randomly chosen tree in the four cardinal directions until they encounter the next tree in the respective direction. Random distances to the right or left of the unequal transects are used to anchor sample subplots.

Keywords: Berries, yields, lingonberry, yield estimation methods, inventory methods.

Pacific Yew Technical Committee. 1992. An interim guide to the conservation and management of Pacific yew. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 72 p.

Describes the need for new management of Pacific yew (*Taxus brevifolia*). Recent and projected harvests of yew bark have changed the way society regards this species. Until taxol can be produced commercially in nurseries or laboratory synthesis, management must ensure that continued bark harvest does not deplete natural stands of large old yew trees and prevent natural regeneration. In 1991, about 57,000 trees were harvested to yield 28 kg of taxol. A general lack of information about population sizes, reproductive biology, genetic variation, mortality, and ecosystem function prevented insightful estimates of the impact of long-term

taxol production from wild stocks of Pacific yew. The Pacific Yew Technical Committee responded by issuing this dichotomous key to guide management of the yew resource given the multiple existing laws and regulations governing management of Federal forest lands. Fifty percent of each age class of yew trees is recommended for retention in the stand provided that at least 5 trees per acre from each age class remain. This rule is felt to uphold the ecosystem function of yew as thermal cover for northern spotted owls (*Strix occidentalis caurina*) and to maintain regeneration and gene flow of yew. Special caution is urged with managing to control *Phytophthera lateralis* infections in areas where yew and Port-Orford-cedar (*Chamaecyparis lawsoniana*) occur together. The planning period considered for the management guide is 100 years but focuses on the period 1992-96. A 90-percent probability is calculated for Pacific yew to survive for 100 years with the managerial policies advocated; this is believed to be a sufficiently cautious probability. Revision of the management guidelines will occur as basic research and a yew inventory are completed. Harvest of needles may change management in the future, should needles be found to yield productive quantities of taxol.

Keywords: Medicinal plants, taxol, management, conservation, Pacific Yew Technical Committee.

Pamela, H; Bawa, K. 1993. Methods to assess the impact of extraction of nontimber tropical forest products on plant populations. Economic Botany. 47(3): 234-247.

Panayotou, Theodore. 1991. Introduction: multiproduct forest management—a key to sustainability? In: Wegge, Per, ed. Status and potential of nontimber products in the sustainable development of tropical forests; Proceedings of the international seminar; 17 November 1990; Kamakura, Japan. ITTO Tech. Ser. 11. Yokohama: International Tropical Timber Organization: 3-7.

Provides an overview of the social and economic importance of nontimber products and discusses the neglect of these products in forest management. Principal reasons for neglect of nontimber forest products include lack of adequate economic and trade data, few established world markets, irregular product supply, a lack of product quality standards, economies of scale achieved by plantations, lack of processing and storage technology, inadequate marketing to potential markets, and low returns. Use of forest resources at local, national, and international levels must be simultaneously considered. Overlap of products and demand among the three levels occurs. Many nontimber goods are not traded in markets or their market activity is not documented. These facts lead to underestimation of their value. In India, 36 percent of the total revenue of the Forest Department in 1980-81 stemmed from nontimber forest products.

Local forests often serve as the only source of livelihood for rural people, and nontimber goods often are the basis for small-scale industries. Compared with timber crops, nontimber products require less investment, are labor intensive, and provide annual, albeit smaller, cash flows. Harvesting of products can be staggered throughout the year when climate conditions are favorable. Ecological disturbance from nontimber products is apt to be less disruptive to ecosystem processes.

Keywords: Economic value, barriers, rural development, ecological sustainability, India.

Panayotou, Theodore; Ashton, Peter. 1992. Not by timber alone: economics and ecology for sustaining tropical forests. Washington DC: Island Press 280 p.

Argues that multiple-use management for timber and nontimber products and services can both maximize economic growth and preserve a forest's value. The book describes the history of tropical forest exploitation, the rationale and implications of the undervaluation of tropical timber, and the limited, but important, examples of natural forest management. Nontimber products and environmental "services" provided by the forest are identified and evaluated. Finally, a multiuse management plan is described, which requires a full valuation of these products and services and serves as a mechanism for sustainable forest use. Chapter 6 describes the social and economic importance of nontimber products worldwide and provides a bibliography of over 60 references. The harvest and use of rattan (*Calamus* spp.) is profiled in a case study at the end of the chapter.

Keywords: Multiple use, tropical forests, environmental services, management, valuation, rattan.

Paré, Germain. 1982. Considérations économiques sur l'allocation des érablieres en forêt publique. I: Méthodologie pour determiner le seuil de rentabilité d'une érabliére exploitée pour la sève=Economic aspects of the allocation of maple stands in state forests. I: Methodology for determining the profitability threshold for a maple stand exploited for sap. Mémoire Service de la Recherche (Terres et Forêts) 82. Québec, PQ: Gouvernement du Québec, Ministère de l'Énergie et des Resources, Service de la Recherche (Terres et Forêts). 58 p. In French with English summary.

Presents a methodology for use by public land managers and private contractors to determine the threshold of profitability for production of maple sugar (*Acer saccharum*) sap from publicly owned forest stands. The method can also be adapted to operations on private lands. It permits the calculation of the minimum volume of syrup to achieve a given profit level (0, 5, 10, or 20 percent). Fixed and variable costs are identified as functions of site conditions, access, and production technology. Once the minimum sufficient quantity is determined, analysis focuses on whether the contractor can produce the desired quantity given the productivity of the site and the technical capacity. This publication also provides an explanation of the theory of modeling threshold points, an analysis of the financial operations of a maple sugar business under different scenarios, and examples of the method for calculating economic profitability.

This article provides a good basis to aid in the feasibility study of the establishment of syrup collection operations for bigleaf maple (*A. macrophyllum*) in the Pacific Northwest.

Keywords: Financial analysis, maple syrup production, profitability, technology, threshold point, variable costs, fixed costs.

Park, Myong Kyu. 1984. A study on the investment effectiveness of oak mushroom cultivation. Journal of the Korean Forestry Society. 63: 61-68. In Korean with English summary.

Examines production of shiitake (*Lentinus edodes*) mushrooms in rural Korea through financial analyses of labor activity and costs of materials. Production is hampered by the small scale of cultivation, lack of efficient technology, low labor productivity, and lack of consistent management. A cross section of shiitake cultivators serves as a sample. The sample population is divided into three categories depending on the amount of area each family has in shiitake cultivation. Production figures show that people with more than 500 m^2 of area in cultivation have a higher production rate of mushrooms per m^3 of bed logs. Person hours of labor and cost of materials are figured per kilogram of shiitake produced and per volume of bed logs. The financial rate of return averages 22.6 percent annually for areas greater than 500 m^2 but only 5.85 percent for plots less than 200 m^2. This article provides one useful methodology for studying activity costs, management efficiency, and net benefits of growing edible wild mushrooms in semidomesticated settings on public lands in the Pacific Northwest.

Keywords: Financial rate of return, investment effectiveness, cultivated mushrooms, economic analysis, scale, Korea.

Payne, Jerry A.; Coder, Kim D.; Horton, Dar L. [and others]. 1990. Neglected native fruit trees and shrubs. Annual Report of the Northern Nut Growers Association. 81: 78-92.

Describes native trees and shrubs in eastern North America that have been neglected for their potential as a food source. The authors emphasize additional functions of the species listed, such as landscape plants and wildlife habitat and forage. Native American and colonial American uses also are given. Genera having comparable species in the Pacific Northwest for potential or actual use are *Rhus, Sambucus, Vaccinium, Amelanchier, Crataegus,* and *Prunus*.

Keywords: Wild edible plants, horticultural plants, North America.

Peluso, Nancy Lee. 1992. The political ecology of extraction and extractive reserves in East Kalimantan, Indonesia. Development and Change. 23(4): 49-74.

Examines the political and social organization for harvesting and marketing rattan (*Calamus* spp.) in East Kalimantan to evaluate the appropriateness of extractive reserves in Indonesia. The author's analysis includes a brief discussion of the history of commercial and subsistence forest extraction in Indonesia. Such products historically were subject to locally enforced usufruct rules. These systems have been progressively replaced with state regulations imposed by a highly centralized government interested in large-scale, industrial exploitation of forest resources. Under state rule, the rattan trade has expanded to the point of risking resource depletion.

The author provides a detailed description of rattan management, including production methods, marketing organization, and local regulations. Rattan is normally a part-time activity that combines with other activities to contribute to peasant livelihoods. Customary rights over rattan differ, with some boundaries defended by force and others by negotiating the sale of rights. Kinship is a key factor in determining access and control over rattan sources. Extensive trade networks have long existed between villagers and riverboat or sedentary middlemen, who are the links

with the exporters and processing places. Harvesters traditionally had permanent links to particular middlemen, often in a debt-credit relation. Traders collude in setting prices, and often are themselves indebted to urban investors. Recently cash transactions between traders and harvesters have become more common, providing harvesters greater freedom but also placing greater pressure on the resource as new harvesters enter the market.

The harvester cooperative model, widely adopted in the Amazon, is problematic in Indonesia where cooperatives are controlled directly by the state. A more workable alternative would be to organize extractive reserves around villages, which already have a system of regulation and authority in place. To be workable, the structure of the reserves would have to allow for change as ecological and socioeconomic conditions change. Unless local people are provided political and economic capacity through control over forest resources, they will not be able to compete successfully with capital intensive firms. The chances are that, as in logging, contract laborers rather than villagers will be hired to harvest rattan, depriving villagers of both their means of subsistence and their means of earning an income.

Keywords: Political ecology, tropical rain forest, extractive reserve, trade networks, rattan, producers' cooperative, Indonesia, basketry, weaving.

Pernau, Winfried. 1990a. Der Markt für frische und verarbeitete Zuchtpilze in der Bundesrepublik Deutschland und der Europäischen Gemeinschaft im Jahre 1989=The market for commercially grown fresh and processed mushrooms in the Federal Republic of Germany and the European Union in 1989. Champignon. 352: 14-25. In German.

Reports on trade statistics for commercially grown mushrooms in the European Union (EU). Only China is a significant exporter to the EU. Major producers within the EU are France, Ireland, the Netherlands, and the United Kingdom. Exports from Ireland to the United Kingdom and from the Netherlands to Germany comprise the major activity among EU partner nations.

Keywords: Cultivated mushrooms, trade, European Union, China, France, Ireland, Netherlands, United Kingdom, Germany.

Pernau, Winfried. 1990b. Entwicklung des Marktes für frische und verarbeitete Pilze in der Bundesrepublik Deutschland im Jahre 1989= Market development for fresh and processed mushrooms in the Federal Republic of Germany in 1989. Champignon. 346: 4-7. In German.

Reports on the status of imports of commercially grown mushrooms to Germany in 1989. Germany remains the largest consumer of mushrooms per capita worldwide (3.5 kg per person annually). Consumption of fresh mushrooms amounted to 213 000 tonnes of which about 50 000 tonnes were produced in Germany. The demand for fresh mushrooms has increased, and German production has increased by 20 percent. The Netherlands, France, and Poland are the principal supplier nations with the supply from the Netherlands nearly quadrupling in recent years. The Netherlands also produces the major share of processed mushrooms; China, France, and Poland are other important suppliers.

Keywords: Cultivated mushrooms, imports, trade, Germany, Netherlands, China, France, Poland.

Peters, Charles M.; Gentry, Alwyn H.; Mendelsohn, Robert O. 1989. Valuation of an Amazonian rainforest. Nature. 339: 655-656.

Argues that traditional forest accounting measures have generally ignored the value of nonwood products and that, consequently, the value of leaving land forested has been grossly underestimated. In this landmark study, the authors analyze harvest strategies on a 1-ha plot along the Nanay River, 30 km southwest of Iquitos, Peru. Of the 275 species on the site, 72 species (26 percent) yielded products with a market value in Iquitos. These products included 11 kinds of edible fruit, one species producing latex (rubber), and 60 species producing commercial timber. The study indicates that the potential revenues from nonwood products significantly exceeds the revenues from timber harvesting or cattle. Their calculations indicated that if a sustainable timber harvesting program were linked with fruit and latex collection, the value of the products on 1 ha would be US$6,820. Of this, fruits and latex comprise more than 90 percent of the total value. The value of nonwood products would be even higher if medicinal plants and lianas were included. Forest conversion to a timber plantation would yield a net value of only US$3,184, and conversion to pasture would yield only US$2,960. The authors attribute the lack of interest in retaining forests to the existence of public policies that promote deforestation, rather than to the lack of value of the products themselves.

Keywords: Economic valuation, Amazon, Peru.

Phipps, D.L. 1951. Secret treasures in the forests. Salem, OR: Oregon State Board of Forestry. 47 p.

Pihlik, Ulve. 1993. Biomass and reserves of *Vaccinium vitis-idaea* in Estonia. Aquilo Ser. Bot. 31: 157-160.

Gives details about the system of inventorying and managing lingonberry (*Vaccinium vitis-idaea*) for production of berries, ramets, and leaves in Estonia. The latter two uses are for medicinal purposes. Tree stands less than 20 years old have a very small and noneconomic biomass of ramets as the result of logging and replanting operations. Between years 20 and 35, biomass of ramets increases and then falls off after year 35 because of worsening light conditions in the understory. Different harvest intensities of ramets show that annual harvesting decreases standing stocks permanently. Full restoration of productivity for lingonberry after gathering material for medical use takes 6 to 7 years in most forest habitats found in Estonia.

Forecasts of ramet biomass make use of regression equations tied to forest types. Economically exploitable ramet reserves of lingonberry equal about 19 600 tonnes but only about 12 percent of that amount actually is gathered. The main use of lingonberry remains as a wild berry food. Estonian forest districts are divided into five categories by their suitability for berry picking and gathering medicinal material.

This article documents a program of studies designed to determine the sustainable use and harvest level of a multiuse nontimber forest species of economic significance.

Keywords: Harvest reserves, berries, medicinal plant, ramets, regeneration, survey, management, harvest, research agendas, Estonia.

Pinedo-Vasquez, Manuel; Zarin, Daniel; Jipp, Peter; Chots-Inuma, J. 1990. Use-values of tree species in a communal forest reserve in northeast Peru. Conservation Biology. 4(4): 405-416.

Examines the nontimber “use values,” defined as the relative utility of species to the local population, of trees in a communal reserve in the Amazon of northeastern Peru. The study was conducted in a 50-year-old secondary stand in a communal forest reserve that was established by the villagers of San Rafael. Although lacking legal status, reserve management was governed by rules for the reserve by residents and nonresidents that described appropriate reserve uses and harvesting techniques. Residents of San Rafael used 60.1 percent of the 218 tree species for food, construction, craft, remedy, commerce, and other uses. Unlike timber harvesting, which generally benefits urban elites and a small fraction of rural elites, nontimber forest products yield a wide array of benefits to rural residents. Communal reserves are suggested as an important method for the local promotion and protection of forests.

Keywords: Use value, communal reserve, Amazon, Peru, equity, rural development, conservation.

Pinkerton, Evelyn W. 1992. Translating legal rights into management practice: overcoming barriers to the exercise of co-management. Human Organization. 51(4): 330-341.

Addresses the conditions under which successful sustainable self-management and comanagement of resources can occur, with a focus on recognition of legal rights and negotiation of agreements and their implementation. The author cites the landmark case U.S. v. Washington in its first (1974) and second (1980) phases to explore the stages and successful strategies employed in translating rights into comanagement practice. The article concludes with six theories about the necessary conditions for comanagement that address the barriers to implementing comanagement and strategies for overcoming them.

Keywords: Comanagement, barriers, Washington.

Piot, J. 1983. La culture du shiitaké japonais, champignon lignivore de grande qualité=The culture of the Japanese shiitake, a high-quality saprophytic mushroom. Revue Forestière Française. 35: 53-64. In French.

Describes the details of shiitake (*Lentinus edodes*) culture and research in Japan. National production figures for shiitake are given for 1936, 1953, 1975, and 1979. The experimental research station in Miyazaki, Kyushu, has dedicated a unit to

study shiitake mushroom ecology and production. The demand of the Japanese public for shiitake has become very high on account of its nutritional and medicinal properties. Cultivation began widely in 1948. Oaks (*Quercus* spp.) and hornbeam (*Carpinus* spp.) furnish most of the inoculant logs. Growers must control humidity and populations of other competing fungi species. Characteristics and management guidelines for popular fresh and dried shiitake varieties are provided.

This article prompts an inquiry into possibilities for developing the market for new species of fungi and the technology for culturing them in the Pacific Northwest on logs of native tree species.

Keywords: Japan, research, mushroom culture, cultivated mushrooms.

Plotkin, Mark; Famolare, Lisa. eds. 1992. Sustainable harvest and marketing of rain forest products. Washington, DC: Island Press. 334 p.

Addresses some of the key issues associated with the sustainable use and marketing of rain forest products. This edited volume consists of case study efforts to develop sustainable strategies for tropical forest management. The examples address various approaches, including more traditional ethnobotanical attempts to catalogue the properties of various products, the formation of extractive reserves, the development of joint ventures between drug companies and traditional healers, and the creation of new international markets for rain forest products. Key themes that emerge are the importance of ethics, the need to develop appropriate mechanisms for compensating indigenous peoples for their knowledge of the medicinal properties of plants, the need for new forms of partnerships among local people, private corporations, nongovernmental organizations, and governmental agencies and the need for local participation in decisionmaking and marketing efforts. Building local economic and political capacity through strengthening local control over resources, training and education, and linking forest users to marketing channels also are important.

Keywords: Tropical rain forest, partnerships, intellectual property rights, indigenous knowledge, local participation, capacity building.

Pojar, Jim; MacKinnon, Andy, comps., eds. 1994. Plants of the Pacific Northwest coast: Washington, Oregon, British Columbia, and Alaska. Redmond, WA: Lone Pine Publishing Co. 527 p.

Highlights findings of ethnobotanical research in the Pacific Northwest with particular emphasis on the role of wild plants as food; as raw materials for baskets, hats, clothing, cordage, toweling, fishing lures, and so forth; and as sources of indigenous medicines. Details of traditional and modern uses of plants are described in notes accompanying the botanical and habitat descriptions and photographs of prominent species found in the coastal zone of southeast Alaska south to central Oregon.

Keywords: Botanical guide, economic botany, indigenous foods, medicinal plants, wild edible plants, basketry, weaving, ethnobotany, Oregon, Washington, British Columbia, Alaska.

Prescott-Allen, Christine; Prescott-Allen, Robert. 1986. The first resource: wild species in the North American economy. New Haven, CT: Yale University Press. 529 p.

Details the historical and current harvests of cascara (*Frangula purshiana*) in the Pacific Northwest. Collecting begins in mid-April and extends to late August. Yield ranges from 5 lb per 3-in diameter tree to 175 pounds for a 17-in diameter tree. Harvesting is often excessive and destroys the tree. Daily yields per harvester range from 100 to 300 lb. Dried bark, which is aged for a year before being used as a laxative, commands a higher price. Cascara is found in nearly 200 products sold in Canada, including veterinary products.

Keywords: Medicinal plants, harvesting methods, laxatives, processing, Canada, Pacific Northwest.

Principe, Peter P. 1991. Valuing the biodiversity of medicinal plants. In: Akerele, Olayinola; Heywood, Vernon; Synge, Hugh, eds. The conservation of medicinal plants: Proceedings of an international consultation; 21-27 March 1988; Chiang Mai, Thailand. Cambridge, United Kingdom: Cambridge University Press: 79-124.

Presents an economic analysis to value the contribution to society from medicinal plants. Lack of comparable, high-quality data hamper analysis. Data exist for pharmaceutical markets, production of some raw materials, and pharmaceutical products derived from medicinal plants. The market value of medicinal plants is a subset of their total economic benefit to society. Use of market values alone can be misleading. Ignoring or undervaluing benefits that are not easily quantified is a common problem. Also, the great difference between the raw material price and the final product price is the result of high development and manufacturing costs. Final market price is a better indicator of market value than the market price of the raw material.

Germany, Japan, and the United States are major importers of medicinal plants for pharmaceutical use. The author estimates total value of prescriptions, derived from 40 species, in the United States in 1980 at US$8-9.8 billion. Plant-based pharmaceuticals represent 12 to 15 percent of the total Japanese pharmaceutical market, 25 percent of the U.S. market, and 35 to 40 percent of the German market. The probability of a given plant species producing a marketable prescription drug is set at 1:1000 to 1:10,000. At the present rate of plant extinctions worldwide, 60 species capable of producing marketable drugs will be extinct by 2050. The methods, considerations, and assumptions to determine benefits foregone as a result of cumulative extinctions are discussed. Another way to value current worth of medicinal plants to society is the cost to society of a disease. Exact determination of the value of recovery of lost life, cost of treatment, and lost labor productivity is difficult to ascertain.

Irreversibility of extinction reduces options for society. Cost of extinction is best assessed with willingness-to-accept compensation for loss of the resource rather than willingness-to-pay to have the resource in the future. The net economic benefit of preservation of biological diversity to society must include a positive option value, because biodiversity has an uncertain future supply. Concludes with

a valuation equation that includes consuer surplus, option and existence values, and net product revenues.

Keywords: Medicinal plants, economic value, United States, Germany, Japan, foregone benefits, willingness-to-pay, willingness-to-accept, consumer surplus, option value, existence value.

Raatikainen, Mikko; Raatikainen, Terttu. 1983. Mustikan sato, poiminta ja markkinoint: Pihtiputaalla=The berry yield, picking, and marketing of *Vaccinium myrtillus* in the commune of Pihtipudas. Silva Fennica. 17(2): 113-123. In Finnish with English summary.

Reports on whortleberry (*Vaccinium myrtillus*) yields and berry pickers in northern Finland in 1977. Total yield was estimated from yields obtained from 17 randomly selected transects each 1 km long. Local crops averaged 21.9 kg/ha. Yields by forest type also are given. Human consumption of the wild crop was estimated to be 1.8 percent. Adult women comprised more than half the number of pickers. Most whortleberries were picked for home use (72 percent). Average family income from the sale of whortleberries amounted to Fimr178, with a maximum income recorded at Fimr712.

Keywords: Berries, yield, experimental design, survey.

Raatikainen, Mikko; Rossi, Esko; Huovinen, Jarvo [and others]. 1984. The yields of the edible wild berries in central Finland. Silva Fennica. 18(3): 199-219.

Develops regression equations for calculating yields of lingonberry (*Vaccinium vitis-idaea*) and whortleberry (*V. myrtillus*) from data about ecological conditions of forest sites. Lingonberry coverage depended on vegetation type, stand age class, crown density, and the method and amount of coppice control. Best yields were on *Vaccinium* and *Calluna* (heather) vegetation types. Fruit yield was a function of vegetation type, amount of lingonberry cover, height of lingonberry shrubs, stand age class, crown density, and weather conditions. From 13 to 20 1-km by 1-m sample strips in five counties throughout central Finland, the national lingonberry yield was estimated to be 180 million kg, 80 percent of which was accessible to pickers.

Whortleberry cover was a function of vegetation type, stand age class, tree crown density, the method and degree of coppice control, and weather conditions. Yield of whortleberries was highest on *Vaccinium* heaths. Berry yield was a function of vegetation type, the dominant tree species, stand age class, tree crown density, height of whortleberry shrubs, and weather conditions. The national yield was estimated at 150 to 200 million kg, of which 60 percent was accessible to pickers.

Average per hectare yields in the samples also are given for lingonberry (*Vaccinium vitis-idaea*), whortleberry (*V. myrtillus*), bog blueberry (*V. uliginosum*), small cranberry (*V. oxycoccos*), crowberry (*Empetrum* spp.), red raspberry (*Rubus idaeus*), cloudberry (*R. chamaemorus*), and thornless blackberry (*R. saxatilis*).

Keywords: Yield estimate, berries, Finland.

Rau, R. 1969. Absatzförderung für Waldgrün durch überbetriebliche Zusammenarbeit = Promoting markets for decorative green through sectoral cooperation. Forstarchiv. 40(9): 193-198. In German with English summary.

Traces the growth of the infrastructure to supply forest boughs to wholesale flower markets in North Rhein-Westphalia. People traditionally have taken the right to gather forest boughs for granted and have been thought to be unreceptive to efforts to sell foliage of local conifer species. The demand for forest greenery has grown steadily in recent years. However, the forest industry has not bothered to diversify; people have not considered the benefits of investing in product quality and in appropriate preparing, sorting, pricing, market research, and advertising. The benefit-cost ratio for state forests for minor forest products (including Christmas trees, which comprise about 23 percent of the total) in North Rhein-Westphalia is estimated to be 64:1. Market tests for conifer greens in 1967 indicated strong consumer demand, but individual suppliers were not initially capable of supplying products regularly. Demand for introduced species such as American red oak (*Quercus rubra*) and Austrian pine (*Pinus nigra*) has also grown. Imports also are increasing because the quality of German conifer greens often is not constant and marketing is difficult. Wholesale quantities are possible only where landowners have started systematic large-scale plantations. Florist shops, nurseries, wholesale flower markets, and most recently, shopping centers provide increasing outlets for greenery. Market development has been hindered by the lack of a visible commercial center, consistent definitions of product grades, and comparable prices. The Rhineland Decorative Greens' Growers Association has been formed to give greenery products a market image and assist individual producers in supplying markets efficiently.

This article indicates that cooperative marketing strategies are extremely important when new industry sectors involving nontimber forest products are first developing.

Keywords: Cost-benefit analysis, conifer greens, market development, barriers, Rhineland Decorative Greens' Growers Association, promotion, quality control, Germany.

Rau, R. 1977. Erfahrungen beim Absatz von Waldgrün und Weihnachtsbäumen= Experience with sales of decorative greens and Christmas trees. Allgemeine Forstzeitung. 32(46): 1139-1142. In German.

Describes the current scope of forest greens production in North Rhein-Westphalia and evaluates the feasibility of efforts to market forest greens in the state. The lack of price information, details of costs of production methods and time, and data about revenues and income make analysis difficult. Since 1968, the Rheinland Decorative Greens Growers' Association has sponsored research and gathered additional information on sales of decorative greens. Average household consumption of greens in North Rhein-Westphalia amounts to 5 kg annually, and total sales equal DM16.1 million. Maximum potential share of the total forest production by forest greens and Christmas trees is about 10 percent; the actual share is considerably less.

The different measures and words in use to sort and grade decorative greens cause confusion. Expanding the decorative greens industry will require uniform terminology and measurements in the German marketplace. Care in sorting is

essential to market product quality, and maintaining product freshness is important to attract customers. Market structure is not well described for the industry as yet. Economic relations among producers, wholesalers, retailers, and end consumers are diverse and complex. Auctions, wholesalers, and producer markets distribute decorative greens to retail outlets such as florist shops, nurseries, and garden centers. Selling decorative greens can involve bough pruning, sorting, bunching, storing, trimming, and arranging. Each step adds value and entails additional labor and risk. The growers' association centralizes members' products for distribution to wholesalers and retailers.

The funeral industry provides stability to the decorative greens industry because product is demanded throughout the year. The Christmas season is crucial but short in duration. New markets need to be developed to expand the industry. A more comprehensive product array including flowers, fruits, and colorful leaves of deciduous trees (in combination with conifer greens) offers opportunities for expansion.

Keywords: Conifer greens, floral greens, value-added, marketing, seasonality, market development, funeral industry, Germany.

Reagan, A.B. 1935. Plants used by the Hoh and Quileute Indians. Transactions of the Kansas Academy of Science. 37: 55-70.

Describes the uses (with a focus on medicinal uses) of more than 60 species of plants by the Hoh and Quileute Indians from observations by the author between 1905 and 1909 and in 1928.

Keywords: Ethnobotany, medicinal plants, Hoh, Quileute.

Redford, Kent H.; Padoch, Christine, eds. 1992. Conservation of neotropical forests: working from traditional resource use. New York: Columbia University Press. 433 p.

Brings together a series of articles describing the importance of incorporating local resource knowledge into strategies for managing neotropical forests. This book is one of the "classics" of the neotropical forest products literature. It provides details on the new kinds of social institutions being created to address the issue of sustainable forest management in the neotropical forest context. This collection of essays stems from a workshop commissioned by the U.S. Man and the Biosphere program, which sought to increase information on how traditional societies manage forest resources. The articles address gaps in existing knowledge, an analysis of current efforts to incorporate local people into natural resource use and conservation decisionmaking processes, and clarification of what is meant by the terms "traditional," "management," and "traditional management."

The editors note that the argument for greater involvement by local populations in natural resource decisionmaking stems from the gap that exists between production systems oriented toward large-scale markets and production systems oriented toward subsistence needs.

Subsistence production may address long-term sustainability questions better than the former, because the survival of the resource users and their children depends on taking a long-term perspective. The articles illustrate, however, that the validity of this assumption depends on circumstances: traditional peoples exhibit a wide-range of diversity of resource use patterns and ability to adjust to rapidly changing socioeconomic contexts.

Key themes raised by contributors to this volume include:

1. By linking indigenous societies to the outside world, ethnobotanists have incurred an obligation to local peoples to ensure that they receive compensation for their knowledge and the opportunity to participate in planning and implementation of management programs. International agreements are suggested to ensure that indigenous peoples are justly compensated for their knowledge.

2. Indigenous resource management approaches are dynamic and have had a much greater influence on the structure of the current forest than previously thought. Much rain forest biodiversity is a result of deliberate anthropogenic disturbance. Maintaining biodiversity thus may depend on maintaining cultural diversity. Several examples of recent efforts to simultaneously maintain biodiversity and cultural diversity, including the Binational Awa Biosphere Reserve in Columbia and Ecuador, are discussed.

3. Forest extraction strategies can provide a basis for sustainable forest management under certain conditions. On Combu Island in Brazil, for example, inhabitants are able to engage in extraction year-round and also are able to make a fairly high income from several complementary extractive activities. Easy access to markets and product diversification seem to be key factors in the success of the Combu Islanders.

4. The development of appropriate social institutions is critical to the development of approaches that mesh both conservation and economic development objectives. New forms of collaboration between local peoples, nongovernment organizations, governments, multilateral and bilateral aid organizations, and business corporations can help achieve these goals. Examples cited included the Maya Biosphere Reserve (Guatemala), the Rio Bravo Conservation and Management Area (Belize), the Beni Biosphere Reserve (Bolivia), the Chimane Conservation Program, the Cuyabeno Wildlife Production Reserve (Ecuador), and the Wildlands and Human Needs Program (a multinational effort jointly funded by the U.S. Agency for International Development and the Worldwide Fund for Nature).

5. Larger economic and political forces often conflict with local resource management strategies. To address the political and economic inequities that characterize societies in neotropical countries, political reforms that strengthen local control over resources, such as extractive reserves, may be necessary.

6. In some cases, forest extraction provides better returns in the long-run to peasant producers than conversion of the forest to agriculture or pasture. Current systems of accounting tend, however, to undervalue the contribution of extractive activities to household and national economies. Better methods for assessing the value of extractive activities are called for.

7. Market expansion for nontimber forest products can provide incentives for local people to refrain from clearing forests, but ensuring that local people benefit from

market expansion, is problematic. One approach currently being tested by the indigenous rights organization, Cultural Survival, is to have nongovernment organizations function as knowledge and power brokers between indigenous groups and business corporations.

Keywords: Tropical rain forest, market expansion, partnerships, land tenure, extractive reserves, indigenous knowledge, Cultural Survival.

Redhead, S.A. 1989. A biogeographical overview of the Canadian mushroom flora. Canadian Journal of Botany. 67: 3003-3062.

Reid, Walter V.; Laird, Sarah A.; Gámez, Rodrigo [and others]. 1993. A new lease on life. In: Reid, Walter V.; Laird, Sarah A.; Meyer, Carrie A. [and others]. [Title unknown]. Washington, DC: World Resources Institute: 1-35. Chapter 1.

Discusses “biodiversity prospecting,” the systematic research of biological diversity for commercially valuable genetic and biochemical resources. The authors suggest methods for returning part of the benefits accruing to private pharmaceutical corporations to the country or region where the drug or its precursors originated as a means to finance resource conservation. Formal legislation to govern biodiversity prospecting does not exist at present, however, and the need for appropriate policies and institutions is acute. New institutional arrangements including genetic and biotic resource property rights, international agreements, and intermediary organizations are proposed to reduce risk to landowners and provide continuing supplies to pharmaceutical firms.

The authors suggest general principles to guide biodiversity prospecting. Developing countries will reap benefits most quickly by restricting resource access, insisting on contractual agreements with collectors and corporations, and funding local value-added industries. The Costa Rica government agency INBio, for example, provides services of sample identification and supplies of uniform quality to firms. Indigenous people and traditional healers should seek protection of their knowledge through intellectual property rights legislation that guarantees equitable compensation. Landowners should be able to charge “user fees” to biodiversity prospectors and scientists who benefit from the ecosystems in which they work. Developing countries and regions should establish technology policies that generate benefits directly from genetic and biochemical resources.

This article speaks from the perspective of tropical ecosystems and countries; however, many of the issues, such as investing in biodiversity, indigenous knowledge, and studies to investigate native plant resources, pertain to management of nontimber forest products in the Pacific Northwest. Of specific concern is how to invest in ecosystems so that their diversity is maintained as a hedge against loss of resources that in the future may be of immense value to humanity.

Keywords: Biodiversity prospecting, indigenous knowledge, property rights, drug screening, rural development, InBio, Costa Rica.

Richards, Michael. 1993. The potential of nontimber forest products in sustainable natural forest management in Amazonia. Commonwealth Forestry Review. 72(1): 21-27.

Explores the assumption advanced by many sustainable forest management proponents that the commercialization of nontimber forest products will promote forest conservation. The author notes that foresters operating on this assumption have been quick to promote market development but may not have adequately thought out the consequences of success. The consequences of the commercialization of five products, rubber (*Hevea brasiliensis*), brazil nuts (*Bertholletia excelsa*), babaçu palm (*Attalea* spp.), varzea palm, and rosewood oil (*Aniba* spp.) are summarized to illustrate some of the potential pitfalls of an uncritical use of the extractive nontimber forest product reserve system.

In the case of rubber, the author questions the long-term economic viability of wild rubber reserves because the demand for wild rubber has declined rapidly as cultivated stands have come into production.

In the area where Brazil nut harvesting predominates, local brazil nut barons control access to the groves. Brazil nut tree cultivation may potentially reduce the demand for wild nuts in the future.

The babaçu palm once was a major export crop but the market fell apart with the introduction of synthetic detergents and the shift to less fatty oils. In the 1970s, when the export trade was increasing steadily, babaçu harvesting and processing tended to shift from women to men as new technology permitted whole fruit marketing and centralized processing.

The varzea palm industry also has had a boom-and-bust history. Destructive harvesting techniques, attributable largely to the use of piece rate labor, resulted in the destruction of large stands of these palms.

Rosewood oil is a high-value, low-volume product amenable to local production. Regeneration of the plant is very slow, though, and it has been essentially mined rather than harvested for renewal.

The author notes that nontimber forest product resources are subject to depletion when the market is booming as people seek quick profits and when the market crashes as people seek to maintain their living standards. Some resources are more subject to destructive harvesting and are unlikely to be sustainably harvested by commercial interests. The faith in nontimber forest product-based forest management as a panacea to forest degradation is likely to be misplaced. Key obstacles include unstable demand, inconsistent supply, limited economic potential compared to alternative income opportunities, volatile export markets, preference among harvesters for other occupations, and the need for knowledge and land for full-time product extraction.

The author also offers several reasons why a nontimber forest product focus can be beneficial: in general, harvesting practices can be nondestructive, many local people have the necessary knowledge, and extractive reserves can provide a tenure system promoting sound social and biological values. The author also recommends that the extractive reserve system be used in conjunction with farming and timber harvesting to ensure adequate and consistent income to rural

people. He further notes that unless cooperative production, marketing, and processing systems are developed, middlemen are likely to capture the bulk of the value of these products. Alternative marketing structures and the development of brand names are two strategies that have been suggested for increasing local share in product value.

The author argues that if nontimber forest product extraction is left to market forces alone, the result will be forest destruction. The author suggests the payment of subsidies to support sustainable extraction in the face of uncertain and volatile markets. He maintains that for extraction to succeed as a strategy, extractor groups will need to diversify the products that they harvest and sell.

Keywords: Tropical rain forests, extractive reserves, sustainable management, market expansion, land tenure, rural development, conservation, Amazon, Brazil, nuts, essential oils, resins.

Richards, Rebecca; Creasy, Max. [In press]. Cultural diversity and ecological sustainability: wild mushrooms harvest practices, environmental attitudes and cultural values among different ethnic gatherers on the Klamath National Forest. Society and Natural Resources.

Characterizes the ethnic groups, their harvest experience, and cultural patterns of harvest among American matsutake (*Tricholoma magnivelare*) pickers in the Klamath region of southern Oregon and northern California. Results of picker surveys, interviews with resource managers, and statistical analyses of permits in the Happy Camp Ranger District, Klamath National Forest, and the Illinois Valley Ranger District, Siskiyou National Forest, in 1992 are presented. Nearly 2,000 permits were issued by the two districts combined.

Conflicts arise because of differences between urban-based nonlocal pickers of Southeast Asian origin and rural, local Native American pickers. Most Asian pickers were Laotians. The intensity of commercial harvests has raised concern for the sustainability of the resource. Although most Forest Service personnel believed that the pickers had several years picking experience, more than half the pickers were picking for the first season. Daily harvests amounted to less than a pound per day. Estimates of annual per capita harvests are extrapolated. About 50,000 lb of matsutake are estimated to be picked from both Ranger Districts. Commercial collection aiming to maximize the resource harvest may be threatening the viability of locally directed harvests at traditional family gathering sites. The authors recommend that permits for mushroom collection be automated and tracked, compliance with permit regulations be enforced, and additional studies be undertaken to clarify the interactions among the permitting process, market dynamics, and picker demand for the matsutake resource. Management should ensure fair and equal access while attempting to preserve traditional claims. Current Forest Service policy to downsize staff and funding based on reduced timber sales decreases the likelihood that there will be adequate investment to ensure a sustainable harvest.

Keywords: Cultural diversity, ecosystem management, human ecology, Klamath bioregion, sustainability, resource conflicts, Southeast Asian, Native American, wild edible mushrooms.

Rizza, Alberto. 1990. Legislazione regionale italiana in materia di raccolta e commercializzazione dei tartufi=Regional Italian legislation regarding truffle harvesting and commercialization. In: Bencivenga, Mattia; Granetti, Bruno, eds. Atti del II congresso internazionale sul tartufo; 24-27 November 1988; Spoleto, Italy. Spoleto: Comunità montana dei monti Martani e del Serano: 605-609. In Italian.

Describes developments in legislation following the 1985 law that instituted norms for the cultivation, harvesting, and marketing of fresh and canned truffles by Italian provinces. This law was intended to temper the conflicts between truffle collectors and landowners. The law distinguishes for the first time between truffle areas under cultivation and areas where truffles grow wild, which are open to the public for truffle gathering. Provincial laws are not coordinated to specify proper foraging tools and set fines for illicit collection. Many provinces have neglected to enact any legislation. This article briefly describes the difficulty of enacting a coordinated management policy for a nontimber forest resource across diverse land-use types. Policymakers in the Pacific Northwest currently are facing similar challenges.

Keywords: Truffles, resource conflicts, regulation, Italy.

Robbins, S.R.J.; Matthews, W.S.A. 1974. The importance of minor forest products. Unasylva. 26(106): 7-14.

Outlines the overall importance of nontimber forest products in the international literature. The definition itself is problematic, as minor forest products can include tree products, other plant and shrub products, and even crops grown within forests. Interestingly, the authors exclude rubber (*Hevea brasiliensis*) because it is of major economic importance. Their reasoning for categorizing various products as major or minor forest products is thus based on the product's relative economic contribution.

Harvesting of minor forest products in temperate forests tends to be more organized than that in tropical forests, and the value of temperate forest products tends to be greater. In tropical forests, harvesting tends to be done by local communities rather than outside entrepreneurs. Where high-value minor forest products are present, agricultural conversion rates are lower. The large variation in prices and markets for minor forest products means that each product has to be considered separately in any plan to develop them for wider economic use. Development of certain minor forest products is likely to be inhibited by low commodity prices and the possibility of synthetic production of biochemicals.

The authors provide summaries of the economic importance of a variety of minor forest products, including naval stores, oils, latexes, and spices. They conclude that very little is known about the contribution of these products to the overall forest economy and recommend additional research.

Keywords: Market potential, international policy, tropical forests, temperate forests, minor forest products, naval stores, essential oils, latex, spices.

Robertson, R.A. 1993. Peat, horticulture and environment. Biodiversity and Conservation. 2: 541-547.

Provides an industry view of the impact of the United Kingdom (UK) peat industry on the UK's peatland resources from the perspective of the UK Peat Producers Association. The UK peat industry is aimed primarily at the horticultural sector, and peat extraction occurs on only 5400 ha, or about 0.5 percent of the area in peatlands. The majority of peatlands are either devoted to forestry or set aside as conservation areas. Most of the area under horticultural production has been worked for generations, and more than 98 percent of horticultural peat holdings are either leased or owned by members of the Peat Producers Association. Demand for peat is high, and the industry can meet only two-thirds of the UK's horticultural peat needs.

Disagreement over the impact of horticultural peat production exists between conservationists and industry. Nonetheless, the industry has recently signed voluntary agreements with the Royal Society for Nature Conservation to refrain from harvesting on sites of special scientific interest and on previously worked areas of high conservation value. Of the 5471 ha held by association members, less than 6 percent are of conservation value. The association currently is working with conservation groups and government agencies to develop a strategy that would allow both development of certain peat areas and conservation of others. This effort is modeled after similar agreements in Ireland and Finland.

At the same time, association members are seeking alternatives to peat as a growing medium. Among the alternatives are other forest products, including bark, mushroom compost, and wood products. The author notes, however, that no other medium currently outperforms peat for exacting uses, thus making it likely that the demand for peat will remain high. To help address this demand, association members have joined forces with local conservation groups and government agencies to restore cutover areas.

The author concludes that peat production is important as a generator of local employment and helps shift the balance of payments in a positive direction for the UK. In addition, he notes that recent efforts on the part of the association to conserve and restore peatlands illustrate that it is possible to maintain both ecological and economic values while producing peat.

Keywords: Peat production, partnerships, rural development, conservation, United Kingdom.

Robinson, Christina M. 1994. Multiple perspectives: rules governing special forest product management in coastal Washington. [Seattle]: University of Washington. M.S. thesis.

Examines the formal and informal rules that govern access to special forest products in coastal Washington. The author compares the differences and similarities between landowners' and harvesters' perceptions of regulations and the reasons for the enactment of the regulations. The authors' analyses are based on information gathered from participant observation at a number of public and private discussions of special forest product policy and from open-ended interviews with 28 individuals involved in special forest product harvesting or management.

Interviewees included tribal members, pickers, buyers, state and Federal land managers, and large industrial timberland managers.

A chart of the rules as described by landowners indicates that considerable variation exists in terms of the costs and conditions of access to special forest products. Rules differ not only by landowner or manager but also, for state and Federal agencies, by administrative unit. Permits and short-term leases were the most common means of regulating access to resources. Most leases are for specific products and thus do not preclude others from having rights to access other products. Gates across roads and posting of land are two additional mechanisms used to control access to special forest products.

Conflict over rights of access to special forest products occurs among several groups and over various issues. Tribal members noted that private landowners frequently deprive them of their treaty rights to traditional gathering grounds. Tribal members also noted that actions by private and public industrial timber managers, such as logging and weed control, often have a negative effect on gathering grounds. Another source of conflict is the relatively recent phenomenon of landowners actually enforcing their claims to these resources. Over the years, such enforcement has been lax and informal claims have developed among long-term pickers. The inability of landowners to enforce rules also is a source of conflict: a number of pickers complained of competition from illegal harvesters.

Landowners' reasons for imposing rules on special forest product harvesting fell into five major categories: (1) to exert claims over their holding, (2) to follow administrative rules imposed by state and Federal agencies, (3) to ensure maintenance of the resource, (4) to obtain revenues, and (5) to meet public needs. Pickers and buyers expressed an understanding of these motivations, but noted that in their opinion, landowners often were not really concerned about the resource itself. In addition, the data indicated that pickers and buyers expressed confusion as to why rules had recently been changed, and sometimes seemed to be unfamiliar with what the "official" rules were.

Most landowners felt that the rules currently being applied would have little effect on pickers' ability to make a living. In contrast, many pickers felt that the trend to ever more costly permits and leases would force many pickers out of business or into picking illegally to avoid high upfront fees. They also noted that the practice of putting gates across access roads to land, which has become increasingly common, has effectively shut pickers out of some of the most productive grounds.

Keywords: Resource management regimes, land tenure, tenure arrangements, resource conflicts, Washington, policy development.

Rogers, Ken E. 1989. Shiitake mushrooms: a forest product from woods to supper table. TFNews. 68(1): 10-13.

Discusses the potential for shiitake (*Lentinus edodes*) cultivation in hardwood forests of east Texas. Notes that shiitake cultivation uses small-diameter trees, which are common over millions of acres in eastern and central Texas. Both oak (*Quercus* spp.) and pecan (*Carya illinoisensis*) are suitable. Shiitake has been a

major agricultural export from Japan for decades. About US$15 million of shiitakes were imported from Japan in 1984. As demand has risen, shiitake production in the United States also has gone up. Most of the U.S. crop comes from Minnesota, Virginia, Ohio, and Pennsylvania. Growers range from small-scale to large, industrial businesses. Expansion opportunity in Texas is good owing to the long growing season, which could enable Texas growers to fill in production gaps from the more northerly states. Establishment costs and procedures for cultivation, including how to inoculate logs, are described. A marketing cooperative, where production, grading, and packaging is centralized, could help expand opportunities by giving small producers access to large grocery chains. At present, the Texas market relies on imports from the north or Japan. Local growers could provide fresher products.

Keywords: Cultivated mushrooms, domestication, marketing cooperatives, North America, Japan, Texas.

Romanoff, Steven. 1992. Food and debt among rubber tappers in the Bolivian Amazon. Human Organization. 51(2): 122-135.

Describes household economic strategies of families in the Amazon rain forest of northern Bolivia. The author notes that indebtedness, primarily for food purchases, is extremely high among most rubber (*Hevea brasilensis*) tapping households. Efforts to form cooperatives have been unsuccessful, primarily due to transportation difficulties. The author notes that conservationists' proposals to achieve sustainable forest use through expanding forest product markets or giving local communities usufruct rights to harvest forest products fail to account for critical social factors. Promotion of extractive industries may serve to strengthen existing social inequities due to the high incidence of food indebtedness between tapper and patron. In addition, the extractive reserve system is likely to exacerbate conflicts between tappers and Native Americans, who live in the reserves. He advocates adopting a cooperation model from Brazil, where the rubber worker union and Native Americans have joined forces to fight forest conversion to pasture. Attempts to establish cooperatives as an alternative to the existing patron system will require careful attention to transportation and technological diversification issues.

The author argues that the debate about extractive reserves has been too general, because it has not taken local context into account. He suggests the need to look at a variety of options, including comanagement, cooperative marketing, multiple-use zones, agroforestry, and protected territories for indigenous people. Land reform (extractive reserves) may be most viable in areas where population pressure is relatively low and transportation is relatively good. In remote areas, equity concerns may need to be met by developing parks and reserves comanaged by Native Americans and conservation organizations. In areas where *campesinos* are well established, agroforestry may provide a better option than reserve establishment.

Keywords: Tropical rain forests, Amazon, extractive reserves, patron-client networks, cooperatives, tenure reform.

Rossi, Esko; Raatikainen, Mikko; Huovinen, Jarmo [and others]. 1984. Luonnonmarjonen poiminta ja käyttö Väli-Soumessa=The picking and use of edible wild berries in central Finland. Silva Fennici. 18(3): 221-236.

Characterizes picking and use of edible wild berries in five counties in central Finland from 1978 to 1981. Lingonberries (*Vaccinium vitis-idaea*) were picked by 86 percent of all families surveyed, and whortleberries (*V. myrtillus*) by 79 percent of families. Red raspberry (*Rubus idaeus*) was the third most popular species. Small quantities of eight other species were picked. Lingonberries were most abundant in cutover areas and the average picked per person was 17.6 l; whortleberries were found in *Calluna*-type vegetation communities and yielded 5.6 l per person. Most berries were for household consumption, and only a small amount were given away to other people. This article demonstrates the kind of information that could be generated about patterns of picking and societal preferences for berry species in the Pacific Northwest.

Keywords: Berries, harvesters, patterns of use, societal preferences, survey, Finland.

Russell, Kenelm. 1990. Manufacturing, marketing, and regulatory considerations: forest fungi. Remarks presented at the Special Forest Products Workshop, 8-10 February 1990. Portland, OR. 9 p. On file with: Kenelm Russell, Washington Department of Natural Resources, Olympia, WA 98504.

Provides an overview of wild edible mushroom harvesting in Washington. Increasing commercial demand in the past decade has led to concerns about overharvesting of wild edible mushrooms. Conflicts exist between recreational and commercial pickers. The author describes the salient features of the wild mushroom market and summarizes statistics about wild mushroom production in Washington State for 1989, when licensed buyers and processors reported buying US$652,247 worth of wild mushrooms. The majority of these mushrooms came from Mason and Gray's Harbor Counties in western Washington, and the most commonly harvested species (by weight) was chanterelles (*Cantharellus* spp.). He notes that these figures are low compared to reports from Oregon, where the morel (*Morchella* spp.) harvest was valued at US$2.6 million in 1987, and British Columbia, which exported an estimated US$9-10 million of matsutake to Japan in 1988.

The author identifies a number of areas of concern arising out of the increasing commercialization of the wild mushroom harvest: resource depletion from overharvesting, production uncertainties, importance of mushroom harvesting as a seasonal source of income, increasing conflicts among various user groups, the underground nature of the wild mushroom industry, and public health concerns as more mushrooms enter the market.

Important policy developments also are summarized. The first step toward stricter regulation of wild mushroom harvesting occurred in 1985 when the Washington State Public Lands Commissioner convened a task force to analyze the issues around commercial harvest of wild mushrooms. As a result of the debates initiated by this group, a series of bills to regulate the wild harvest were put before the state legislature. In January 1989, the Wild Mushroom Harvesting Act was put into effect. Its provisions required that (1) buyers and dealers obtain an annual license,

(2) that buyers submit to the Washington State Department of Agriculture information about the source and quantity of products purchased, and (3) that the Department of Agriculture publish statistics about harvest totals.

Russell ends with a discussion of issues reflecting landowner concerns over wild mushroom regulation. Until recently, few landowners paid attention to mushroom harvesters, but the growing commercial interest in these species has raised the interest of landowners in exercising their property claims. The Washington Department of Natural Resources has initiated a system of leases, where rights to harvest wild mushrooms are sold through a bidding process. Other Washington State agencies allow recreational picking, but proibit commercial harvesting. The author concludes with the observation that very little is known about the ecological and economic aspects of wild mushroom harvesting, and that research to fill this void is necessary if the industry is to develop further.

Keywords: Wild edible mushrooms, cultivated mushrooms, leases, Washington, regulation, management, policy.

Russell, Kenelm W. 1987. What we need to know about commercial harvesting. McIlvainea. 8(1): 37-41.

Sets an agenda for research in the Pacific Northwest for improving knowledge about edible wild mushrooms. The current lack of good economic and ecological data makes management difficult and heightens the risk of unsustainable harvests. The proposed research agenda includes baseline studies about the ecology of commercial mushroom species, social and economic profiles of pickers, social perceptions and opinions of concerned interest groups, accurate determination of wild mushroom crops and actual harvests of each crop, and applied ecological research into potential site manipulations by forest land managers. Securing adequate and consistent funding and ensuring good organization and exchange of research information also are essential to making native mushroom harvests a long-term feature of the forest economy of the Pacific Northwest.

Keywords: Research, wild edible mushrooms, Pacific Northwest.

Ruth, Robert H., Jr.; Underwood, J. Clyde; Smith, Clark E.; Yang, Hoya Y. 1972. Maple syrup production from bigleaf maple. Res. Note PNW-181. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. 11 p.

Describes tests of syrup production (sap flow) and quality from bigleaf maple (*Acer macrophyllum*) on the west side of the Willamette Valley during winter 1970-71. Each tree had an annual flow of 0-17 gal of sap per tree. Tapping season began in mid-November and ran to early March. Compared to sugar maple (*A. saccharum*) syrup, bigleaf maple syrup was more acidic and had higher ash and invert sugar content, giving it a different flavor. Selecting high-producing trees with high sugar content in sap is crucial to making syrup tapping profitable. Best opportunities for commercial exploitation occur in pure stands or with trees accessible from the road. Suggestions for appropriate silviculture are given. No commercial production is known as yet.

Keywords: Maple syrup, economic development, Willamette Valley, Oregon.

Saar, Maret. 1991. Fungi in Khanty folk medicine. Journal of Ethnopharmacology. 31: 175-179.

Saari, Veli. 1993. Collection products of transmission line corridors and their utilization possibilities. Aquilo Ser. Bot. 31: 47-54.

Advocates more intensive use of powerline corridors in the landscape as sources for nontimber forest products. Most promising plants are those which benefit from clearing and are sufficiently abundant to establish and maintain economic markets. Genera of common plants under consideration in Finland for management having representatives in the Pacific Northwest are *Betula, Epilobium, Juniperus, Picea, Pinus, Rubus, Sorbus,* and *Vaccinium*. Juniper and lingonberry (*V. vitis-idaea*) are particularly well-adapted. Production of medicinals comes from juniper berries, leaves of *Vaccinium* species, and shoots of native conifers. Young birch leaves and fireweed shoots are used in salads and soups. Young conifers are available as horticultural transplants, and numerous honey plants (fireweed and ericaceous shrubs) can harbor bee colonies.

Commercial species of mycorrhizal mushrooms tend to grow in largest numbers in the powerline corridors within 6 m of the forest edge. Older powerline corridors tend to have greater species diversity and volume yield than younger corridors. In general, the corridors produce fewer mushrooms than the surrounding forest. The author proposes that private plant collectors in particular could contract with power companies to manage and collect commercial plants within the corridor.

This article presents a novel use of human-created landscape elements such as powerline corridors for economic production of nontimber forest products.

Keywords: Management practices, edible wild plants, edible wild mushrooms, medicinal plants, powerline corridors, Finland.

Saastamoinen, O. 1977. Economics of forest uses in Finnish Lapland. Silva Fennica. 11(3): 162-168. In Finnish with English summary.

Describes the relative economic significance of various activities in Finnish Lapland forests. Annual harvests of wild berries and edible mushrooms together constituted between 3 and 11 percent of the value of annual timber harvests from the region between 1972 and 1976. Major species are cloudberry (*Rubus chamaemorus*), lingonberry (*Vaccinium vitis-idaea*), whortleberry (*V. myrtillus*), and false morel (*Gyromitra esculenta*). The home use of these species is poorly known. Reindeer husbandry and recreation and tourism are other important goods and services that forests provide.

Keywords: Economic value, household use, wild berries, wild edible mushrooms, Finnish Lapland, Finland.

Saastamoinen, Olli. 1982. Economics of multiple-use forestry in Saariselkä forest and fell area. Communicationes Instituti Forestalis Fenniae. 102: 1-102.

Examines combinations of land use for timber production, reindeer grazing, and recreation use of forest lands in Finnish Lapland from an economic perspective.

Total value of production and value-added production are calculated to determine the relative economic importance of forest uses. Production theory is used, which explores the prevailing technological relations (production functions) between inputs (factors of production) and outputs (ecosystem products) and takes into account possibilities for substitution. Outputs consist of main products, byproducts, and waste products. Most special forest products are considered byproducts. Understanding the biological and economic relations in joint production systems is essential for economic evaluations of forest management. Product transformation curves (empirical and theoretical) between timber production and reindeer lichen biomass under differing intensities of reindeer grazing, recreation, and timber production are presented. The author then devises a three-commodity model to show the interactions among the three economic sectors. In the long term, recreation measured by far the greatest economic net returns. The highest economic use for forests was a combination of tourism and other recreation and extensive reindeer grazing.

This volume provides an excellent intellectual framework for methodologies for researching and managing nontimber forest products in the Pacific Northwest by using production theory.

Keywords: Finland, grazing, joint production, lichens, multiple use, production function, production theory, recreation.

Saastamoinen, Olli. 1984. Minor forest products in Finland. In: Policy analysis for forestry development: Proceedings of the international conference for IUFRO Division 4; 27-31 August 1984; Thessaloniki, Greece. Thessaloniki: Forest Research Institute of Thessaloniki: 221-229. Vol. 2.

Reviews the role of berries, edible fungi, decorative lichens, and wild plants in forest economies of Finland. Most products are for home use, some for national markets, and a very few for international markets. In the last 15 to 20 years, more information has become available about edible fungi and public interest has risen. Average consumption of wild mushrooms does not exceed 1 kg per person, and wild berry consumption is estimated at 5 to 6 kg per person. The most important mushroom species are golden chanterelles (*Cantharellus cibarius*), boletes (*Boletus* spp.), milk caps (*Lactarius* spp.), and false morels (*Gyromitra esculenta*). Fifteen species are considered commercially significant; many others are consumed by households. Annual yields of mushrooms differ more than do yields of berries. The annual yield of mushrooms in 1982 was Fimr15.0 million.

Decorative lichen harvesting (mostly *Cladonia alpestris*) is restricted to a small area just south of the reindeer management area. Lichens are found primarily on dry, infertile soils under pure Scotch pine (*Pinus sylvestris*) stands. Lichen gathering is labor intensive. Unlike berries and mushrooms, which are considered common property, decorative lichens are the property of the landowner. The best quality lichens are exported. The total value of the 1982 lichen crop was Fimr8 million.

Commercial plant products also include roundleaf sundews (*Drosera rotundifolia*), Labradortea (*Ledum palustre*), and birch leaves (*Betula* spp.). Birch sap production, common in Russia, has potential for Finnish birch forests. Beekeeping for honey production from flowers in cutover areas is also practiced in Russia and is

as yet little discussed in Finland. Domestic bees in forest sites may help to increase the production of berries by increasing pollination rates.

Between 1980 and 1982, the total value of all minor forest products in Finland amounted to 8 percent of the value of timber produced. When compared to data from 1974-78, the economic importance of minor forest products is increasing slightly relative to timber. Minor forest products in Finland are an integral part of the multiple use of forests and have the potential to diversify forestry production, generate employment in rural ecosystems, supplement income, and provide recreational opportunities.

Keywords: Berries, wild edible mushrooms, lichens, household consumption, common property, resins and other exudates, honey, bees, Finland.

Saastamoinen, Olli. 1992. Comparative economics of multiple use in boreal and tropical forests: cases from Finland and the Philippines. Manuscript of a paper delivered at the IUFRO centennial meeting, 30 August–4 September 1992. Berlin; Eberswalde, Germany. On file with: Social and Economic Values Research Program, Pacific Northwest Research Station, Forestry Sciences Laboratory, P.O. Box 3890, Portland, OR 97208-3890.

Reports on the effect of increasing restrictions on forest management on the status of nontimber forest products in Finland. Data and estimates of stocks of nontimber products are routinely incorporated into national income accounts. Medicinal plants and birch (*Betula* spp.) sap are becoming, at least locally, newly important products. Finnish nontimber products share four features: (1) most are common resources not tied to land ownership; (2) human use of standing crops of these resources is low (3-7 percent for whortleberries [*Vaccinium myrtillus*] and 1-2 percent for edible mushrooms); (3) conflicts between timber and nontimber uses have been thus far resolvable; and (4) uses of nontimber products involve commercial, subsistence, and recreational consumption. The relative importance of minor forest products to total forest economic production in Finland has risen from 6 percent between 1974 and 1978 to 10 percent in 1991. Low levels of annual timber harvestand a downward trend in stumpage prices are the primary causes. Regional differences in the relative importance are considerable; as much as 25 percent of forest values come from nontimber products in Finnish Lapland.

Keywords: Economic value, management, Finland, berries, wild edible mushrooms, medicinal plants, saps and resins.

Saastamoinen, Olli; Lohiniva, S. 1989. Picking of wild berries and edible mushrooms in the Rovaniemi region of Finnish Lappland. Silva Fennica. 23(3): 253-258.

Reports on results from a questionnaire mailed to randomly selected households in two communities in northern Finland concerning berry and mushroom collection in 1983 and 1985. Use of nine wild berry species and the false morel (*Gyromitra esculenta*) was investigated. The response rate was 80 percent in the 1983 survey and 84 percent in the 1985 survey. Respondents mirrored the socioeconomic distribution of the communities at large. Four-fifths of all households picked at least one species of berry for home use, but only one-third picked mushrooms. Cloudberry (*Rubus chamaemorus*) was the most lucrative species; 40 percent were sold

and provided 38 percent of all income from nontimber forest products in 1983. In 1985, cloudberries accounted for 92 percent of all income from nontimber forest products. Total amounts of berries collected in the Rovaniemi region are two to four times greater than the national average. Nationally, picking activities differ considerably by species, region, and year. Opportunities for expanding picking may be available. Most collections are for home use, which has reached local saturation. Shipping to other regions is possible because picking for sale offers tax-free income. Most berry pickers are elderly people. Training and extension advice to pickers are seldom available.

Keywords: Survey, harvesting, berries, wild edible mushrooms, income, Finland, Finnish Lapland.

Salafasky, Nick; Dugelby, Barbara L.; Terborgh, John W. 1993. Can extractive reserves save the rain forest? An ecological and socioeconomic comparison of nontimber forest product extraction systems in Peten, Guatemala[,] and West Kalimantan, Indonesia. Conservation Biology. 7(1): 39-52.

Describes important socioeconomic factors that affect the success of extractive reserves in tropical forests. Major factors include well-defined resource tenure rights, physical and social infrastructure, existing markets, and alternative land uses. Socioeconomic elements must interact positively with ecological and political conditions to make reserves a viable part of sustainable development. Density of the particular nontimber forest product affects the search, travel, and transport time that a person must expend to harvest successfully. Optimal economic foraging behavior encourages people to minimize time to acquire products and maximize profit. Because most products have seasonal availability, a sustainable extractive system requires a complementary mix of products throughout the year so that work and a labor force are more likely to remain stable. Sustainability of the product supply demands that harvesting of nontimber forest products should not reach levels that depress the regeneration and survivorship of the crop species.

Formal and informal rules of conduct and long-term commercial and social relations can restrain negative effects of individuals on the common good and ecosystem health. An established infrastructure is needed in extractive reserves to organize and speed delivery of nontimber products and to secure improved wages and access to material goods. Extractive reserves may support a low level of both employment and per capita resources in a land-poor country. Improvements in the systemic workings of an extractive reserve could involve agroforestry systems for enrichment planting, development of additional products, and greater local control over marketing through cooperatives. On a broad landscape scale, extractive reserves are best incorporated with other complementary land uses; they are not a stand-alone panacea.

Keywords: Extractive reserves, infrastructure, optimal foraging, sustainability, land tenure, agroforestry, cooperative.

Salo, Kauko. 1979. Mushrooms and mushroom yield on transitional peatlands in central Finland. Annales Botanici Fennici. 16: 181-192.

Reports on experiments to calculate yields of commercial mushrooms under several fertilizer treatments and at several successional stages after peatland draining. Highest total yields of mushrooms in 1975-76 were on a sphagnum and

heather bog plot fertilized with NPK. Recently drained bog sites without fertilizer treatments had poorest yields. *Lactarius rufus*, a commercial species in Finland, was the most common fungus species; its fruiting bodies comprised nearly 54 percent of the total weight of all collected fungi. Levels of *L. rufus* in 1976 were lower than in 1975, probably owing to either weather conditions or the lessening effect of fertilization, or both. Saprophytic fungal species, with one exception (*Omphalina ericetorum*), were little affected by fertilization treatments.

Forest stand management measures to improve the productivity of wild edible mushrooms are poorly known. This article addresses the role of fertilization, usually used to promote tree growth, on the growth and yield of both commercial and noncommercial species of mushrooms. Comparable studies would be useful in the Pacific Northwest to clarify the effects of forest management practices on the distribution and abundance of economically important mycoflora.

Keywords: Bogs, draining, fertilization, growth, yield, experimental design, stand management, wild edible mushrooms, Finland.

Salo, Kauko. 1984. Joensuun ja Seinäjoen asukkaiden luonnonmarjojen ja sienten poiminta v 1982=The picking of wild berries and mushrooms by the inhabitants of Joensuu and Seinäjoki in 1982. Folia Forestalia. 598: 1-21. In Finnish with English summary.

Reports results from a survey questionnaire sent to households in Joensuu and Seinäjoki, Finland, about wild berry and mushroom harvests. Out of 700 mailings, 533 households replied. The 1982 harvests of berries and mushrooms were lower than average, about one-third the amount from the previous year. Well over half of the responding households picked berries. The percentage of mushroom pickers was very different in the two towns: 68 percent in Joensuu and 28 percent in Seinäjoki. The typical urban resident who picks berries and mushrooms is between 30 and 50 years old. In family groups, the mother is the main picker, but fathers are increasingly participating. Most picking occurs on weekends; 20 percent of Joensuu residents take at least some of their summer holiday during the best mushroom- and berry-picking season. Summer cottages are important starting points for picking trips. With improved roads, travel to more remote spots is possible and travel distances have increased. Distribution of households by quantities of mushrooms and berries picked is provided.

Lingonberries (*Vaccinium vitis-idaea*) usually were picked in clearcuts, young forest, and mature forest, on upland sites and on southern slopes near tops of hills. Whortleberries (*V. myrtillus*) were typically picked in mature upland forests, Norway spruce (*Picea abies*) swamps, and young stands thinned for poles. Whortleberry crops were local with best yields in on hillslopes, along lakes, and on islands where spring frost damage was reduced. Major mushroom species picked were milk caps (*Lactarius* spp.), golden chanterelles (*Cantharellus cibarius*), boletes (*Boletus* spp.), *Suillus* spp., *Leccinum* spp., *Gyromitra esculenta*, *Russula* spp., and polyps (*Albatrellus ovinus*). Milk caps were located on moist and dry upland sites. *Gyromitra esculenta* was found in cutover sites, especially where the ground had been ploughed. Most species of edible mushrooms were found in spruce swamps and young forests in dry upland areas.

Keywords: Survey, household, Finland, berries, wild edible mushrooms, clearcutting.

Salo, Kauko. 1985. Luonnonmarjojen ja sienten poiminta Suomussalmella ja eräissä Pohjois-Karjalan kunnissa=Wild berry and edible mushroom picking in Suomussalmi and in some North Karelian communes, eastern Finland. Folia Forestalia. 621: 1-30. In Finnish with English summary.

Reports the results from a study in Suomussalmi county on the role of wild berries and edible mushrooms as sources of added income for rural residents. People are leaving eastern Finland in search of better economic opportunities. The present study was established by the Department of Peatland Forestry to determine the amounts of wild berries and edible mushrooms picked in the region, their market value and value relative to timber stands, the relative importance of income from berries and mushrooms in household budgets, and whether berry and mushrooms harvests in Suomussalmi differ from harvests in other communes.

Questionnaires were sent to a random sample of residents of Suomussalmi and three other communes about their harvests of mushrooms and berries in 1982 and 1983. Of 900 questionnaires sent out, 583 households replied. Nonresponding households were interviewed by telephone.

The most popular species of wild berries were lingonberry (*Vaccinium vitis-idaea*), whortleberry (*V. myrtillus*), cloudberry (*Rubus chamaemorus*), red raspberry (*R. idaeus*), European mountainash (*Sorbus acuparia*), and small cranberry (*V. oxycoccos*). The most commonly picked edible mushrooms were milk caps (*Lactarius* spp.), false morels (*Gyromitra esculenta*), boletes (*Boletus* spp., *Suillus* spp., *Leccinum* spp.), and golden chanterelles (*Cantharellus cibarius*). Data on average harvests in each community were calculated. Residents of Suomussalmi significantly led residents in other communes in amounts of berries picked and sold. In Suomussalmi and Nurmes, the proportion of value from timber compared to the value of berries and edible mushrooms is 10:1, well above the Finnish average of 28:1.

Clearcuts, old thinned stands, and mature pine stands were the best sites for lingonberry gathering. The average berry-picking trip (including travel) was 5.75 hours. Average amounts of berries picked per person were tabulated. Best whortleberry-picking sites were in old thinned stands and mature stands growing on moist mineral soil. Scoops usually were used for gathering. Milk cap and bolete mushrooms were found on many of the same sites as lingonberries and whortleberries. The composition of groups of gatherers, mode of transportation, and preferences by age and occupational groups were analyzed. Picking berries and mushrooms provided tax-free income to households. Average added income was Fimr347, and 5 percent of respondents earned more than Fimr5,000 annually from berries and mushrooms.

Pickers consumed berries for their own use in a variety of ways. Most berries were frozen; mushrooms were eaten fresh and rarely were frozen or dried. Knowledge of local mushroom species differed considerably among the different communes. Parents frequently taught their children about edible wild mushroom, thus ensuring that knowledge is passed down from one generation to the next.

Keywords: Survey, household, harvest, consumption, berries, wild edible mushrooms, economic value, clearcutting, Finland.

Salo, Kauko. 1993. Yields of commercial edible mushrooms in mineral soil forests in Finland, 1985-1986. Aquilo Ser. Bot. 31: 115-121.

Describes the methods used for surveying wild edible mushrooms as part of the eighth national forest inventory in Finland. The survey relied on 3,009 circular plots, each measuring 300 m, located systematically on survey tracts. The tracts were 16 km apart in an east-west direction in south and central Finland, 32 km apart in north Finland, and 24 km apart in a north-south direction throughout the country. Within each tract, 1 to 4 plots (400 m apart in south and central Finland) or 1 to 3 plots (600 m apart in north Finland) were designated. Four quadrats for sampling were established within each plot.

Inventory field teams include a team leader, a biologist, and two field assistants. The biologist describes and analyzes vegetation cover, maps forest damage, and collects epiphytic lichens and mosses from outside plots as samples to detect air pollution. Forests suitable for berry production are classified by vegetation cover. Fungi are sampled only once in a survey year. Seasonal variation in the sampling causes considerable variation in the results. Average yields of mushroooms are calculated only for plots where commercial wild mushrooms are found. Yield is expressed as fresh weight per hectare, with average fresh weight determined from baseline studies in northern Karelia. The inventory also tracks the occurrence and yield of commercial edible mushrooms in stands of different ages found on sites with different mineral soils.

This article provides an outline of Finnish protocols to inventory nontimber forest products, particularly mushrooms and berries, and may suggest useful applications for inventory efforts in the Pacific Northwest.

Keywords: Wild edible mushrooms, berries, Finnish national forest inventory, inventory methods, mineral soils, permanent sample plot, yields, Finland.

Salo, Kauko. 1995. Nontimber forest products and their utilization. In: [Editors unknown]. Multiple-use forestry in the Nordic countries. [Place of publication unknown]: Communication of the Finnish Forest Research Institute: [pages unknown].

Discusses the role of berry, mushroom, lichen, and conifer species of economic importance in Scandinavian countries. Many traditional forest uses in Scandinavia, such as cattle grazing and charcoal, resin, and tar production, are no longer practiced. Berry picking remains a viable economic pursuit in many regions. Of the 30 edible berry species, 16 are picked commercially. Members of the following genera are harvested: *Arctostaphylos, Empetrum, Fragaria, Juniperus, Prunus, Rosa, Rubus, Sorbus,* and *Vaccinium*. Ecological habitats for major species are described. Annual crops are highly variable, and the author provides a summary of means and ranges of crop yields for Sweden and Finland. Natural and managerial factors affecting phenology and harvest yields are briefly discussed. Per-hectare monetary value of berries and mushrooms often is greater than the tree crops from many forests. In many instances, peatlands have been drained at great expense to provide forest stands of low productivity and where the greater value in berry production would justify restoration of sites to bogs. Lingonberries (*Vaccinium vitis-idaea*) are the most important species in Finland, and the whortleberry (*V. myrtillus*) ranks first in Sweden and Norway.

The best edible mushrooms are *Boletus edulis, Suillus luteus,* and *Cantharellus cibarius*. Most commercial mushrooms are mycorrhizal species found in upland forests in the company of Scotch pine (*Pinus sylvestris*), Norway spruce (*Picea abies*), and birch (*Betula* spp.) trees. Descriptions of berry and mushroom harvesters as well as estimates of the percentage of total natural production consumed by people also are provided for Sweden and Finland.

Danish forestry, comprised mostly of privately owned lands, produces large amounts of ornamental conifer foliage, most notably from Caucasian silver fir (*Abies nordmanniana;* 37 percent by cultivated area) and noble fir (*A. procera;* 34 percent by cultivated area). Denmark ranks first in production of greens with 7367 ha under production, yielding 27 000 tonnes of ornamental foliage, most of which is exported. Large investments are required for high-grade stock, weed-control equipment, and labor, fertilization, and irrigation.

Public access rights to forest products are rooted in ancient traditions. Formal regulations in Sweden date back to 1608. In Sweden and Finland, all citizens have the right of free access to wild berries, mushrooms, wild plants, fallen branches, and detached cones lying on the ground. Income from sale of wild berries, herbs, and mushrooms is tax free in Finland, but income from lichens is taxable. No exemptions from taxation exist in Sweden. Residents of Poland and the Baltic States go to northern Sweden to pick berries. Picking cloudberries (*Rubus chamaemorus*) in Lapland regions of Norway and Finland is locally prohibited for nonresidents of the region. Denmark and Iceland permit picking berries for consumption onsite, but if berries are taken offsite for consumption at home, permission of the landowner is necessary.

Keywords: Harvesting, lichens, conifer greens, berries, wild edible mushrooms, yield, regulation, taxation, Sweden, Norway, Finland, Denmark.

Sanojca, K.; Hendriksen, H.A. 1978. Et forsøg med plantning af nobilis-gran (*Abies procera* Rehd.) på Løvenholm Skovdistrikt=An experiment with planting a noble fir (*Abies procera* Rehd.) stand at the Løvenholm Forestry District. Forstlige Forsøgsvaesen i Danmark. 36(2): 289-312. In Danish with English summary.

Savage, Mark. 1995. Pacific Northwest special forest products: an industry in transition. Journal of Forestry. 93(3): 6-11.

Describes new means of collecting and processing noble fir (*Abies procera*) boughs in western Washington by using helicopters and refrigeration warehouses. One plant is described that has 180 employees processing some 40,000 lb of boughs every day from mid-October to early December. Floral greens such as salal (*Gaultheria shallon*), evergreen huckleberry (*Vaccinium ovatum*), beargrass (*Xerophyllum tenax*), and ferns also are collected, and 80 percent of harvests is shipped abroad. Export of these greens occurs year round, mostly to wholesalers in Germany and the Netherlands. Important medicinal plants include Pacific yew (*Taxus brevifolia*), purple foxglove (*Digitalis purpurea*), and maidenhair fern (*Adiantum* spp.).

Administering sales of multiple products is complex. Timing is critical because products are perishable and subject to ephemeral appearance, seasonal pest

infestations, and unpredictable weather conditions. Familiarity with demand, prices, market criteria for product quality, market trends, and industry structure is essential. Substantial profits can be obtained from efficient harvest of boughs, floral greens, and mushrooms because their market values are high. The author states that high-site stands of noble fir and Pacific silver fir (*A. amabilis*) between 1,000 and 5,000 ft in elevation have the highest economic potential. Many young noble fir stands are now in need of bough pruning. Attention must focus on a mix of products, developing a loyal customer base, and adequate inventory.

On public lands, long-term leases (6 to 10 years) have been awarded. Leases often include stipulations regarding tree thinning, pruning, and road and trail maintenance. Procedures for permitting, collecting, leasing, and compliance are still evolving. Monitoring employer-employee relations, respect for property rights, ethnic and other social tensions, and harvest practices for sustainability concern managers and law enforcement officials. Research is needed to develop management regimes that combine timber production and special forest products. Fear of insect and fungal infestation have prompted the erection of trade barriers. The validity of these barriers may be doubtful.

Keywords: Management practices, policy formulation, barriers, leases, conifer greens, floral greens, medicinal plants, comanagement.

Schlosser, W.; Blatner, K.; Chapman, R. 1991. Economic and marketing implications of special forest products harvest in the coastal Pacific Northwest. Western Journal of Applied Forestry. 6(3): 67-72.

Summarizes the results of a 1989 mail survey used to sample special forest product businesses (floral and Christmas greens) west of the Cascades in Washington, Oregon, and British Columbia. The industry was estimated to consist of about 60 businesses, mostly in Washington State, employ about 10,300 workers, and lease about 673,000 acres for special forest products production. Sales were estimated at US$128.5 million, consisting primarily of US$47.7 million paid for plant materials, payroll of US$23.8 million, and overhead expenses of US$48.5 million. Information also was generated on industry market perceptions, channels of distribution, and future market opportunities. Producer expenditures by product for 19 floral and Christmas greens are presented.

Keywords: Floral greens, conifer greens, economic value, distribution, markets, trade, Pacific Northwest.

Schlosser, W.; Blatner, K.; Zamora, B. 1992. Pacific Northwest forest lands potential for floral greenery production. Northwest Science. 66(1): 44-55.

Estimates the occurrence of several significant floral greenery species based on existing plant association guidelines. The ideal canopy cover characteristics for each significant floral greenery species is discussed, followed by the production potential and management considerations for floral green harvests in each of the five forest zones in the Pacific Northwest. The western hemlock zone is the most accessible and productive zone and possesses the highest potential for floral greens production. Specific recommendations are made to ensure proper

management of floral greens, including use of long-term leases, broad-scale advertising of leases, and periodic monitoring of floral greens populations.

Keywords: Floral greens, plant associations, leases, canopy cover, production, management, Pacific Northwest.

Schlosser, William; Blatner, Keith A.; Baumgartner, David M. [n.d.]. Floral greens and Christmas ornamentals: important special forest products. Pullman, WA: Washington State University, Cooperative Extension Service.

Describes the significance of the floral and Christmas greens sector of the special forest product industry in the Pacific Northwest. A 1991 study of these sectors indicated that they generated US$128.5 million in sales at the wholesale level in 1989. In the Pacific Northwest (western Washington, western Oregon, and southeastern British Columbia), buyers purchased US$38 million in floral greens and US$9.6 million in boughs. Together, these segments provided full- and part-time employment for more than 10,000 people.

Significant floral greens include salal (*Gaultheria shallon*), evergreen huckleberry (*Vaccinium ovatum*), Cascade Oregongrape (*Mahonia nervosa*), and western swordfern (*Polystichum munitum*). Most species are harvested year-round except in spring when plant tips are fragile and when winter snow makes harvest difficult.

In contrast, Christmas greens are harvested primarily in fall and winter and are used during the holiday season. Commercial species include noble fir (*Abies procera*), Douglas-fir (*Pseudotsuga menziesii*), western redcedar (*Thuja plicata*), western white pine (*Pinus monticola*), subalpine fir (*Abies lasiocarpa*), lodgepole pine (*P. contorta*), and western juniper (*Juniperus scopulorum*), all of which tend to retain needles after harvest. Other products, such as cones, complement the ornamentals.

Noble fir and western redcedar are the two major species harvested in terms of total tonnage per year. Boughs are clipped from young trees (saplings or pole timber) as the older trees do not provide the type of branches desired by the industry. Harvests often are conducted in regenerating stands and can be done every 2 or 3 years. Clipping of branches for boughs is beneficial for timber production and thus does not compete with logging interests.

Keywords: Floral greens, conifer greens, Pacific Northwest.

Schlosser, William E.; Blatner, Keith A. 1993. Critical aspects of the production and marketing of special forest products. Manuscript prepared for the President's Forest Conference Committee. 73 p. On file with: Social and Economic Values Research Program, Pacific Northwest Research Station, Forestry Sciences Laboratory, P.O. Box 3890, Portland, OR, 97208-3890.

Provides a descriptive overview and policy analysis of special forest products industries in the Pacific Northwest. Five major product types are considered: floral greens, Christmas ornamentals, wild edible mushrooms, edible and medicinal plants, and Pacific yew (*Taxus brevifolia*). This paper summarizes findings of the authors' previous studies concerning product value and employment in the floral

greens and Christmas ornamentals sectors. This sector generated US$128.5 million from wholesale receipts from processors in Oregon, Washington, and British Columbia and employed 10,000 people full- or part-time in 1989. The wild edible mushroom sector is also described, with about US$20.3 million in processor purchases from an estimated 27,800 harvesters gathering 4.0 million lb in 1992 in Oregon, Washington, and Idaho. No information currently is available on the value paid to harvesters, number of persons employed, and market structure for other edible and medicinal plants. Pacific yew collection employed 1,500 people in Washington, Oregon, Idaho, and Montana.

The authors consider the industry structure and markets in five distinct components: landowners, product harvesters, producers and processors, wholesalers and brokers, and retailers. The objectives of landowners and the leasing of harvest right to harvesters or processors differ considerably. To date, no consistent system for issuing permits or leases has been implemented for Federal forest lands in the Pacific Northwest. Lack of consistency in management and regulation has led to strife among different user groups and has engendered mistrust and disregard for Federal land management and its objectives. Unregulated harvesting works only when harvest levels are low. Management to serve the three major types of harvesters (recreational, small commercial, and large commercial) must be carefully conceived through designating distinct harvest areas for each harvester group. Small-scale commercial harvesters could purchase harvest lease rights for a specific area. For larger harvesters, the agency would make available larger parcels and multiple units subject to competitive bidding, analogous to conventional timber sales.

Vertical integration and interindustry trade are common. An estimated 28,000-30,000 people were employed in special forest products industries in 1992, and about 14,000 people participated in more than one of the industries. Many jobs are part-time or seasonal. For matsutake (*Tricholoma magnivelare*), 1.1. million lb were sold in 1992; it is the most valuable wild edible mushroom in the Pacific Northwest. Most of the matsutake crop (76 percent) went to Japan in 1992.

Special forest products alone are likely not a panacea for enhancing rural employment. Most jobs are comparatively low paying, seldom with benefits and security. Processing jobs pay higher salaries than harvesting jobs. Many jobs also are transitory and involve an itinerant lifestyle “following the harvest.” Harvesting evergreen boughs occurs during a brief 70-day period from October through early December, and mushroom harvests are concentrated from September through November. Jobs connected with yew harvest are expected to disappear from the Pacific Northwest as alternate synthetic sources become available.

The western hemlock (*Tsuga heterophylla*) zone is the most productive forest for special forest products, but the Pacific silver fir (*Abies amabilis*) and mountain hemlock (*T. mertensiana)* zones are important for products such as beargrass (*Xerophyllum tenax*). Virtually every evergreen species except the hemlocks growing in the Pacific Northwest can be used commercially for evergreen boughs. Noble fir (*Abies procera*) and subalpine fir (*A. lasiocarpa*) are the most valuable. Most boughs are harvested from sapling or pole-sized trees. Bough production generally enhances timber quality production.

Much of the edible wild mushroom harvest is sent to Japan (>25 percent) and Europe (25 percent, most going to Germany and France). In 1992, morels

(*Morchella* spp.) constituted one-quarter of the crop, most coming from eastern Oregon and Washington, with equal shares of the morel crop (20 percent) sold in Japan and Europe. Slightly more chanterelles (*Cantharellus* spp.) were harvested than morels, more in western Oregon and Washington (total 94 percent), with 35 percent sold in the Western United States and 44 percent sold in Europe (primarily France, Germany, the Netherlands).

Options for joint management of forests for timber and special forest products offer novel approaches to extracting greater and perhaps more even flow of economic values from forests in the Pacific Northwest. For example, most species useful as floral greens flourish in shade provided by overstory trees; for example, salal (*Gaultheria shallon*), Oregongrape (*Mahonia* spp.), and western swordfern (*Polystichum munitum*). Both even-aged and uneven-aged tree harvest systems can be managed to improve the quantity and quality of floral greens specific to the plant association at a site. Clearcuts and seedtree regeneration favor commercial quality evergreen huckleberry (*Vaccinium ovatum*), for example.

Major areas in need of research include identification of species' distributions, life histories, role in ecosystem function, and susceptibility to population decline. New ways are needed also for characterizing populations of special forest products within existing forest inventory databases. Specific targets for effective inventorying are given concerning plot size, cycles of remeasurement, and so forth. Community and regional development efforts should emphasize value-added products and identify existing and potential markets based on resource inventories. Tracking the marketing and sales of special forest products would be useful to forecasting and planning for potential growth. Coordination among different land owners to support growth and yield of special forest products will be necessary to provide the commercially required quantities for profitable harvests.

Keywords: Floral greens, conifer greens, wild edible mushrooms, edible plants, medicinal plants, economic value, industry structure, distribution, trade, employment, research agenda, policy, joint management, Pacific Northwest, President's Forest Conference.

Schlosser, William E.; Blatner, Keith A. 1994. Special forest products: an east-side perspective. Manuscript for the Interior Columbia Basin Ecosystem Management Project. 53 p. On file with: Social and Economic Values Research Program, Pacific Northwest Research Station, Forestry Sciences Laboratory, P.O. Box 3890, Portland, OR, 97208-3890.

Emphasizes the potential products marketed from east-side forests. Principal species of floral greens are beargrass (*Xerophyllum tenax*), boxleaf myrtle (*Paxistima mysinites*), western swordfern (*Polystichum munitum*), babysbreath gypsophila (*Gypsophila paniculata*), hollyleaved barberry (*Mahonia aquifolium*), and Oregongrape (*M. repens*). Most of the floral greens businesses are located west of the Cascades, but they market products collected as far away as 300 mi. Range plants having floristry value include pepperweed (*Lepidium* spp.), black henbane (*Hyoscayamus niger*), Indian ricegrass (*Oryzopsis hymenoides*), and arrowleaf balsamroot (*Balsamorhiza sagittata*).

Among wild edible mushrooms, the most widely harvested species are morels (*Morchella* spp.). Other major species are the American matsutake (*Tricholoma*

magnivelare), boletus (*Boletus* spp.), cauliflower mushroom (*Sparassis crispa*), Oregon black truffle (*Picoa carthusiana*), and spreading hedgehog (*Dentinum repandum*). Huckleberries (*Vaccinium* spp.), Saskatoon serviceberries (*Amelanchier alnifolia*), and elderberries (*Sambucus* spp.) are the principal plant food species.

The authors present their interpretation of ecosystem management for special forest products. More intensive management requires a formal assessment of plant growth and regeneration to determine at what level a sustainable harvest occurs. Identification of habitat type, successional pathways, and accompanying understory plants help define the environmental conditions that a vegetation manager must strive for. Optimal habitats for the major commercial species of special forest products are described as well as management and harvesting methods. A site-specific example is provided from the grand fir-twinflower habitat type in northern Idaho.

Special forest product industries on the east side have been actively developed in the last 10 years. At present, the appropriate mobile and trained workforce is not available. Jobs in these industries tend to be lower paying and even more seasonal than timber jobs. Business costs may be lower but transportation costs to end markets will be greater from the east side. Increasingly, the mushroom collections east of the Cascade crest will be processed locally. Joint marketing of mushroom and berry products might be efficient for companies interested in obtaining a stable workforce to collect wild products. Such horizontal integration to industry structure might solidify market presence of east-side companies.

The authors make general forecasts about the future contribution of special forest products to the east-side economy. A community with a processing facility for floral greens, Christmas ornamentals, or wild edible mushrooms will likely achieve increased employment for 50 to 125 individuals and infuse between US$325,000 to US$1.5 million annually. A logging mill in 1990 producing 20 mmbf would have added 177 people in all phases of production and contributed US$5.1 million in wages to the local economy. Secondary employment and indirect benefits to communities are not accounted for in each estimate. Finally, institutional barriers to economic growth of special forest products industries are discussed.

Keywords: Floral greens, conifer greens, wild edible mushrooms, eastern Oregon, eastern Washington, employment, economic value, barriers, employment, processing, ecosystem management.

Schlosser, William E.; Blatner, Keith A. 1995. The wild edible mushroom industry of Washington, Oregon and Idaho: a 1992 survey of processors. Journal of Forestry. 93(3): 31-36.

Provides an overview of the wild edible mushroom industry in the Pacific Northwest. Major commercial species include morels (*Morchella* spp.), golden chanterelles (*Cantharellus cibarius*), American matsutake (*Tricholoma magnivelare*), and boletes (*Boletus* spp.). Commercial truffle species include the Oregon black truffle (*Picoa carthusiana*) and true truffles (*Tuber* spp.). Most wild edible mushrooms are harvested in western Washington and Oregon, but the harvest area extends from northern California to Alaska. Harvesting occurs in both spring and fall.

Data were gathered through a census of mushroom processors based in Washington, Oregon, and Idaho who purchased mushrooms in the region in 1992. The master list was developed from information in telephone directories, lists from agricultural departments, and personal contacts. Dilman's total design method for mail questionnaires was used. Nonrespondents were contacted by telephone to see if they continued to remain involved in the industry.

The survey findings revealed that the average length in business was 9 years. Processors employed an average of five individuals in 1992, and purchased from an average of 112 harvesters. An average total of 54,000 lb was harvested, the average value of purchases per processor was US$278,000. Most mushroom processors also purchased other special forest products, and most operated seasonally. For the industry, a total of 3.9 million lb was purchased in 1992, of which more than half was purchased in western Washington and Oregon. Morels had the highest volume (1.3 million lb), and Oregon produced the bulk of the mushrooms (62 percent). Prices differed by species, place, and time of purchase. The gross value of the industry's production for 1992 was estimated at US$41.1 million; US$25.1 million for Oregon, US$11.9 million for Washington, and US$1.6 million for Idaho.

Most of the product was sold to international markets: 27 percent was sold in the Western United States, 28 percent to Japan, and 25 percent to Europe (Germany and France). The product markets differed by species: morels were sold mostly in the United States, chanterelles were destined for Europe, and most American matsutake were sold to Japan.

The authors conclude that special forest products are not a panacea for economic development. Most jobs in the industry are part time or seasonal and can serve to supplement income earned from other occupations. Harvests range widely in quantity, however, and markets are strongly international, thus subject to intense competition.

Keywords: Survey, wild edible mushrooms, industry structure, economic value, employment, trade, price, Oregon, Washington, Idaho.

Schlosser, William E.; Blatner, Keith A.; Schuster, Ervin G.; Carroll, Matthew S. 1995. Potential for expansion of the special forest products industry in the northern Rockies. Western Journal of Applied Forestry. 10(4): 138-143.

Analyzes the potential for expansion of the special forest product industry in the northern Rockies. Examines the current status of special forest product harvests in the region in five categories: floral greens (beargrass [*Xerophyllum tenax*], western swordfern [*Polystichum munitum*], Oregongrape [*Mahonia* spp.], and babysbreath gypsophila [*Gypsophila paniculata*]), boxleaf myrtle [*Paxistima mysinites*], Christmas ornamentals, wild edible mushrooms, other edibles and medicinals, and Pacific yew (*Taxus brevifolia*). The authors then explore the advantages and constraints the region faces in expanding the industry. They conclude that the region has abundant special forest product resources and a suitable labor supply, transportation network, and business environment to successfully expand the special forest product industry, although numerous social, economic, and biological issues need to be addressed for the industry to reach its full potential.

Keywords: Northern Rockies, economic development, floral greens, conifer greens, wild edible mushrooms, medicinal plants, yew.

Schlosser, William E.; Roché, Cindy Talbot; Blatner, Keith A.; Baumgartner, David M. 1992. A guide to floral greens: special forest products. Ext. Bull. 1659. Pullman, WA: Washington State University, Cooperative Extension Service. 10 p.

Provides an introduction to eight major plants of the floral greens industry for harvesters and small landowners. Key ecological, morphological, and management characteristics are described, and references are provided for additional information. The guide also includes range maps, plant illustrations, and color photographs of each species.

Keywords: Floral greens, guide.

Schneider, M. 1990. Acorns as a staple food—different types and change of exploitation through time. Bodenkultur. 41(1): 81-88.

Surveys the present and historical uses of acorns for use as food and fodder worldwide. Acorns were particularly important as a food staple to California native peoples as early as 5000 B.C. Tanoak (*Lithocarpus densiflorus*) was considered the most reliable crop species although the acorns are comparatively poor in protein. California black oak (*Quercus kelloggii*) and Oregon white oak (*Q. garryana*) were preferred species.

Keywords: Nuts, California, Pacific Northwest, ethnobotany.

Schnepf, Chris, ed. 1995. Dancing with an elephant: Proceedings of the business and science of special forest products: a conference and exposition; 1994 Jan. 26-27; Hillsboro, OR. Pullman, WA: Washington State University Cooperative Extension. 213 p.

Provides an overview of biological, social, and economic aspects of special forest products use and management in the Pacific Northwest region of the United States. Chapters address the following topics: size and scope of the special forest products industry in the Pacific Northwest; private landowner and harvester perspectives of the industry; regulations and enforcement on private, state, and Federal lands; resource sustainability issues; updates on chanterelle, morel, and matsutake research efforts in the Pacific Northwest; marketing and business development strategies for special forest products; and case studies of attempts to use special forest product industry expansion and value-added efforts to spur rural economic development.

Keywords: Economic development, sustainable development, regulation, enforcement, wild edible mushrooms, floral greens, cultivation, monitoring, marketing, value-added, cooperatives.

Schröder, Hubertus. 1977. Schmuckreisig-Gewinnung bei der Douglasie= Decorative greens yields from Douglas-fir. Allgemeine Forstzeitung. 32(46): 1159-1161. In German.

Describes management for Douglas-fir (*Pseudotsuga menziesii*) in Germany to increase yields of decorative greens. Douglas-fir has gained in popularity in Germany because of its attractive appearance, good needle retention compared to western hemlock (*Tsuga heterophylla*), ease of handling its branches during processing, and its forest scent. It is used for wreathes, arrangements, garlands, and graveside memorials. The first cut for foliage on a tree occurs when the tree is 3 to 4 m tall (by age 10) and runs from the tree base up to as high as the hand can reach. About half of the foliage mass should be left on the tree so that future growth is not jeopardized. Branches must be less than 3 to 4 cm wide for cutting with pruning shears. To prevent the spread of fungal infection, the stumps of branches cut in the winter are removed in the summer. This step increases management costs considerably. Three to four years later (by age 15), another cut can be taken with long-handled clippers or chainsaws. At this time the live crown must comprise at least a third of the total stem length after pruning up to 4 m. Some branches previously pruned produce a second crop of commercial-quality foliage. The next cut for foliage can occur at the same time as the first stand thinning. Yields fom this cut may be near zero if the stand is closely spaced, and thus preventing growth of spreading crowns.

Keywords: Conifer greens, management practices, Germany.

Schweitzer, Jeff; Handley, F. Gray; Edwards, James [and others]. 1991. Summary of the workshop on drug development, biological diversity, and economic growth. Journal of the National Cancer Institute. 83 (18): 1294-1298.

Argues that pharmaceuticals derived from tropical natural products can promote economic growth in developing countries while conserving the biological resources providing the products. The role of intellectual property rights and the economics of conservation of biological diversity remain challenges to useful policy formulation. Providing market-driven monetary incentives for conservation is important. Plans are underway to ensure that a portion of profits obtained from pharmaceutical development are returned to appropriate institutions in the country from which plant material originated. Drug companies have found comparatively few new compounds from natural sources in the last 25 years. Companies often emphasize total synthesis of natural drugs so that destructive collections from the wild are no longer necessary. Protecting natural resources must go hand-in-hand with preserving cultural diversity and indigenous knowledge. Equal partnership, cooperation, and fair compensation are basic principles for multinational efforts to use biodiversity and traditional knowledge for sustainable management.

Compensation mechanisms need to be developed to bridge the time gap of the 10 to 15 years from identification of a potentially useful species to production of a derivative drug. Four areas of action are particularly needed: improving infrastructure of host countries, developing inventories of native species and indigenous knowledge, personnel training to meet needs of host countries, and assisting with the healthcare priorities of host countries.

This article underscores important issues in the development of pharmaceutical products and provides an outline for research and research support for new products from temperate and tropical ecosystems.

Keywords: Medicinal plants, plant-derived drugs, product development, compensation, intellectual property rights, biodiversity, conservation.

Scoones, Ian; Melnyk, Mary; Pretty, Jules N., comps. 1992. The hidden harvest: a literature review and annotated bibliography. London: International Institute for Environment and Development, the Sustainable Agriculture Programme. 256 p.

Assembles a substantial bibliography about wild foods in agricultural societies, with primary emphasis on tropical environments. Core topics discussed are wild foods as supplements for food security, their nutritional value to people, resource control, local institution in management of wild food resources, the origins of differing societal uses of wild foods, and their estimated economic value to people. Essays on each subject preface each subject area division in the bibliography. Seasonality typifies wild foods. Within a forest ecosystem, the human regulations regarding ownerships may have temporal, spatial, and generic limits. Poorer people rely more heavily on wild foods for nutrition and as a source of income. In India, in particular, efforts in community-based joint management for forest use have attempted to work around the network of marketing middlemen who prevent primary hunters and gatherers (who are in the greatest economic need) from acquiring all but a very small proportion of resource value. Efforts in Brazil have emphasized custodianship and wild plant harvest in extractive reserves. The final section lists references about wild plant harvests around the world.

Keywords: Wild foods, nutrition, resource control, economic value, equity, tropics.

Seely, Harold. 1993. An economic assessment of the special forest products industry in southwest Washington. Seattle, WA: Pacific Lutheran University. 35 p. Unpublished thesis.

Addresses the economic potential of the special forest products industry in four western Washington counties (Grays Harbor, Mason, Wahkiakum, and Pacific) and evaluates the capacity of special forest product employment to adequately substitute for timber-related jobs. Methodology includes a literature review and interviews with representatives of land management agencies, community development agencies, forest product companies, and special forest product companies. The author provides an overview of southwest Washington and the mushroom and floral green industries, and then assesses the current economic contribution of special forest products to the region. The author estimates that three sectors of the special forest product industries (mushrooms, holiday greens, and floral greens) contributed US$90.5 million to the region in 1991 and employed 2,189 (full-time equivalents). Although the employment and economic contributions are significant, the author cautions that employment is not full-time and harvest seasons of various special forest products conflict with each other, making it difficult to earn a family wage exclusively from special forest product harvest opportunities. Management

challenges also are discussed, and the author proposes a special forest products cooperative to address these challenges and form a monopoly that could create industry stability and efficiency.

The study concludes that the special forest products industry is an important component of the southwestern Washington economy but is unlikely to yield the growth and wage levels needed to compensate for declining timber-related employment. The author also argues that the structure of the special forest products industry with its low capital requirements, relatively lower wages, and smaller, cyclical nature make it an unlikely substitute for the timber industry. The author notes, however, that the timber and special forest product industries could potentially form a synergistic relation.

Keywords: Floral greens, conifer greens, wild edible mushrooms, economic value, employment, southwestern Washington, cooperative.

Sendak, Paul E.; Bennick, John P. 1985. The cost of maple sugaring in Vermont. Res. Pap. NE-565. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeast Forest Experiment Station. 14 p.

Develops an annual maple syrup production cost series for 1972 to 1984 to examine the effects of changing technology. The authors estimate physical inputs of plastic vacuum tubing for 3,000 taps and an open-pan evaporator and respective costs per gallon of syrup. Most increases in cost were the result of inflation. Sugar content of the sap affects production costs as well. A doubling of the sugar content (1.5 to 3 percent) results in a 40 percent decrease in production costs per gallon. Total cost of syrup production is most sensitive to changes in wages and fuel oil costs, and these variables have the greatest potential to reduce costs. Wood may provide the cheapest fuel source. The ratio of maple syrup price to production costs also is figured (1977=100). An appendix includes equipment lists and labor and energy requirements. This paper introduces the economic considerations important to economic development of harvests of bigleaf maple (*Acer macrophyllum*) and birch (*Betula* spp.) sap in the Pacific Northwest.

Keywords: Cost analysis, economies of scale, equipment, fuel costs, labor wages, maple sugar production, sugar content.

Shaw, Elmer W. 1949. Minor forest products of the Pacific Northwest. Res. Note 59. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. 10 p.

Is the first known Forest Service publication about minor forest products in the Pacific Northwest. Net value from unprocessed products in 1949 from the region is estimated to be US$4-5 million. Important decorative greens are thought to create US$2-3 million of extra income. Major species are western swordfern (*Polystichum munitum*), salal (*Gaultheria shallon*), evergreen huckleberry (*Vaccinium ovatum*), Port-Orford-cedar (*Chamaecyparis lawsoniana*), and other conifers for boughs. Markets have not yet been developed for other suitable products. Cascara (*Frangula purshiana*) and purple foxglove (*Digitalis purpurea*)

are the most important medicinal plants gathered. Current standards for bunching, packing, processing, and resource protection are given as are current prices. “Brush pickers” are extolled as forest custodians on the lookout against wildfires. A brief description of their cultural ethos is given.

Keywords: Berries, medicinal plants, wild edible plants, conifer greens, floral greens, cones, economic value, harvesting, processing, Pacific Northwest.

Shepard, Gill. 1990. Conservation, development, and the future of the rainforest. Appropriate Technology. 17 (3): [pages unknown].

Suggests that two approaches for conservation of rain forests are possible: finding values for forests that do not require that trees be cut, and cutting trees in ways that do less damage to the forest. Whichever approach is used, managers should remember that tropical forests are inhabited, and that local people hold more knowledge than anyone else about how to manage those forests. Recent studies in the Amazon indicate that indigenous people have a very complex interaction with their environment: many trees are not just managed but cultivated.

Unfortunately, valuing such forests is not easy. Many of the local values lie outside the cash sector, so that their value is not readily apparent in monetary terms. At the national level, many forest products are traded internally and, thus, neither bring in hard currency nor are attractive to governments interested in revenue generation.

Attempts to market nontimber rain forest products thus are often beset by the dilemma of how to retain benefits at the local level. In India, two problems have been identified: locally processed materials are unable to meet the standards and cost structures of larger markets, and once nontimber forest products become profitable, processing and sale (and sometimes collection) are taken over by capital-intensive industrial or governmental concerns. Local harvesters, processors, and traders become landless laborers rather than entrepreneurs. International distortions in product values at the local level also need to be taken into account. The author cites the example of the gum-arabic tree (*Acacia nilotica*) in the Sudan, where low international prices devalued the domestic price to the point where it made more sense to convert the trees to charcoal. Creating international markets for nontimber forest products is thus a two-edged sword. Controlling nontimber forest product harvest rates becomes increasingly difficult as they rise in value, particularly if regulatory regimes lack legitimacy or authority.

The author argues that sound nontimber forest product management will require transferring greater authority to local governance. By strengthening indigenous rights, vulnerability to international markets is lessened as people can then make the choice between subsistence and cash activities.

Keywords: Tropical rain forest, India, market expansion, tenure reform, market vulnerability.

Shiva, M.P.; Jaffer, Rubab. 1990. Prospects by models for raising aromatic plants in different forestry programmes for economic uplift. Indian Forester. 116(2): 168-176.

Discusses management considerations for an intensive agroforestry system based on stands of lemonscented gum (*Eucalyptus citriodora*) and camphortree (*Cinnamonum camphora*) underplanted with oil-yielding grasses for production of aromatic oils and poles. An accounting of management costs, product yields, and financial returns is included. Considerations of spatial design for tree density and for best balance of species are key to maximizing income for rural landowners. Although the species are very different, possible parallels exist for developing alternative silviculture for nontimber forest products in the Pacific Northwest. Vegetation management in the Pacific Northwest and commensurate economic analysis could be undertaken to project production and value from stands combining wood, aromatic conifer oil, and beargrass (*Xerophyllum tenax*) products, for example.

Keywords: Alternative silviculture, aromatic oils, agroforestry, economic analysis, India.

Shiva, Vandana; Sharatchandra, H.C.; Bandyopadhyay, J. 1984. Social forestry—No solution within the market. The Ecologist. 12 (4): 158-168.

Critiques the social forestry programs begun in India in the early 1980s. The impetus for social forestry was the growing awareness that government-run plantation forestry contributed little to enhancing living conditions for vast numbers of India's rural inhabitants, and the ability of such plantations to produce adequate supplies of forest products was highly dependent on the participation of the population in keeping grazing animals out of newly planted woodlots. Social forestry differs from previous forestry programs in its assumption that an effective reforestation program requires participation by local communities.

The authors use evidence from social forestry programs in the district of Kolar in Karnataka State to show how the very structure of social forestry is incapable of delivering on its promises to meet the needs of rural people and restore India's forest wealth. Social forestry is structured to break down the interdependence among community members by promoting the planting of species, such as eucalyptus (*Eucalyptus* spp.), that allow wealthier farmers with access to urban markets to become less dependent on their fellow farmers. At the same time, the emphasis on exotic species has diminished the value of local knowledge and increased local dependence on outside experts for plant resources and information about how to grow them.

Social forestry thus fails to meet its social equity goals and its ecosystem health goals. The authors conclude that as long as market demands drive the choice of species promoted by social forestry programs, such programs will fail to meet their objectives.

Keywords: Social forestry, exotic species, rural development, social equity, ecosystem health, market pressure, India.

Shubat, Deborah Jo. 1983. Management of native lowbush blueberry for recreational picking in northeastern Minnesota. Minneapolis: University of Minnesota. M.S. thesis.

Provides information on recreational berry pickers and management of wild berry stands in the United States. The author notes that lowbush blueberries (*Vaccinium angustifolium*) have historically been sought by Native Americans and incoming Euro-American settlers. Native Americans managed berry stands through the use of fire, but experiments with berry cultivation did not begin until the early 1900s, when the U.S. Department of Agriculture funded experiments on highbush blueberries (*V. corymbosum*) and then on lowbush blueberries in the 1960s. Attempts to breed lowbush blueberries have encountered sterility and clonal propagation difficulties; as a result, wild stands remain the only economically viable source of such berries.

The author describes the geographical distribution of lowbush blueberry in Minnesota and various methods of management, including thermal and mechanical pruning, fertilizing, mulching and herbicide use, which have been used successfully in commercial berry patches in New Brunswick, Maine, and Minnesota. Paired plots of burned and unburned patches were established at four sites and one unburned plot at a fifth site. Treatments tested included mechanical pruning, mulching, and fertilizer and herbicide application. Pretest and posttest data were collected on stem density, stem length, and number of flower buds per plant and analyzed by using analysis of variance. The results of the experiment indicated that sawdust mulching is not effective and that mulching is contraindicated when plants have been pruned recently. Pruning stimulated stem growth, and mechanical pruning appeared to be more effective than burning. Herbicide use had little influence on berry yield.

Fifty-one pickers, selected nonrandomly, were interviewed during August 1981 and 11 were interviewed in August 1982. Data were gathered on how people use wild berries, how much berry picking costs, and picker opinions of berry management. The pickers interviewed tended to be disproportionately female adults, and the majority picked a variety of wild fruits every year. Forty-three percent picked only for recreation, 31 percent picked berries specifically for food, and 26 percent picked for both purposes. Pickers traveled 93 miles round trip on average, over half were local residents, and most noted that this was an important activity to them. Although the majority favored more active berry management on public lands, an unspecified percentage noted that they would favor such activity only if they did not have to pay to pick the berries. None of the pickers claimed to pick for commercial use.

Keywords: Berries, management, harvesting, survey, harvesters, pruning, herbicide, yield, mulching, fertilized, experimental design.

Shubin, Vladimir. 1993. Fruit body production in edible forest mushrooms in relation to weather conditions. Aquilo Ser. Bot. 31: 111-113.

Reports on a 20-year study begun in 1970 in Karelia, Russia, where plots were examined every 3 to 7 days from June to October. Locations of fruiting bodies were mapped, mushrooms were picked for identification, and weighed. Dry hot summers

reduced crop amounts. Years with the largest crops of edible mushrooms (for example, 1974 and 1981) were years when the season began early and was prolonged with humid August weather and a dry autumn. *Russula aeruginea* fruited soon after summer rain, ensuring a crop even in dry years, and *R. xerampelina* flourished in years with more typical greater rainfall. *Boletus edulis* was an example of an early season species that, as a rule, did not achieve high production levels. Lag effects from soil moisture and temperature may play an important part in crops the following year. In mature forests, the ground froze later than in open sites or younger stands, thereby extending the growing season. Nineteen percent of years had high crops and 43 percent had low crops.

Keywords: Wild edible mushrooms, experimental design, yield, Russia.

Signorini, Daniela; Valli, Oriano. 1984. Il tartufo: habitat, ricerca, zone di reperimento, addestramento del cane, e tecniche di coltivazione del bianco e del nero=Truffles: habitat, research, range, dog training, and techniques for cultivating white and black truffles. Milan: Ottaviano. 239 p.

Describes the role of middlemen in the commercialization of truffles (*Tuber* spp.) in Italy. To strengthen their individually weak economic positions, truffle suppliers create consortia for a larger market share that can guarantee them a bargaining position equal to that of local intermediary purchasers. Marketing consortia are undermined by tacit agreements among local purchasers to divide up the truffle growing areas into zones of influence. The purchasers refuse to buy at local prices any truffle coming from outside their region where prices might be lower. Thus truffle gatherers cannot obtain the best price in these imperfect markets. A clandestine distribution network exists where truffles from central Italy (Tuscany and Umbria) are shipped to Alba (in the north) and sold as though they were local products for much higher prices. Some businesspeople (trattoria owners, tailors, or barbers) who have lots of public contact collect truffles from gatherers as a side business. They provide a service to their client wholesalers by grading and sorting truffles and prevent interaction between the truffle gatherers and the wholesalers. Wholesalers in general have total control for setting prices for the truffles, based on seasonal availability. The margin of price increase from the intermediary to the wholesaler is 15 to 25 percent. The wholesaler's sale price is considerably higher than the price paid to the truffle gatherer by the local purchaser. Lower grade truffles are selected for use in pâtés, which are sold at 20 percent above the wholesaler's purchase price. The higher grade truffles are sold at 75 to 85 percent of the wholesaler's purchase price. From these margins, transportation, storage, and cleaning costs need to be subtracted.

Centers of truffle consumptions are the larger cities (Milan, Turin, Rome), each of which is controlled by one or a few wholesalers who sell to retailers (restaurants and grocery stores). In France, in contrast, every large city has a store that specializes exclusively in the sale of truffles.

There is no systematic method in Italy to calculate the production volume of truffles. Estimates are provided based on experts in the sector. Fifteen percent of white truffle (mostly *Tuber aestivum*) production is exported to the United States, Brazil, Switzerland, and Germany. Most of the black truffle (mostly *T. melonosporum*) production destined for export goes to France. Average prices

are given by grade for 1983-84. A brief description of national and regional laws regulating the gathering and trade of truffles in Italy is provided as well.

Keywords: Truffles, industry structure, cooperatives, imperfect markets, price setting, distribution, trade, prices, regulation, Italy.

Simpson, R.D.; Sedjo, R.A. 1992. Contracts for transferring rights to indigenous genetic resources. Resources. Washington, DC: Resources for the Future; Fall; 109: 1-6.

Discusses compensation to countries for the use of tropical forests as genetic resources to provide a conservation incentive. Establishment of a country's property rights and sovereignty in its indigenous genetic resources is an essential part of the Biodiversity Convention. Contracts calling for royalty payments contingent on discovery are suggested as an effective mechanism for commercializing genetic resources. Vertical integration by both buyer and the seller are recommended to reduce contract complexity. A brief summary is provided of recent contracts with royalty provisions, including contracts entered into by the National Cancer Institute, Biotics, and Merck and Company.

Keywords: Genetic resources, conservation, property rights, tropical forest, Biodiversity Convention, royalty payment.

Sittenfeld, Ana; Villers, Renata. 1993. Exploring and preserving biodiversity in the tropics: the Costa Rican case. Current Opinion in Biotechnology. 4: 280-285.

Describes the increasing interest of the pharmaceutical industry in biodiversity prospecting, defined as the systematic search for new sources of chemical compounds, genes, proteins, microbes, and other potentially valuable products. INBio (Instituto Nacional de Biodiversidad) was formed in 1989 to inventory Costa Rica's substantial biodiversity and to use this information for the promotion of biodiversity conservation and nondamaging, sustainable economic development. In addition to the National Biodiversity Inventory described above, INBio is collaborating with Intergraph Corporation to create a computerized biodiversity management information system, eventually linking geographic information systems, text, photographs, and maps. INBio is helping Mexico, Indonesia, and Kenya form similar national institutions.

Keywords: Biodiversity prospecting, conservation, sustainable development, Instituto Nacional de Biodiversidad, geographic information system, Costa Rica.

Sittenfeld, Ana; Villers, Renata. 1994. Costa Rica's INBio: collaborative biodiversity research agreements with the pharmaceutical industry. In: Meffe, G.K.; Carroll, C.R., eds. Principles of conservation biology. Sunderland, MA: Sinauer Associates Inc.

Describes the work of INBio (Instituto Nacional de Biodiversidad), a Costa Rican nongovernmental organization, in conducting a national biodiversity inventory and in forming collaborative research agreements with pharmaceutical companies. In exchange for access to Costa Rica's biological wealth for drug prospecting,

pharmaceutical companies help to fund local prospecting, sample processing, identification and resupply, and conservation activities. In addition, agreements call for royalty payments to conservation programs if commercialization is successful. INBio is currently involved in a 10-year cataloging effort of Costa Rican biodiversity. The National Biodiversity Inventory is expected to cost US$70 million, encompass all major taxa, and describe about half a million species. INBio pioneered the concept of "parataxonomists" to carry out this inventory. Parataxonomists are local community members trained and paid to carry out collection and initial cataloging of species. The article also describes the opportunities and challenges of biodiversity prospecting for drugs and the historic US$1 million agreement between INBio and Merck for drug prospecting and evaluation.

Given the largely untapped medicinal potential of Pacific Northwest forests, INBio provides an excellent example of how to capture local value from biodiversity prospecting.

Keywords: Parataxonomy, inventory, biological diversity, compensation, plant-derived drugs, Costa Rica, Instituto Nacional de Biodiversidad.

Slee, RW. 1991. The potential of small woodlands in Britain for edible mushrooms production. Scottish Forestry. 45(1): 3-12.

Considers possibilities for raising commercial crops of edible mycorrhizal and saprophytic fungi species in small woodlands in the United Kingdom. Markets for "natural" and nontraditional foods have grown, including those for edible mushrooms other than *Agaricus* spp. Commercial harvesting of wild mushrooms is still a small-scale industry, but golden chanterelles (*Cantharellus cibarius*) and boletes (*Boletus* spp.) from northern Scotland are shipped to southeast England and continental Europe. The economic challenge to commercial pickers is to identify middlemen who ensure fair prices or to establish direct links to end users. Sufficient down wood is necessary for the continued production of fruiting bodies of edible saprophytic species. Colonization rates of logs depend on temperature and log moisture content. Competition from other saprophytic fungi occurs for the same sites and may threaten economic yields. Inoculation of logs with vigorous strains of commercial species is important.

Development of commercial crops of edible wild mushrooms requires knowledge that does not currently exist. Information about actual and potential yields, the range of socially permissible environmental manipulation, prospects for markets, and legal questions concerning property rights must be researched. No data exist in the United Kingdom for measured yields of edible wild fungi. Monitoring of yields is made difficult when multiple pickers work on the same site. The annual variation in yield is considerable because of multiple environmental fluctuations. Effects of harvesting on subsequent yields is unknown.

Details for improving fungi production are not well understood. Management of saprophytic fungi is limited to introduction of shiitake (*Lentinus edodes*) to production on logs under native forest. Shiitake, a nonnative species, may encourage the reintroduction of once widespread coppice silviculture for firewood and ecological diversity. Fungi crops are a source of supplemental income in small hardwood forests that serve multiple social values beyond timber production.

Keywords: Cultivated mushrooms, United Kingdom, domestication, down wood, edible wild mushrooms, monitoring, vegetation management.

Smith, G. Warren. 1983. Arctic pharmacognosia. II: Devil's club: *Oplopanax horridus*. Journal of Ethnopharmacology. 7: 313-320.

Points out the historical and present-day importance of devilsclub (*Oplopanax horridus*) to medicine. Among Native American peoples, the species has use as an emetic, purgative, and poultice, but with its hypoglycemic activity, it may have a role in the treatment of diabetes.

Keywords: Native American plant uses, medicinal plants.

Smith, Harriet L. 1978. Camas: the plant that caused wars—an Oregon vignette. Lake Oswego, OR: Smith, Smith, and Smith Publishing Company. 18 p.

Chronicles the role of camas (*Camassia* spp.) bulbs in the diet of Pacific Northwest Indians. Extracts from the journals of Meriwether Lewis and other early Euro-American diarists describe the process to collect and prepare camas. Conflicts between Native Americans and Euro-American settlers over access to camas fields led to armed conflict involving the Bannock tribe.

Keywords: Wild edible plants, Meriwether Lewis, resource conflict, Bannock tribe.

Steiner, P.R. 1981. The forests as a source of natural adhesives. In: Oliver, J.F., ed. Adhesion in cellulosic and wood-based composites. New York: Plenum Press: 67-88 .

Argues that forests are an underused source of raw materials for adhesives. Steiner describes the chemical reactivity and structure, physical properties, and adhesive potential of three major sources of natural adhesives from trees, including lignin, bark, and foliage. Additional research is needed on raw material variability, aging effects, material separation and purification, and the influence of coreactants to more fully examine the potential of these natural adhesives.

Keywords: Product development, adhesives, lignin, bark, foliage.

Stewart, Hilary. 1987. Cedar, tree of life to the Northwest coast Indians. Vancouver, BC: Douglas and McIntyre. 192 p.

Describes the economic botanical uses of western redcedar (*Thuja plicata*). Uses of bark include material for basketry, matting, clothing, and cordage. Small branches are used to make ropes and threads. Cedar roots are important for basketry as well.

Keywords: Fiber, Native American uses, baskets.

Stewart, T. 1994. Land-use options to encourage forest conservation on a tribal reservation in the Philippines. Agroforestry Systems. 18(3): 225-244.

Explores the optimal land use option for the Ati tribe of Nagpana, Iloilo, Philippines, through economic analysis of present land uses, the potential productivity of these

uses, and an examination of the constraints to conservation practices. Through household surveys, participant observation, discussions with key informants, and analysis of published secondary data, Stewart examines the net present value of four land use strategies, concluding that present farming systems are not sustainable and that a charcoal model with forest retention is more appropriate for Nagpana. Stewart's methodology for assessing the market value of nontimber forest products gathered for subsistence use may be of interest.

Keywords: Economic analysis, land use, survey, household, net present value, subsistence, Ati tribe, Phillippines.

St. Pierre, R.G. 1992. The development of native fruit species as horticultural crops in Saskatchewan. Hortscience. 27(8): 866, 947.

Describes the attempts of the Native Fruit Development Program of the University of Saskatchewan to incorporate native species in horticultural cultivation and management. The goal of the program is to support the diversification and health of agricultural economies by enhancing alternative production based on a mix of farming operations and by expanding food processing industries. Growth in local, national, and international markets (eastern Europe, Japan, Taiwan, and China) is foreseen. A wide range of income per hectare is projected (Can$8,860 to Can$67,500/ha), and development costs are high (Can$3600 to Can$12,000/ha). Program activities include germ plasm collection and selection, development of propagation protocols, the biology and culture of selected species, and information transfer to growers. Targeted native species, also found in the Pacific Northwest, are common chokecherry (*Prunus virginiana*), Saskatoon serviceberry (*Amelanchier alnifolia*), mooseberry viburnum (*Viburnum edule*), cranberry viburnum (*V. opulus*), *Vaccinium* spp., and beaked hazelnut (*Corylus cornuta*).

This article contains significant information about species native to the Pacific Northwest and about constraints, rewards, and potential support from well-planned economic development programs.

Keywords: Native species, economic development, income, germplasm collection, propagation, technical assistance, Saskatchewan, Canada, berries, wild edible plants.

Stratton, Lee. 1990. Resource harvest and use in Tatitlek, Alaska. Tech. Pap. 181. Juneau, AK: Alaska Department of Fish and Game, Division of Subsistence. 163 p.

Surveys multiple subsistence uses in Tatitlek, a small Chugach village on Prince William Sound and the oldest continuously inhabited Alaska Native village in the region. Uses of native plants for food are greatly overshadowed by harvests of fish and game species. Three data collection methods were employed in this study: mapping interviews, household surveys, and interviews with key respondents in 13 households. Village residents also were hired to introduce the researcher and her project and to conduct household surveys. Village participation in the survey was 61 percent and 76 percent respectively, for the two survey years, 1988 and 1989.

Demographic and economic profiles of the village and characterization of household expenses provide the socioeconomic context for subsistence harvesting in the village. Historical uses of native vegetation are described. A list of species known for their historical use and not used during the study years is given. Three-quarters of all households picked berries. Annual per capita harvests were 9.1 and 16.7 lb. Blueberries (*Vaccinium* spp.), salmonberries *(Rubus spectabilis*), small cranberries (*V. oxycoccos*), and currants (*Ribes* spp.) were the most frequently picked. Other greens and mushrooms were picked by only 19 percent of households.

Keywords: Native American uses, subsistence, berries, social surveys, household, Tatitlek, Chugach, Alaska.

Stratton, Lee. 1992. Cordova: a 1988 update on resource harvests and uses. Tech. Pap. 204. Juneau, AK: Alaska Department of Fish and Game, Division of Subsistence. 93 p.

Summarizes research for Cordova in south-central Alaska on noncommercial harvests and uses of wild fish, game, and plant resources in 1988. Although fish harvests dominated wild harvests by weight, wild plants constituted 2.4 percent (equal to 5.6 lb) of the average per capita consumption of subsistence resources for the year. The comparatively more urban and non-Native population of Cordova consumed less subsistence wild foods than did smaller and more remote Alaska Native villages elsewhere around Prince William Sound, but much higher amounts than in similarly sized communities in south-central and southeastern Alaska. The annual plant harvest amounted to 13,448 lb. Most of the vegetation gathered (96.4 percent) was berries.

Methods used to gather data included a household survey that tracked harvest amounts as well as monetary income and household expenses. Stratified random sampling was used to divide the revised estimated permanent resident households into three categories of wild food consumption: high (with furbearer trapping), low (no furbearer trapping), and no consumption. Mapping of resource sources also was carried out. Data on total household income, demography, and distribution of occupations provide a context for the subsistence harvest. The importance of sharing wild food resources in Cordova also is documented. Wild plants were not as widely shared as fish and other resources. Less than one-fourth of all households gave or received wild berries. Use and harvest of berries were down from figures obtained in 1985.

This study serves as a model for conducting similar studies about the subsistence use of wild foods.

Keywords: Native American uses, subsistence, berries, social surveys, Alaska, Cordova.

Suttles, Wayne. 1951. The economic life of the Coast Salish of Haro and Rosario Straits. Seattle, WA: University of Washington. PhD. dissertation.

Tappeiner John C.; Zasada, John C. 1993. Establishment of salmonberry, salal, vine maple, and bigleaf maple seedlings in the coastal forests of Oregon. Canadian Journal of Forestry Research. 23(9): 1775-1780.

Outlines the germination and survivorship of several species used for nontimber forest products in the Pacific Northwest. The species under consideration do not survive well in clearcut conditions and do not compete with young Douglas-fir (*Pseudotsuga menziesii*) seedlings. In contrast, commercial thinning operations favor establishment of the four species (salmonberry [*Rubus spectabilis*], salal [*Gaultheria shallon*], vine maple [*Acer circinatum*], and bigleaf maple [*Acer macrophyllum*]) from seed and perhaps from vegetative reproduction (clones, layering). Managing soil substrate is important; seedling establishment for salal and salmonberry was higher on mineral soil and in thinned stands. Salal seedling growth was erratic and survival was low. Seed predation and browsing were considerable for both maple species. All species except salmonberry thrived best in commercially thinned stands.

This article points to alternatives in understory management in commercially thinned stands that could lead to production of commercial and subsistence crops of nontimber forest products such as salal foliage, moss growing on vine maple and bigleaf maple, and salmonberry crops. Understanding the reproductive biology and success in early survival can provide land managers with strategies to create less risky sources of additional income from forest stands with productive understories.

Keywords: Berries, moss, floral greens, soil disturbance, seed propagation, seedling survival, thinning, comanagement.

Teit, James A. 1930. Ethnobotany of the Thompson Indians of British Columbia. Washington, D.C.: U.S. Bureau of American Ethnology.

Categorizes and discusses economically important plants used by the Thompson Indians under the following headings: medicines, foods, plants chewed, non-medicinal drinks, kinnikinnick (*Arctostaphylos uva-ursi*), dyes, scents, charms, ceremonial plants, and plants mentioned in mythology. Elsie Steedman provides exhaustive descriptions of the uses and methods of preparations from the field notes of Teit.

This article is a very detailed list of uses for native plants, most of which are found in the Pacific Northwest.

Keywords: Native American uses, Thompson Indians.

Terashima, Yoshie; Tomiya, Kenzo; Takahashi, Miyoko; Iwai, Hiroju. 1993. Distribution and characteristics of shiros of *Tricholoma bakamatsutake* in a mixed forest of *Pasania edulis* and *Castanopsis cuspidata* var. *sieboldii*. Transactions of the Mycological Society of Japan. 34: 229-238.

Tewari, D.N. 1993. Non-timber forest produce in poverty alleviation. Indian Forester. 119(12): 959-969.

Argues that nontimber forest products in India have the potential to effect economic improvement for people living in and around forest areas who comprise the 30 percent of the people living below the poverty line. Benefits of development include an alternative food source in the event of famine and a source of products for the Ayurvedic, Unani, and Sidha systems of medicine. Nontimber forest product industries currently generate employment equal to 5 million person years, and incomes from nontimber products in at least eight Indian States comprise 50 percent of state forest revenues and 80 percent of export earnings from forest products. To expand these industries and create wealth, extraction must be sustainable and products must be properly valued. Greater knowledge of development and use of products is needed, particularly for plant chemicals. Some 60 percent of products are directly consumed or bartered and thus are not accounted for in commerce statistics. Resource stewardship of nontimber products in public forests is absent, resulting in resource degradation. Stewardship is much better on private lands. Collecting products offers employment opportunities for entire families, but women predominantly carry out postharvest operations, such as cleaning, sorting, grading, drying, and packing. There is an urgent need for better storage and preservation facilities.

The most crucial problem is marketing of nontimber forest products. Some products, such as sandal (*Santalum* spp.) and tendu (*Diospyros melanoxylon*), are traded exclusively by state monopolies with the result that many people do not or cannot secure the proper permits to participate in the product industry. Tribal collectors receive very low incomes for collecting nonmonopoly products while end-consumers often pay inflated prices; middlemen profit most. There is no government control in these instances. Initial processing should take place in or near the forest to improve the economic and social status of poor people. The 1988 National Forest Policy explicitly calls for increasing the productivity of nontimber forest products per unit area per unit time and promoting site-appropriate, small-scale, forest-based enterprises to support rural development and entrepreneurship. Simple rules and regulations are needed to encourage conservation, cultivation, harvesting, and sale of products. A national seminar held in 1993 issued recommendations for a national strategy for nontimber forest products to carry out national policy. Those strategies are listed in an appendix.

Keywords: Rural development, sustainability, marketing, monopoly, value-added, policy, regulation, national strategy, India.

Thomas, Margaret. 1993. Sustainable development and special forest products. In: IUFRO symposium on forestry and rural development in industrialized countries: where are we going? 19-24 September 1993; Fredericton, NB: [Place of publication unknown]: [Publisher unknown]: 132-146.

Summarizes the role of special forest product microenterprises in sustainable development strategies. The focus of sustainable development should be on providing long-term employment and decent incomes for local people while managing resources in ways that maintain future options. Sustainable development strategies emphasize attracting, keeping, or encouraging development of enterprises that operate in environmentally sound ways.

Thomas notes that sellers can tap into specialty markets, adding value with creative packaging and marketing, and target recreational and tourist markets. She reviews several examples of special forest product microenterprises in the United States, including Texarome (which extracts essential oil from Texas cedar [*Juniperus* spp.]); Litehouse Dressings (which sells huckleberry [*Vaccinium* spp.] products); a one-person operation in Oregon that makes animal bedding from wood shavings; a Minnesota business selling decorative willow (*Salix* spp.); a Montana business selling medicinals; and a woman in West Virginia who runs a special forest product "dude ranch" operation. Her examples range from one-person operations to larger businesses, such as the medicinals company in Montana with a staff of 30 and annual sales of US$3.1 million.

Most of these businesses are run as supplemental, rather than full-time, employment operations. Special forest product-based development strategies work best when local people have strong knowledge of forest ecology and marketable plants and their uses, when the surrounding community supports local products, and when landowners are willing to work through networks of harvesters, growers, and buyers.

Forestry professionals can help rural sustainable development by becoming aware of special forest product opportunities, acting as conduits of information among rural economic development organizations and communities, and working closely with community organizations and leaders. Thomas believes that there are three basic paths to developing special forest product opportunities: policies that favor using a greater diversity of resources, provision of technical assistance in business development, value added and marketing, and development of stewardship contracts and agroforestry demonstration projects.

Keywords: Rural development, market expansion, policy, sustainable development, entrepreneurs.

Tocci, Augusto; Veracini, Alberto. 1990. Tartuficultura e rimboschimento= Truffle culture and reforestation. Economia Montana. 22(6): 24-26. In Italian.

Considers the role of truffles (*Tuber* spp.) in Italian reforestation efforts. With the exodus of rural people to cities, maintenance of rural ecosystems has declined. The reforestation efforts of the 1920s and 1950s have not been sustained. Sheep and goat grazing, in particular, has led to site degradation. Agricultural production has concentrated on the best sites, and marginal lands have been left largely neglected. Reforestation of marginal land by natural processes has been very slow. Combining truffle growing with reforestation provides an economic incentive to restore more quickly. The impetus is the high value of truffles among increasingly affluent Italian consumers. Private benefits to the landowner from truffle revenues are coupled with public benefits from increased hydrological efficiency, reduction of erosion, and recuperation of ecosystem health.

Keywords: Reforestation, truffles, grazing, Italy.

Trappe, James M. 1990. Use of truffles and false-truffles around the world. In: Bencivenga, Mattia; Granetti, Bruno, eds. Atti del II congresso internazionale sul tartufo; 24-27 November 1988; Spoleto, Italy. Spoleto: Comunità dei monti Martani e del Serano: 19-30.

Provides an overview of the uses of hypogeous fungi outside Europe. Apart from desert truffles from the Middle East, southern Africa, and Australia, other forest species of truffles are known from Nepal and India (*Tuber indicum*), Japan (*Rhizopogon* spp.), and Mexico (*Melanogaster umbrinigleba* and *Rhizopogon* spp.). The Japanese species grow in the presence of Japanese red pine (*Pinus densiflora*). In North America, Native American uses of hypogeous mushrooms are not known. However, in the Pacific Northwest, a small truffle industry based on the Oregon white truffle (*Tuber gibbosum*) has emerged. The species prefers elevations less than 300 m and forests less than 100 years old. Disruptive raking of productive sites is the prevalent method of harvest. Other species, *T. levissimum* and *Picoa carthusiana*, also are marketable. Regulation of the industry does not yet exist. Rational harvesting methods are needed, especially the use of dogs to locate truffles. Where fertilization, liming, and weed control have been undertaken, specimens of Oregon white truffle attain diameters up to 10 cm. Joint stand management for Christmas trees and truffles might be one way to increase economic yield. Other culinary truffle species in the United States are found in the South in association with pecan (*Carya illinoisensis*) trees and in Illinois oak (*Quercus* spp.) forests. Introductions of *T. melanosporum* from Europe into hazel and oak stands in the West requires massive liming for successful yields. Texas has sites most similar to the soil and climate of the Périgord region of France, the center of French truffle production.

Keywords: Truffles, market development, fertilization, joint production, United States.

Trinity Project Management Team. 1992. The Trinity project: an economic diversification strategy for rural, timber-dependent communities. Hayfork, CA: U.S. Department of Agriculture, Forest Service, Shasta-Trinity National Forest; final report. 13 p. [plus appendices].

Discusses the potential for realigning the rural economy of Trinity County, California, away from single resource dependence on timber. Forty-five percent of the population is characterized as low or very low income, and unemployment averages 14 percent. An untapped market for natural floral, culinary, decorative, medicinal, and pharmaceutical products exists both domestically and internationally. Herbal medicine products are particularly sought after in Europe. Growing such plants requires only small parcels of land. With growers pooling harvests, large volumes could be amassed for sale, and eventually value-added processing facilities could be established. A 5-year goal is to convert 480 acres to medicinal herb production. In the third year of production, average annual revenue per acre is estimated at US$34,600. In 1992, Trinity Alps Botanicals was formed as a marketing association. Other important products in the area are pine (*Pinus* spp.) cones, mosses, boughs of incense-cedar (*Calocedrus decurrens*), tanoak (*Lithocarpus densiflorus*), and canyon live oak (*Quercus chrysolepis*). Combining cultivation of native plants of commercial value with landscape restoration would create enduring economic benefits for the region. These activities provide new

impetus to rural economic development in both the short and long term. The Trinity Project provides technical and financial planning assistance, because people have limited experience growing herbs and information is often scarce or inaccessible. Extension tools in the project include a resource inventory, outreach to farmers and foragers, and workshops. Appendices to the report include several pro forma business plans, the Shasta-Trinity National Forest resource inventory of vascular plants, and a grower's guide.

Keywords: Rural economic development, Trinity Project, Shasta-Trinity National Forest, moss, business plans, herbs, medicinal plants, marketing association, California.

Turner, Nancy. [In press]. Traditional ecological knowledge. In: Schoonmaker, Peter; von Hagen, Bettina; Wolf, Edward C., eds. The rainforests of home: an exploration of people and place. Washington, DC: Island Press.

Explores the importance and validity of indigenous knowledge in the Northwest Coast culture area. Turner describes the role of traditional ecological knowledge among a variety of Northwest Coast cultures in shaping spirituality and enforcing the sustainable use of resources. Strategies that helped to optimize the sustainable use of resources included the use of salmon weirs, which allowed both capture and observation of the health of salmon runs, selective burning to enhance berry production, and selective harvesting of bark, cedar planks, fiber, root vegetables, and medicinal plants. For example, boards were split from standing cedar trees, leaving the tree alive. Ecological indicators were used to estimate resource abundance and appropriate harvesting times; for example, a low incidence of twin fawns suggested to the natives that they use constraint in the number of deer taken. Resource sustainability also was ensured through strategies based on diversity and adaptability. Northwest Coast cultures relied on at least 400 plant species and 100 animal species. Adaptive strategies are reflected in social organizations such as family and kinship groups, which permit sharing of goods and services. Finally, sustainable resource use relied on effective exchange of information among cultural groups and generations and the development of culturally appropriate ways of teaching and learning.

Keywords: British Columbia, indigenous knowledge, Pacific Northwest, sustainability.

Turner, Nancy C.; Bell, Marcus A.M. 1971a. The ethnobotany of the Coast Salish Indians of Vancouver Island [part 1]. Economic Botany. 25(1): 63-104.

Turner, Nancy C.; Bell, Marcus A.M. 1971b. The ethnobotany of the Coast Salish Indians of Vancouver Island [part 2—appendix]. Economic Botany. 25(3): 335-339.

Summarizes the uses of plants in Salish culture for food, tools, furnishings, medicines, and religious rites. Information is gleaned from early anthropological studies and interviews with three Salish informants. The author gives details of uses for species, mode of collection, storage, and preparation. Fungi comprised

a very minor component of the Native diet. The plant families with the largest numbers of species used for food are *Liliaceae* (important for carbohydrates), *Ericaceae*, *Grossulariaceae*, *Rosaceae* (the highest proportion of fruit), and *Umbelliferae*. The *Rosaceae* and *Umbelliferae* are the most significant for native medicinals. Uses of plants among the western Washington Salish people were very similar or identical (60 percent) to uses among the Vancouver Island Salish. With the interior Thompson Indians, the overlap is only 20 percent. An appendix lists all known plants used by the Salish and their respective uses.

Keywords: Ethnobotany, Salish, Thompson Indians.

Turner, N.J. 1979. Plants in British Columbia Indian technology. Handb. 38. Victoria, BC: The British Columbia Provincial Museum. 304 p.

Turner, N.J.; Bouchard, R.; Kennedy, D.I.D. 1980. Ethnobotany of the Okanagan-Colville Indians of British Columbia and Washington. O. P. S. n. 21. Victoria, BC: British Columbia Provincial Museum. 156 p.

Turner, Nancy J. 1971. Native economic plants of Totem Park. Davidsonia. 2(2): 22-28.

Turner, Nancy J. 1972. The ethnobotany of the Bella Coola Indians of British Columbia. Syesis. 6: 193-220.

Turner, Nancy J. 1973. The ethnobotany of the southern Kwakiutl Indians of British Columbia. Economic Botany. 27(3): 257-310.

Turner, Nancy J. 1974. Plant taxonomic systems and ethnobotany of three contemporary Indian groups of the Pacific Northwest (Haida, Bella Coola, and Lillooet). Syesis. 7 (Supp. 1): [pages unknown].

Turner, Nancy J. 1975. Food plants of British Columbia Indians. Part 1: Coastal peoples. Handb. 34. Victoria, BC: The British Columbia Provincial Museum. 264 p.

Turner, Nancy J. 1978. Food plants of British Columbia Indians. Part 2: Interior peoples. Victoria, BC: The British Columbia Provincial Museum. 250 p.

Turner, Nancy J. 1981. Indian use of *Shepherdia canadensis*, soapberry, in western North America. Davidsonia. 12(1): 1-14.

Characterizes the use of russet buffaloberry (*Shepherdia canadensis*) and its close relative silver buffaloberry (*S. argentea*) in northwest North America for food (edible fruits), sources of medicine, and weaving and rope making from the fibrous

bark. Saponins (natural detergents) in the berries cause foaming. Usually berries are cooked, dried, and stored in solid cakes. Details of native trade in buffaloberries and their use in creating “Indian ice cream” also are given.

Keywords: Wild edible plants, medicinal plants, saponins, berries, North America.

Turner, Nancy J. 1982. Traditional use of devil’s club (*Oplopanax horridus*: Araliaceae) by Native peoples in western North America. Journal of Ethnobiology. 2(1): 17-38.

Characterizes medicinal applications of devilsclub (*Oplopanax horridus*) including treatment for rheumatism, arthritis, digestive ailments, tuberculosis, colds, skin diseases, and diabetes. Specific plant uses by different ethnic groups over the natural range of the plant are detailed in a table. The plant has hypoglycemic properties but is not well understood pharmacologically. Aside from its physical properties for healing, devilsclub also is used in shamanistic practices to confer protection and purification on people. Devilsclub wood is used to make fishing lures, bark is used as a deodorant, and charcoal is used as ceremonial face paint.

Keywords: Indigenous uses, medicinal plants, ethnobotany.

Turner, Nancy J. 1991. Burning mountain sides for better crops: aboriginal landscape burning in British Columbia. Archaeology in Montana. 32(2): 57-73.

Turner, Nancy J.; Bell, Marcus A.M. 1973. The ethnobotany of the southern Kwakiutl Indians of British Columbia. Economic Botany. 27 (3): 257-310.

Turner, Nancy J.; Davis, Alison. 1993. When everything was scarce: the role of plants as famine foods in northwestern North America. Journal of Ethnobiology. 13(2): 1-28.

Turner, Nancy J.; Efrat, Barbara S. 1982. Ethnobotany of the Hesquiat Indians of Vancouver Island. Cult. Recov. Pap. 2. Victoria, BC: The British Columbia Provincial Museum. 99 p.

Synthesizes information from taped interviews, primarily with four Hesquiat elders, on the traditional economic botany culture of the Hesquiat people. Certain ecosystems such as acid bogs produced *Sphagnum* spp., Labradortea (*Ledum* spp.), and small cranberries (*Vaccinium oxycoccos*), which were rare or absent elsewhere. Contact with Europeans also brought many new plants to the region that were incorporated rapidly into the corpus of plant use. European crop plants have supplanted the use of many native species as root crops and vegetable greens. Gathering plant foods had a distinct seasonal cycle beginning with horsetail (*Equisetum* spp.), common cowparsnip (*Heracleum lanatum*), salmonberry (*Rubus spectabilis*), and thimbleberry (*R. parviflorus*) shoots in the spring and early summer, followed by a rapid succession of other berries throughout the summer. Edible “root” crops such as western brackenfern (*Pteridium aquilinum*), rhizomes, cows clover (*Trifolium wormskioldii*), and Pacific silverweed (*Argentina egedii*)

roots, and bulbs were dug in the fall. Dried cakes of salal (*Gaultheria shallon*) berries were an important item in trade among coastal village groups on Vancouver Island. Individual ownership of plant resources, such as berry patches and western redcedar (*Thuja plicata*) groves, was recognized. Western redcedar was the most important plant for roping and basketry, and fine clothing was made from the inner bark of Alaska yellow-cedar (*Chamaecyparis nootkatensis*). Barks of western hemlock (*Tsuga heterophylla*) and red alder (*Alnus rubra*) were used for dyes. Medicinal use of plant followed practices found among other peoples in the region. Herbalists believed that plant medicines were more effective if their composition were kept secret. Yarrow (*Achillea millefolium*), licorice fern (*Polypodium glycyrrhiza*), cascara (*Frangula purshiana*), Sitka spruce (*Picea sitchensis*), and western hemlock, however, were widely known for their curative effects. A list of plants with known names in the Hesquiat language and their known ethnobotanical uses are listed.

Keywords: Ethnobotany, Hesquiat, British Columbia, wild edible plants, basketry, weaving, medicinal plants, dye plants.

Turner, Nancy J.; Hebda, Richard J. 1990. Contemporary use of bark for medicine by two Salishan native elders of southeast Vancouver Island, Canada. Journal of Ethnopharmacology. 29: 59-72.

Reports on the traditional use of tree and shrub barks by Native Americans in the Pacific Northwest. Interviews with two Native herbalists provide a compendium of 23 tree and shrub species used by Salish peoples. Grand fir (*Abies grandis*) was the most widely used conifer tree. Members of the rose family figure importantly in medicinal bark use: Saskatoon serviceberry (*Amelanchier alnifolia*), Oregon crabapple (*Malus fusca*), Indian plum (*Oemleria cerasiformis*), bitter cherry (*Prunus emarginata*), Nootka rose (*Rosa nutkana*), and salmonberry (*Rubus spectabilis*). Uses include treatments for respiratory and digestive ailments, diabetes, fever, childbirth, and skin problems. Steps to prepare two bark-based recipes for medicinal use are given in full. Bark is harvested from the east side of the plant and only in small quantities. The authors call attention to a revival in interest among residents of western Canada in traditional medicine and its potentially wider role in public health.

Keywords: Bark medicines, medicinal plants, indigenous uses, Salish.

Turner, Nancy J.; Kuhnlein, Harriet V. 1982. Two important “root” foods of the Northwest Coast Indians: springbank clover *(Trifolium wormskioldii)* and Pacific silverweed (*Potentilla anserina* ssp. *pacifica*). Economic Botany. 36: 411-432.

Describes the historical use of two important wild plants in the diets of Northwest Coast Indians. Rhizomes of cow clover (*Trifolium wormskioldii*) and roots of Pacific silverweed (*Argentina egedii*) were harvested, prepared, and eaten in a similar manner. They are often found in association along shorelines and alluvial flood plains as the dominant herbaceous species. Harvest occurred from October to March, and only women did the work. Average harvest was 500 g to 1 kg per hour. Harvest of sufficient quantities for a family’s winter use would take several days. Traditional harvest areas for the two species were marked out and passed from one generation to the next. Actual domestication of cow clover occurred in the 1920s in British Columbia. The rhizomes and roots generally were eaten cooked,

often after being steamed in an underground pit. The clover resembles the taste of cooked beansprouts; silverweed is comparable to sweet potato. The clover foliage is also a source of greens over a long season in spring and summer.

These species may be important for their potential to furnish commercial wild crops and eventual domestication as agricultural plants. The plants improve diversity of available food with good nutrition. The lands where these two plants grow together do not support any other kind of agriculture except grazing.

Keywords: Wild edible plants, Native American uses, traditional food, harvest, domestication, land use, British Columbia, Northwest Coast Indians.

Turner, Nancy J.; Kuhnlein, Harriet V. 1983. Camas (*Camassia* spp.) and rice-root (*Fritillaria* spp.): two liliaceous root foods of the Northwest Coast Indians. Ecology of Food and Nutrition. 13: 199-219.

Turner, Nancy J.; Thomas, John; Carlson, Barry F.; Ogilvie, Robert T. 1983. Ethnobotany of the Nitinaht Indians of Vancouver Island. Occas. Pap. 24. Victoria, BC: British Columbia Provincial Museum. 165 p.

Turner, Nancy J.; Thompson, Laurence C.; Thompson, M. Terry; York, Annie Z. 1990. Thompson ethnobotany: knowledge and usage of plants by the Thompson Indians of British Columbia. Memoire 3. Victoria, BC: Royal British Columbia Museum. 335 p.

Ulluwishewa, Rohana. 1991. Modernization versus sustainability: disintegrating village agroecocomplexes in the dry zone of Sri Lanka. Environmental Conservation. 18(2): 103-109.

Urbani, Ana. 1985. Ritratto di tartufo dalle origini a oggi=Portrait of truffles from the earliest times to the present. Milan: SugarCo Edizioni S.r.l. 271 p. In Italian.

Suggests that truffle (*Tuber* spp.) production is worthwhile on sites with low fertility where forestry in combination with truffle production has the highest economic value. An accounting of stand establishment costs and expected yields for 400 hazelnut (*Corylus avellana*) trees per ha with truffle inoculation is provided in the appendix. Regional and national laws regarding the management, harvest, and commerce of truffles are cited in appendices as well.

Keywords: Wild edible mushrooms, Italy.

Urbani, Bruno. 1990. Problematiche attinenti la legislazione nazionale, regionale e fiscale sul tartufo come prodotto agricolo: la capacità di assorbimento del mercato per quanto attiene i nuovi impianti tartufigeni in produzione nel prossimo futuro=Problems regarding national, regional, and fiscal legislation of truffles as agricultural products: capacity of the market to absorb truffle plantations soon to be in production. In: Bencivenga, Mattia; Granetti, Bruno, eds. Atti del II congresso internazionale sul tartufo; 24-27 November 1988; Spoleto, Italy. Spoleto: Comunità montana dei monti Martani e del Serano: 639-644. In Italian.

Examines market response to increases in truffle (*Tuber* spp.) production from the expansion of cultivated truffle plantations. Because Italian law states that the right of truffle harvest is free ("res nullius"), truffles are subject to a higher rate of taxation than the rate normally applied to agricultural products. The tax status of truffles in Italy is at variance with other European Economic Community nations, thus creating unfair competition.

Keywords: Legislation, truffle markets, truffle plantations, Italy, European Economic community, trade.

U.S. Department of Agriculture. 1960. Forest industry opportunities in rural development. Washington, DC.

U.S. Department of Agriculture. 1963. Special forest products for profit: self-help suggestions for rural areas development. Agric. Info. Bull. 278. Washington DC: 64 p.

Focuses on opportunities to augment the products and services of the 4.5 million family-owned forest acres in the United States. Income-generating products for rural development include decorative plant materials, horticultural plant stocks, seed collection, wild foods (including honey), medicinal plants, aromatic oils, naval stores, mulches, and recreational services.

Professional expertise of foresters and the personal needs of landowners can assure a reliable plan for economic stability of rural families. Case histories of successful business ventures for each of the product lines describe important factors to consider in establishing new businesses. Special mention is made of the floral greens industry in the Pacific Northwest, emphasizing the importance of evergreen huckleberry (*Vaccinium ovatum*), salal (*Gaultheria shallon*), and western swordfern (*Polystichum munitum*) and the cascara (*Frangula purshiana*) bark trade.

People interested in establishing forest-based enterprises are urged to follow eight planning steps: (1) take stock of current available products and assets, (2) become familiar with existing businesses in an area of personal interest, (3) examine current and potential markets and outlets, (4) investigate labor supply, (5) explore options for financing, (6) know legal and regulatory restrictions and obligations, (7) develop a strategy for sales promotion, and (8) draw up an explicit, long-range business plan.

Keywords: Alternative income, business plan, cascara, medicinal plants, floral greens, multiple use, rural development.

U.S. Department of Agriculture, Forest Service. [n.d.]. Special forest products: Region 6 update. [Place of publication unknown]: [Pacific Northwest Region].

Summarizes special forest products program and provides suggestions for future direction. Lists fiscal year 1991 special forest product sales as derived from information request sent to each Forest in the Region in January 1992. Permits,

quantity sold, and value of sale are listed by Forest and by product for mushrooms, beargrass, and Christmas trees: all other products are aggregated for the region.

Keywords: Pacific Northwest, Forest Service, sales, permits.

U.S. Department of Agriculture, Forest Service. [n.d.]. The forest beyond the trees: a browser's guide to special forest products. Olympia, WA: Pacific Northwest Region, Olympic National Forest.

Describes some of the special forest products found in the Olympic National Forest and discusses their uses and whether they fall within commercial or noncommercial permit programs. Products described include saw logs, cedar, firewood, bark, poles, transplants, rock, floral greens, berries, mushrooms, medicinal plants or plant parts, and cones. A chart in the back lists various kinds of products, the permits available, and certain restrictions such as allowable quantities and duration of permits.

Keywords: Olympic National Forest, permits, wild edible mushrooms, wild edible plants, medicinal plants, berries.

U.S. Department of Agriculture, Forest Service. 1989. Rural development opportunities in special forest products. Washington, DC: Cooperative Forestry. 23 p.

Proposes that special forest products be considered tools for creating jobs and improving the economy and quality of life for rural Americans. Twenty-six product categories are suggested as alternatives or additions to timber-based rural economies. Major species for each product category are given in an appendix. The emphasis is on products requiring small initial capital investments. Development of special forest product industries raises concerns about the potential for overharvest, conflicts among users often based on destructive competition and cultural differences, tensions between product gatherers and buyers, occupational safety, public health, and property rights. Crucial factors in the development of new industries and helpful educational tools to bring greater awareness of special forest products to forest-based communities are discussed as well.

Keywords: Rural development, United States.

U.S. Department of the Interior, Bureau of Land Management. 1992. Pacific yew comprehensive management strategy. Portland, OR. 20 p. [plus appendix].

Summarizes the recommendations of a task force established by congressional direction to provide for the sustainable management of the Pacific yew (*Taxus brevifolia*). Interest in the Pacific yew grew after a National Cancer Institute screening in 1962 revealed cytotoxic activity in yew bark extracts. Taxol (diterpene amide) was identified as the active substance and toxicology studies followed. In 1991, taxol advanced to clinical trials and limited treatment, demand shot up to 750,000 lb of bark, and a Collaborative Research and Development Agreement was signed with Bristol-Myers Squibb. These events precipitated concern for yew conservation and management and the formation of the task force.

The task force report reviews the history of taxol development, describes current and planned yew programs, and identifies yew management issues. Programs described include administrative policies, the annual agreement between Bristol-Myers Squibb and the Bureau of Land Management, Pacific yew inventories, the preparation of a Pacific yew environmental impact statement, resource management plans, existing laws, regulations and policies, and Pacific yew regeneration and research activities. Identified yew management objectives included ensuring a sustainable yew supply to the medical community and ensuring full consideration of ecosystem relations in Pacific yew management plans and decisions. The background of each objective is explored and, past, current, and planned activities to support the objective are discussed.

Keywords: Yew, medicinal plants, taxol, management, policy.

U.S. Department of the Interior, Bureau of Land Management Task Force. 1993. Managing special forest products in Oregon and Washington: a final report. Portland, OR. [Irregular pagination].

Summarizes the work of a Bureau of Land Management task force in identifying 12 major issues limiting effective management of special forest products harvested in Oregon and Washington. The 12 limiting issues are described, along with background information, identification, and analysis of options, recommendations, rationale, and implementation procedures for each issue. Categories of issues include contract and permit administration, contracts, pricing, the National Environmental Protection Act process, recording timber sales, inventory, monitoring and research needs, qualifications of special forest product personnel, public education, and road maintenance. Five major recommendations are made: (1) expand nontimber forest product analysis in Resource Management Plans and Environmental Impact Statement documents; (2) develop an Oregon and Washington handbook for uniform standards and guidelines for nontimber forest product management; (3) provide funds and management personnel for enhancing nontimber forest product programs; (4) complete inventory, monitoring, and research; and (5) conduct effective public education, extension, and outreach.

Keywords: Education, forest management, inventory, research and development.

Vales, D.J. 1986. A bibliography on salal (*Gaultheria shallon* Pursh). Veg. Manage Res. Rep. VMR-1. Victoria, BC: British Columbia Ministry of Forests, Vancouver Region Research Group.

Vales, David Joseph. 1986. Functional relationships between salal understory and forest overstory. Vancouver, BC: University of British Columbia. M.S. thesis.

Valmonte, A.D.; Alonzo, D.S.; Lopez, F.R. 1971. Bibliography of Philippine minor forest products. Compilation 1. Laguna, Philippines: Forest Products Research and Industries Development Commission. 25 p. [372 refs.].

Vance, N.; Peterson, C.; Steinfeld, D. [and others]. 1993. Special forest products. Silvicultural Institute XV, Module 5. Unpublished manuscript. On file with: N. Vance, Pacific Northwest Research Station, Forestry Sciences Laboratory, 3200 SW Jefferson Way, Corvallis, OR 97331.

Includes responses of silviculturists from Indian nations, the U.S. Department of the Interior, Bureau of Land Management, and the USDA Forest Service throughout the Pacific Northwest to a questionnaire on special forest products. Survey questions address management constraints to joint production systems, means to integrate productions, ways to estimate economic returns for comparison with timber revenues, and ways to manage species for which existing information is inadequate. The authors also include a management plan for noble fir (*Abies procera*) boughs, examples of financial analysis, a list of special forest products (plants and fungi, both native and introduced) marketable in the Pacific Northwest, and a bibliography of articles about special forest products in the Pacific Northwest.

Keywords: Survey, silviculture, management, planning, joint production, economic returns, financial analysis, species lists, wild edible mushrooms, wild edible plants, cultivated mushrooms, Pacific Northwest.

Vance, Nan C. 1995. Medicinal plants rediscovered. Journal of Forestry. 93(3): 8-9.

Discusses the role of medicinal plants in the development of many commercial drugs. In the United States, many of the traditional medicines used by Native American immigrant groups have disappeared from common usage. The resurgence of interest in holistic medicine, however, has prompted renewed efforts to collect wild plants for medicinal purposes. Examples of North American plants and their development as medical resources are Pacific yew (*Taxus brevifolia*) and American ginseng (*Panax quinquefolius*). Conservation of plant populations and conflict among user groups for resources on public lands are two emerging areas for which policy development is needed.

Keywords: Medicinal plants, phytochemistry, conservation, resource conflicts, policy.

Vander Kloet, S.P. 1988. The genus *Vaccinium* in North America. Pub. 1828. Ottawa, ON: Agriculture Canada, Research Branch. 201 p.

Presents descriptions of all North American species of *Vaccinium*, detailing habitat, range, and economic importance and use. Information also is given on cultivation, reproduction, seed dispersal, mycorrhiza, and classification. This book offers a good introduction to *Vaccinium* species found in the Pacific Northwest.

Keywords: Berries, North America, cultivation, reproduction, seed dispersal, mycorrhiza.

VanGaasbeck, Scott. 1992. A guide to edible and useful plants of the Siskiyou National Forest. Grants Pass, OR: U.S. Department of Agriculture, Forest Service, Siskiyou National Forest. 46 p.

Lists common edible berries, nuts, spices, greens, and mushrooms as well as medicinal and fiber plants found in the Siskiyou National Forest. Each species, its habitat, its uses, and modes of preparation are described. Requirements for permits and limits to harvest amounts are stipulated. Guidelines for responsible collecting are given: collect no more two-thirds of any one plant's fruit and one-tenth of its leaves, and not more than one-twentieth of an entire population when collecting whole plants.

Keywords: Economic botany, Siskiyou National Forest, permits, preparation, sustainability, berries, nuts, wild edible plants, wild edible mushrooms, medicinal plants, basketry, weaving.

Vasquez, Rodolfo; Gentry, Alwyn H. 1989. Use and misuse of forest-harvested fruits in the Iquitos area. Conservation Biology. 3 (4): 350-361.

Provides an overview of some of the fruits in the Iquitos (Peru) area that potentially could be developed either as plantation crops or wild edibles. From data collected in 1987, the authors note that rural people use about 139 wild fruits, of which at least 52 species are sold in the Iquitos market. At least 28 are sold regularly, and over half the fruit species in the Iquitos market are harvested from the wild. About half the fruit vendors sell wild fruits. Forest diversity could become an economic advantage if more attention were paid to fruit and less to timber. For the forest dweller, this strategy would reduce risk and provide incentives to retain forest cover.

Despite the economic promise of wild fruits, the authors note that it is important to keep in mind the dangers of commercialization. Using tropical fruit marketing as a conservation strategy requires that new markets be developed and that trees not be destroyed during the harvesting process. The authors cite the case of the aguaje palm (*Mauritia* spp.), which has a highly valued fruit. Despite increases in price, production of aguaje seems to be falling. Other fruits have virtually disappeared despite their high value, indicating a production crisis. For aguaje, the production crisis is due to harvesters cutting down the trees to get the fruit rather than picking the fruit. Harvesters in one area now have to walk several days to reach harvestable stands. To combat destructive harvesting, the Iquitos Distrito Forestal has begun to charge a tax on extraction rights for two of the most important fruits (*Mauritia* and *Jessenia*). A portion of this tax is to be spent on reforestation. The authors note that harvesters rarely pay the tax, that no reforestation has been done, and that no harvesting education efforts have been undertaken. Other fruits are currently not regulated at all.

Keywords: Amazon, tropical rain forest, market expansion, wild fruit, conservation.

Villarreal, L.; Perez-Moreno, J. 1989a. Aprovechamiento y conservacion del "matsutake americano" (*Tricholoma magnivelare*) en los bosques de México = Use and conservation of the "Amercian matsutake" (*Tricholoma magnivelare*) in Mexican forests. Micologia Neotropical Aplicada. 2: 131-144. In Spanish.

Reports on the development of a market for the American matsutake (*Tricholoma magnivelare*) from Mexico in Japan since 1985. Annual harvest has reached 15 tonnes. Harvesting has been reported from the States of Mexico, Michoacan,

Hidalgo, Puebla, and Veracruz. Indigenous consumption is not known. Prices reached a high of US$17.00 per kg in 1989 in Veracruz State. Average prices are from US$5.75-7.70 per kg. The species occurs in association with *Pinus teocote* and fruits in the rainy season between July and October. More than 3000 kg were collected in Cofre de Perote National Park, Veracruz, over 7 weeks in 1988, averaging a daily aggregate harvest of 56 kg.

Products are subject to specifications of the Japanese market and Mexican phytosanitary standards. Mushrooms must be cut by hand and cleaned, be kept fresh and undamaged, have no maggots, and be stored at the right humidity. Shipping occurs in storage containers kept at 8 °C from the collection point to the packing station, and at 4 °C when shipped abroad. Japanese store prices are about US$50.00 per lb. Harvests of the intensity experienced in the last 5 years may be considerably reducing the viable wild populations in harvest regions to the point of threatening their survival. In many areas, the species is now rare. Damage occurs when basidiocarps cannot release sufficient spores to start new colonies before they are picked. The mycelia are damaged by basidiocarp collection and soil compaction. Conservation of the species requires retention of the forest cover and better understanding of the biology and ecology of the matsutake. The governments of the States of Hidalgo and Veracruz signed accords in 1989 with Japanese importers and the local collectors to ensure conservation measures. The accord in Hidalgo was annulled because of lack of due process. Ecological and physiological studies are needed to demonstrate the allowable harvest intensity to guarantee future conservation of the matsutake. Efforts also are underway to train and inform collectors about best harvesting practices.

Keywords: Wild edible mushrooms, harvesting, price, sustainability, conservation, trade, Mexico, Japan.

Villarreal, L.; Perez-Moreno, J. 1989b. Los hongos comestibles silvestres de México, un enfoque integral=The wild edible mushrooms of Mexico: an integrated focus. Micologia Neotropical Aplicada. 2: 77-114.

Presents an overview of existing knowledge about historical and current consumption of edible wild mushrooms in Mexico. Provides a chronological list of scientific articles citing instances of edible mushrooms in Mexico and of species currently found in Mexican markets. The authors refer to existing literature and their multiple visits to 10 markets in Veracruz State. For each species, the vernacular and scientific names, the markets where found, dates, price, age and sex of the mushroom gatherer or vendor, and the approximate volume for sale were recorded from each visit. Women and children comprised 70 percent of the gatherers and averaged 4 to 10 kg of sales per day with incomes depending on the variable prices for different species. Golden chanterelles (*Cantharellus cibarius*) and king boletes (*Boletus edulis*) were among the most frequently encountered species. Prices average US$2.50-5.00 per kg. Most trade in mushrooms in Mexico involves domestic use; limited export of mushrooms was primarily to the United States between 1984 and 1987 and amounted to US$410,000. Mushroom imports from the United States have less than a quarter of this export value.

A program to expand trade must consider ecological, economic, and social issues of mushroom harvests. Very little is known about how to manage harvests sustainably. Data about reproductive phenology and productivity are based on

studies undertaken between 1983 and 1985 in Cofre de Perote, Veracruz. Integrated studies on edible mushrooms in Mexico are proposed, with a focus on fungal taxonomy, ecology, and ethnomycology.

Keywords: Wild edible mushrooms, price, harvesters, social organization, markets, trade, Mexico.

Villarreal, Luis; Guzmán, Gastón. 1986. Producción de los hongos comestibles silvestres en los bosques de México. II.=Production of wild edible mushrooms in the forests of Mexico. Part 2. Biotica 2(4): 271-284. In Spanish.

Reviews data on the production of edible wild mushrooms in the forests of El Cofre de Perote, Veracruz, Mexico, in 1984. Fruiting body production is analyzed in conjunction with the abundance, phenology, growth form, substrate, mycorrhizal features of species, and environmental factors such as temperature and rainfall. Four plots in two forest types (pine and pine–true fir) were inventoried. The pine forest contained more species of edible mushrooms as compared to the pine–true fir forest and as compared to the previous year. The golden chanterelle (*Cantharellus cibarius*) was found widely in both forests in 1984 and only in low numbers in the pine–true fir forest the year before. Estimated production of commercial mushrooms per hectare per year was 860 kg in the pine forest and 454 kg in the pine–true fir forest, both lower than values obtained in 1983. The values are higher estimates than any previously made for forest ecosystems.

Keywords: Wild edible mushrooms, production, abundance, phenology, growth form, substrate, environmental factors, forest type, Mexico.

von Aderkas, Patrick. 1984. Economic history of ostrich fern, *Matteuccia struthiopteris*, the edible fiddlehead. Economic Botany. 38(1): 14-23.

Describes the factors that have led to a sharp increase in demand for the ostrich fern, *Matteuccia struthiopteris*, which historically was consumed as a seasonal delicacy in Maine and the Maritime Provinces of Canada. In 1984, only one company processed ferns for commercial sale, and the market for its products remains restricted to New England and New York. Harvesting of ferns is still done mostly by Native Americans, and prices range between US$0.22 and $0.50/lb at the buying station. Production in Maine is estimated at 40 to 50 tons, of which 12 to 15 tons are processed by one firm. Canned ferns have been largely replaced by frozen ferns, which are presently produced by just one firm in New Brunswick. This firm produces between 50 to 100 tons per season, with production depending on labor availability and the timing and severity of frosts.

Licensing of pickers in Maine is controlled by the Passamoquoddy tribe, which exercises rights to fern grounds within its reservation. No such regulation exists in New Brunswick. Recently the Métis and Non-Status Indians in New Brunswick have discussed the possibility of forming a cooperative society to assist them in marketing the ferns. Overharvesting has been reported in the St. John River Valley since the early 1970s. Attempts to propagate ostrich fern on a large scale have proven unsuccessful. Currently research on the ostrich fern is being carried out by the Department of Agriculture in New Brunswick, as well as by the Atlantic Fiddlehead Research Organization. The author argues that the development of

the ostrich fern market will require the ability to propagate this species through tissue culture on a mass scale.

Keywords: Ferns, wild edible plants, technology development, producer cooperative, domestication, Native American, Passamoquoddy, Canada, Atlantic Fiddlehead Research Organization, North America.

von Hagen, B. 1993. A preliminary assessment of the special forest products industry as a sustainable development vehicle for timber dependent communities in the Pacific Northwest. Paper presented at the Oregon Academy of Sciences, 27 February 1993, McMinnville, OR. On file with: Ecotrust, 1200 NW Front, Suite 470, Portland, OR 97209.

Analyzes the emerging special forest product industry in the Pacific Northwest from a sustainable development perspective. Significant special forest products are described and sales volumes, harvest history and management issues briefly summarized. Potential markets, industry structure and trends and regulatory issues also are reviewed. Critical questions needing to be addressed before special forest product harvesting can be recommended as a viable sustainable development activity are outlined.

Keywords: Sustainable development, management, policy.

Walls, J.; Freed, J.; Myer, J. [and others]. 1991. Agroforestry research project 1991. [Place of publication unknown]: Columbia-Pacific Resource Conservation and Development Council. 74 p. [plus appendices].

Investigates the feasibility of an economic development project based on agroforestry in the four-county area of Grays Harbor, Mason, Pacific, and Wahkiakum Counties in Washington. Feasibility was explored through a survey of 862 businesses, 3,800 large and small timberland owners, and 156 farmers, small-scale agriculture operators, business organizations, and commodity buyers. Survey results and economic development potential are discussed for floral greens, native plants, mushrooms, Christmas trees, and medicinal plants. Perceptions by land owners and managers of the development of the special forest product industry also were explored through informal interviews with public and private foresters and land managers. Agricultural production and marketing opportunities are reviewed, followed by a discussion of cooperatives.

Appendices include (1) samples of permits, leases, and product specification lists from special forest product buyers; (2) brief descriptions of commonly harvested special forest products; (3) bibliographies for agroforestry, agriculture, and cooperatives, among other topics; (4) Washington State economic development assistance guide; and (5) a special forest products directory with over 1,000 entries, including a guide to Paradox 3.5, the database management program used for the directory.

Keywords: Floral greens, native plants, wild edible mushrooms, conifer greens, medicinal plants, economic development, survey, cultivation, cooperatives, directory, southwestern Washington, Grays Harbor County, Pacific County, Wahkiakum County, Mason County.

Walter, G.R. 1978. Economics of multiple-use forestry. Journal of Environmental Management. 5: 345-356.

Argues that a transition to forest management for multiple use is difficult to achieve. Historical precedence of a single economic product (timber), the tradition of free access to all other resources, difficulty in analyzing joint production, and internalized damage costs make achieving a socially acceptable allocation of goods and services difficult. Multiple use allocations are not easily solved because the production possibility curves may be difficult to discern, and prices for many forest products may not exist or be figured in economic calculations. Management for multiple use is complicated by spatial diversity, different modes of analysis, and historical complexity. Shifts in public opinion and political pressure make the search for solutions dynamic and ongoing.

Keywords: Multiple use, joint production, societal preference, management, economic analysis.

Warren, D.M.; Brokensha, D.; Skikkerveer, [first name or initial unknown]. 1991. Indigenous knowledge systems: the cultural dimension of development. London: Kegan Paul International.

Washington State Department of Agriculture. 1991. Wild mushroom harvesting: wild mushrooms harvested in Washington State during 1991. [Place of publication unknown].

Washington State Department of Agriculture; Washington Agricultural Statistics Service. 1990. Wild mushroom harvesting in Washington State, 1989. Olympia, WA. 4 p.

Summarizes the wild mushroom harvest in Washington State in 1989, the first year that the Wild Mushroom Harvesting Act was in force. The act mandates gathering data regarding commercial harvest so that better decisions are made about potential regulation and control of wild mushroom harvests. Commercial buyers and processors must be licensed and report the quantity of mushrooms purchased. The act also encourages recreational harvesters to report harvests voluntarily.

Harvests and shipments of wild mushrooms were low as the result of a lack of rainfall. The value of the reported wild mushroom harvest was more than US$652,000 with an average price per pound of US$2.53. Purchasers bought 257,000 lb. Grays Harbor and Mason Counties constituted the bulk of mushroom harvests (95 percent). Chanterelles comprised 97 percent of the volume. Other prominent species were king boletes (*Boletus eduls*) and the American matsutake (*Tricholoma magnivelare*), the most valuable species at US$13.49/lb statewide. Chanterelles were exported mostly to West Germany (9,750 lb), and processed morels were exported to Japan (38,800 lb). Recreational harvests, reported by mycological societies, showed that the most popular counties for recreational picking were Chelan, King, and Snohomish.

Keywords: Wild edible mushrooms, harvests, shipments, price, volume, trade, Wild Mushroom Harvesting Act, commercial value, recreational picking, Washington.

Wästerlund, Iwan. 1989. Hur påverkar skogens skötsel förekomsten av storsvamparnas fruktkroppar?=How is the occurrence of mushroom fruitbodies influenced by silvicultural treatments? Svensk Botanisk Tidskrift. 83: 103-112. In Swedish with English summary.

Wästerlund, Iwan; Ingelög, Torleif. 1981. Fruit body production of larger fungi in some young Swedish forests with special reference to logging waste. Forest Ecology and Management. 3: 269-294.

Weber, Trutz. 1977. Schmuckgrün als forstliche Nutzung=Decorative greens as a forest use. Allgemeine Forstzeitschrift. 32(46): 1135-1136. In German.

Points to existing beliefs and regulations that limit the potential exploitation of decorative greens as economically viable products in public and private forest enterprises in Germany. Designation of decorative greens as byproducts belittles their role in forestry. Sales of forest greens are not presently allowed to exceed DM200 to any one person per month from any single forest district. There is currently a need to develop competence among forest managers in marketing decorative greens. Grading standards, required use of metric measurements, processing methods, and price schedules need to be established. Careful planning assures continued decorative green cropping that can be profitable to the forest owner and in demand by consumers. Training is now required. Filling new jobs in public lands forestry at a time when there is already a dearth of personnel is hardly likely. Development of decorative green production is most likely to occur on private lands. Decorative greens provide a temporary source of income on otherwise fallow or unproductive agricultural land and could provide an opportunity to avoid the sharp landscape edge between forestry and farm land. The author proposes regional associations to promote the development of decorative greens culture and thereby enhance forest productivity and net profitability.

This article describes obstacles to resource development that reflect issues facing development of nontimber forest products in the Pacific Northwest.

Keywords: Conifer greens, economic development, trade associations, training, production, Germany.

Wehmeyer, A.S. 1986. Why so little research on the noblement of indigenous edible wild plants. Acta Horticulturae. 194: 47-53.

Questions the practicality of ignoring research into applications of edible wild species in the local South African flora for increased food production. Universities and research institutions have largely ignored this type of research, preferring instead to introduce exotic crops into the South African landscape. Domestication of indigenous species for food production began only in 1982 with research of marula (*Sclerocarya birrea*) in the Anacardiaceae family. Wild populations of many of the plant species with dietary and economic potential are scarce as the result of a lack of conservation measures. The author encourages, in particular, university departments of horticulture to undertake more research addressing the use of native flora.

Keywords: Wild edible plants, domestication, conservation, South Africa.

Wheeler, D. 1992. The underground story—What's going on with truffles and trees, voles and owls? Mushroom, the Journal. Spring: 25-27.

Wheeler discusses the importance of mycorrhizal fungi to tree health and survival rates. Truffles, which grow and fruit underground, are a particularly overlooked component of forest health. For example, the Oregon white truffle (*Tuber gibbossum*) inhibits Douglas-fir root rot, a condition cited as killing more old-growth trees than clearcutting does. Not only do truffle-inoculated trees grow faster and resist disease, but the truffles also have economic value. Wheeler analyzes the commercial value of Oregon white truffles in a Christmas tree farm, arguing that the US$10,000 per acre annual truffle yield exceeds the value of managing for lumber, Christmas trees, or poles, making the truffle-inoculated trees worth more alive than dead. The author suggests that a management strategy involving truffle inoculation and selective harvesting could increase tree crop rotations and increase production over the long-term.

Keywords: Truffles, root rot, inoculation, economic value, management, joint production.

Wheeler, Nicholas C.; Hehnen, Mark T. 1993. Taxol: a study in technology commercialization. Journal of Forestry. 91(10): 15-18.

Depicts the process of policy formulation by a private corporation to develop production of taxol, a nontimber forest product. Development and commercialization of new products requires a receptivity to innovation, tolerance of risk and failure, the presence of staunch advocates, and flexible corporate processes. Management for commercialization of new products consists of scoping corporate objectives and skills in light of emerging economic and social issues, assessment of technical and commercial feasibility of product development, development of a business plan, market and production testing, and implementation. Multidisciplinary teams are important for effective movement from one phase to the next and in technology transfer and application.

The societal demand for taxol is projected to outstrip the naturally occurring supplies without the aid of domestication. Genetic selection and plantation silviculture seem to provide a solution. The lack of knowledge of Pacific yew (*Taxus brevifolia*) initially created uncertainty about the wisdom of further product development, but changes in demand and technology have led to expanded production. Technical areas of investigation include genetic parameters in taxol production, nongenetic factors in taxane yields, postharvest effects on yew physiology, growth regulators, improved assay protocols, and improved propagation and cultivation techniques. Commercial crop trees are grown on 3- to 5-year rotations.

Keywords: Medicinal plants, taxol, production, commercialization.

Wickens, Gerald E. 1991. Management issues for development of nontimber forest products. Unasylva. 42(165): 3-8.

Discusses main issues in directing development of nontimber forest products to a "whole-forest" management system for sustainability. Ideally, that system retains traditional knowledge about the forest. Unnecessary changes in land tenure away

from collective ownership can derail development when people transition from subsistence economies to market economies. Impacts on nontimber forest products, particularly related to tenure issues, should be included in environmental analyses of development projects. Impacts may be difficult to assess, however, when the basic ecology and reproductive biology of valuable nontimber species are not well understood. Case studies with a local focus are needed to acquire interdisciplinary knowledge. Long-term commitment and public participation in these studies are essential. The economic value of nontimber forest products can be increased by plant-breeding programs and by improving critical steps in production (harvesting, storage, transport, processing, and marketing). More complex social integration in forest management will offer expanding opportunities for multiproduct outputs (maximum benefit with minimum disturbance) and for domestication of forest species for increased production.

Keywords: Economic value, holistic approach, traditional knowledge, production, domestication, policy.

Williams, N.M.; Baines, G. 1993. Traditional ecological knowledge: wisdom for sustainable development. Canberra: Australian National University, Centre for Resource and Environmental Studies.

Wolf, Edward; Wortman, David. 1992. Pacific yew management on National Forests: a biological and policy analysis. Northwest Environmental Journal. 8: 347-366.

Considers the impact of commercial harvest on the distribution and abundance of Pacific yew (*Taxus brevifolia*) in the Pacific Northwest and examines the process by which the USDA Forest Service shaped its policies on yew harvesting in 1991 and 1992. Meeting demands for large amounts of yew bark while accommodating the societal demand for protection of old-growth forests makes forest management complex. Yew bark suddenly became a valuable commodity when the National Cancer Institute requested a 12-fold increase in yew bark harvest as a source for taxol. Bristol-Myers Squibb Corporation was entrusted with supplying the harvest from Forest Service and Bureau of Land Management lands. A lucrative black market in stolen yew bark developed.

Guidelines for interim management specified the need to provide for adequate regeneration of Pacific yew, maintain its genetic variability, and ensure its continued role in ecosystem function in forests. Harvested trees were left with 6- to 18-inch-high stumps to encourage stump sprouting, and seedlings were planted to supplement existing sprouting populations. Guidelines favored vegetative rather than natural sexual reproduction because bark stripping occurred before seed-bearing arils could form. Harvesting has likely decimated the oldest age classes. The authors estimate that 100,000 trees were harvested in 1991. Whether this harvest represents a serious depletion of yew population stocks is not known. Foliage, although less productive, is a source for taxol, but no foliage clipping was undertaken initially to augment the net taxol supply. In many timber sales, no attempt was made to salvage yew bark before sites were burned to remove slash. Challenges to Forest Service management of Pacific yew came with a petition to the U.S. Fish and Wildlife Service to list the tree species as “threatened.” A comprehensive Environmental Impact Statement was begun in 1992, and the

Pacific Yew Act (H.R. 3836) was signed into law in 1992 to formalize standards, guidelines, and schedules for inventory and management of Pacific yew by the Forest Service.

The contractor responsible for coordinating yew collection employed 550 workers from local communities from May through August 1991 and 1,115 workers for the same period in 1992. Little public attention has focused on the role that Pacific yew and other nontimber products might play in the management of National Forests. The authors characterize Forest Service policymaking as cautious and passive. Policy formulation for Pacific yew shows how the Forest Service allows its agenda for management to be set by other institutions, such as the National Cancer Institute and the U.S. Congress, to the possible detriment of ecosystem sustainability. One concern is that Pacific yew will once again become irrelevant to forest management in the event that substitutes for yew bark become available. The boom and bust economy of yew bark will provide no lasting solution to sustainable employment based on ecosystem resources. The Forest Service must address the role that economically valuable nontimber species play in Pacific Northwest society. Genetic stocks of wild yew remain an irreplaceable stock of other chemical compounds that may be precursors to yet other important drugs and must be valued in any economic analysis accordingly. New management, with precedents in tropical forest management, is needed for the Pacific Northwest. Extractive reserves that combine conservation and economic extraction are one possible innovation.

Keywords: Ecosystem management, medicinal plants, taxol, policy formulation, extractive reserves.

Wood, D.A.; Smith, J.F. 1987. The cultivation of mushrooms. In: Norris, J.R.; Pettifer, G.L., eds. Essays in agricultural and food microbiology. London: John Wiley & Sons, Ltd.: 309-343.

Describes the economic and biotechnological significance of mushroom cultivation. Less than 10 species are cultivated in commercial quantities worldwide. Genera of commercial fungi with edible wild species in the Pacific Northwest are *Agaricus, Auricularia, Coprinus, Flammulina, Clitocybe, Pholiota, Pleurotus, Stropharia, Tremella*, and *Volvariella*. Traditions of cultivation go back 2,000 years in China. Mushroom cultivation represents the most viable biotechnology for conversion of plant residues from forestry and agriculture to foodstuffs for human consumption. Understanding the microbial pathogens and competitors interacting with the mushroom crop is essential to commercial production.

Keywords: Mushrooms, cultivation, production, waste conversion.

Yudina, Valentina. 1993. The effect of collection of medicinal mire plants on the recovery of their coenopopulations. Aquilo Ser. Bot. 31: 153-155.

Advocates monitoring the amount and frequency of plant harvesting and the rate of recovery of biomass. The study examined three species: *Andromeda polifolia* (bog rosemary; native to the Pacific Northwest), *Chamaedaphne calyculata*, and *Menyanthes trifoliata* (common buckbean; native to the Pacific Northwest).

Experiments to test the effects of harvests were conducted at 60 test sites with the following treatments: (1) annual collection of leaves; (2) collection of leaves at 2-year intervals; (3) collection of leaves at 3-year intervals; and (4) control without collection.

The author's results indicate that a one-time harvest allows plants to recover their original biomass. For *Menyanthes trifoliata*, the number of shoots increased but the mass of each shoot and leaf declined after six consecutive harvests. *Chamaedaphne calyculata* and *Andromeda polifolia* both had smaller amounts of surface cover, shoot number, and shoot phytomass. *Andromeda polifolia* grows most slowly because buds are torn off with the shoot when the plant is harvested. This article shows the kind of experiments that could be undertaken to assess appropriate harvesting rates for medicinal plants. Two of the plants studied here are native to the Pacific Northwest.

Keywords: Harvest effects, medicinal plants, recovery time, sustainability, experimental design.

Zaitseva, Nina. 1993. Medicinal raw material resources of the Karelian forests and problems concerning their protection. Aquilo Ser. Bot. 31: 147-151.

Assesses the resource potential and current management problems involving 30 of the most common of the more than 300+ medicinal plant species found in Karelia, Russia. The most important plant families serving as sources of medicinal plants are *Rosaceae, Compositae, Scrophulariaceae, Gramineae, Labiatae*, and *Leguminosae*. Harvests in the 1970s averaged 10 tonnes annually but volumes reached 80 tonnes between 1986 and 1990 as more species were harvested. Labradortea (*Ledum palustre* with related species in the Pacific Northwest) is the principal species followed by lingonberry (*Vaccinium vitis-idaea*). Other species of industrial importance for medicinal use are in the genera *Sorbus*, *Vaccinium*, and *Potentilla* plus kinnikinnick (*Arctostaphylos uva-ursi*). These species have been the subject of research studies, and the last two have been collected so extensively that populations have been depleted.

Stocks of medicinal plants are tabulated from stationary and transect methods. Fixed plots are used as constant sampling areas. Transects provided data for formulating regional reference tables. Most of the existing resource stocks of medicinal plants consist of whortleberry (*V. myrtillus*), lingonberry, and *Ledum palustre*. Serious problems such as industrial and transportation pollution are impinging on the quality of native raw materials for medicinal uses.

This article calls attention to problems in maintaining the stocks and product quality of native medicinal plants available for economic harvests.

Keywords: Conservation of resources, economic exploitation, medicinal plants, pollution effects, inventory, monitoring, fixed plots, pollution, harvest volume, Russia.

Zimmer, Karl; Girmen, Mahir. 1987. Gärtnerischer Anbau statt Raubbau= Horticulture instead of predatory waste. Deutscher Gartenbau. 41(16): 988-989. In German.

Warns about the harmful effects on ecosystems yielding bulb and corm species for German horticultural markets. Ninety-five percent of the imports arrive from agricultural suppliers in the Netherlands, and an undetermined percentage of minor species are imported directly from the wild. Turkey is the source for most of the imports of wild bulbs and corms. Many of the species are endemic and have restricted ranges. Demand for rare species in private gardens has risen steadily in the past few years. About 60 percent more bulbs and corms are actually dug than are exported from Turkey because the bulbs and corms are too small for marketing. There is heavy competition for plants, and the start of the harvest season is set ever earlier, often before the plants are able to set seed. Additional pressures come from sheep and goat grazing. There is an urgent need for legislation to prevent theft of native plants and curb exports. The Turkish government is not expected to be particularly responsive to restrictive measures.

To offset social pressures in native ecosystems, the authors suggest developing protocols for growing endangered native bulb and corm species. A sufficient supply of seed is needed and germination requirements must be understood. The specifications for high germination rates differ considerably, even among species in the same genus. Commercial reproduction is not possible without this detailed knowledge, and much research is needed. Another source of plants is application of in vitro culture techniques. One limitation for supplying in vitro material is the naturally short amount of time when plants are green. Managing laboratory conditions to encourage germination or bulb budding year round is crucial.

Keywords: Horticultural plants, bulbs, corms, conservation, harvesting, cultivation, Turkey, Netherlands, Germany.

Zybachenko, Sergei. 1993. Non-woody resources in the forest zone, their use, and problems of investigation. Aquilo Ser. Bot. 31: 5-8.

Describes the role of nonwoody resources in Karelia and Finland for food, medicinal uses, and fodder. Berry plants in the genus *Vaccinium* and in the Rosaceae are the most important food plants in the taiga zone. In the former USSR, there are 2,000 medicinal plant species, and 300 are currently used in medical research. Sixty of the 250 species of edible wild mushrooms are traditionally used, with 20 or so species being very popular.

Management of nonwoody resources depends on the density of both the local human population and the road network. Many investigators believe that the level of use of available resources does not exceed 5 percent. Constraints on increasing the amount of harvest are insufficient resource surveying, inability to plan and forecast harvesting volumes and their location, the physical demands of harvest work, poor transportation network, shortage of labor, and lack of storage and handling facilities.

The USSR Academy of Sciences, institutes, and universities carry out resource assessments. These assessments include the biology and distribution of wild plants, ecological and geographical variability in biochemical composition of plants, yield capacity, and raw material reserves. Methods are being developed to produce short-term forecasts and increase resource productivity. Productivity of wild forest

plants depends on canopy closure, species composition, and stand age. Whortleberry (*V. myrtillus*) yields drop by a factor of 10 in uncut forests compared to forest clearings. Yields of lingonberry (*V. vitis-idaea*) and cranberry (*V. oxycoccos*) are variable. Mushroom production is highest in stands between 15 and 35 years old in the taiga zone because the upper soil is adequately warmed. Mechanisms controlling yield are not yet predictable and production is cyclical.

Scientists and managers use traditional silvicultural methods to increase productivity of wild berries, medicinal herbs, and mushrooms. These include improvement cuttings, applications of mineral fertilization, understory burning and thinning, removal of competing vegetation, careful harvesting, and plant conservation. All measures combined lead to a 1.5- to-2 fold increase in productivity. Clearfelling, the dominant timber harvest method in the former USSR, damages 20 to 60 percent of berry bushes and destroys the soil cover on a third of the area on average. Loss of forest soil fertility causes drastic declines in cowberry and whortleberry biomass.

In ecosystems where anthropogenic pollutants destabilize ecosystems, organized monitoring is especially important. A consistent network of frequently sampled plots can reveal the state of ecosystems, guide conservation, and help determine the optimal level of resource exploitation.

Keywords: Berries, wild edible mushrooms, medicinal plants, Russia, Finland, productivity, clearcutting, pollution, monitoring.

Index

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Units of Measure

When you know:	Multiply by:	To find:
Acres	0.40	Hectares
Centimeters (cm)	0.39	Inches
Cubic meters (m^3)	35.32	Cubic feet
Degrees Celsius (^0C)	9(^0C)/5 + 32	Fahrenheit
Degrees Fahrenheit (^0F)	(^0F - 32) /1.8	Celsius
Feet (ft)	0.305	Meters
Gallons (gal)	3.8	Liters
Gallons per acre (gal/acre)	9.5	Liters/hectare
Grams (g)	0.035	Ounces
Hectares (ha)	2.47	Acres
Inches (in)	2.54	Centimeters
Kilograms (kg)	2.21	Pounds
Kilograms per hectare (kg/ha)	0.892	Pounds per acre
Kilometers (km)	1.609	Miles
Liters (l)	0.26	Gallons
Meters (m)	3.28	Feet
Miles (mi)	1.61	Kilometers
Milliliters (ml)	0.06	Tablespoons
Pounds (lb)	0.45	Kilograms
Pounds per acre (lb/acre)	1.12	Kilograms per hectare
Square feet (ft^2)	0.09	Square meters
Square meters (m^2)	1.20	Square yards
Thousand board feet (Mbf, log scale)	0.2	Cubic feet
Tons	0.91	Tonnes
Tonnes	1.10	Ton

Von Hagen, Bettina; Weigand, James F.; McLain, Rebecca; Fight, Roger; Christensen, Harriet H. 1996. Conservation and development of nontimber forest products in the Pacific Northwest: an annotated bibliography. Gen. Tech. Rep. PNW-GTR-375. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 246 p.

This bibliography encompasses literature on the historic and current scope of nontimber forest product industries in the Pacific Northwest and includes references on international markets and trade that bear on these industries. Key themes in the bibliography are biological and socioeconomic aspects of resource management for sustainable production; procedures for identifying, monitoring, and inventorying important resources; means for technical innovation and resource development; and public education about nontimber forest resources. Social policy issues address the role of nontimber forest products in rural development and the spectrum of ethical considerations required for socially acceptable policy formulation. Economics literature covers estimating the contribution of nontimber forest products to a whole ecosystem economy, analyzing and planning for joint production of agroforestry systems, and enhancing the performance of nontimber forest product sectors.

Keywords: Bibliography, conservation, sustainable development, economic analysis, wild edible mushrooms, floral greens, medicinal plants, conifer greens, forest policy, nontimber forest products, trade.

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