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Opportunities for Conservation-Based Development of Nontimber Forest Products in the Pacific Northwest

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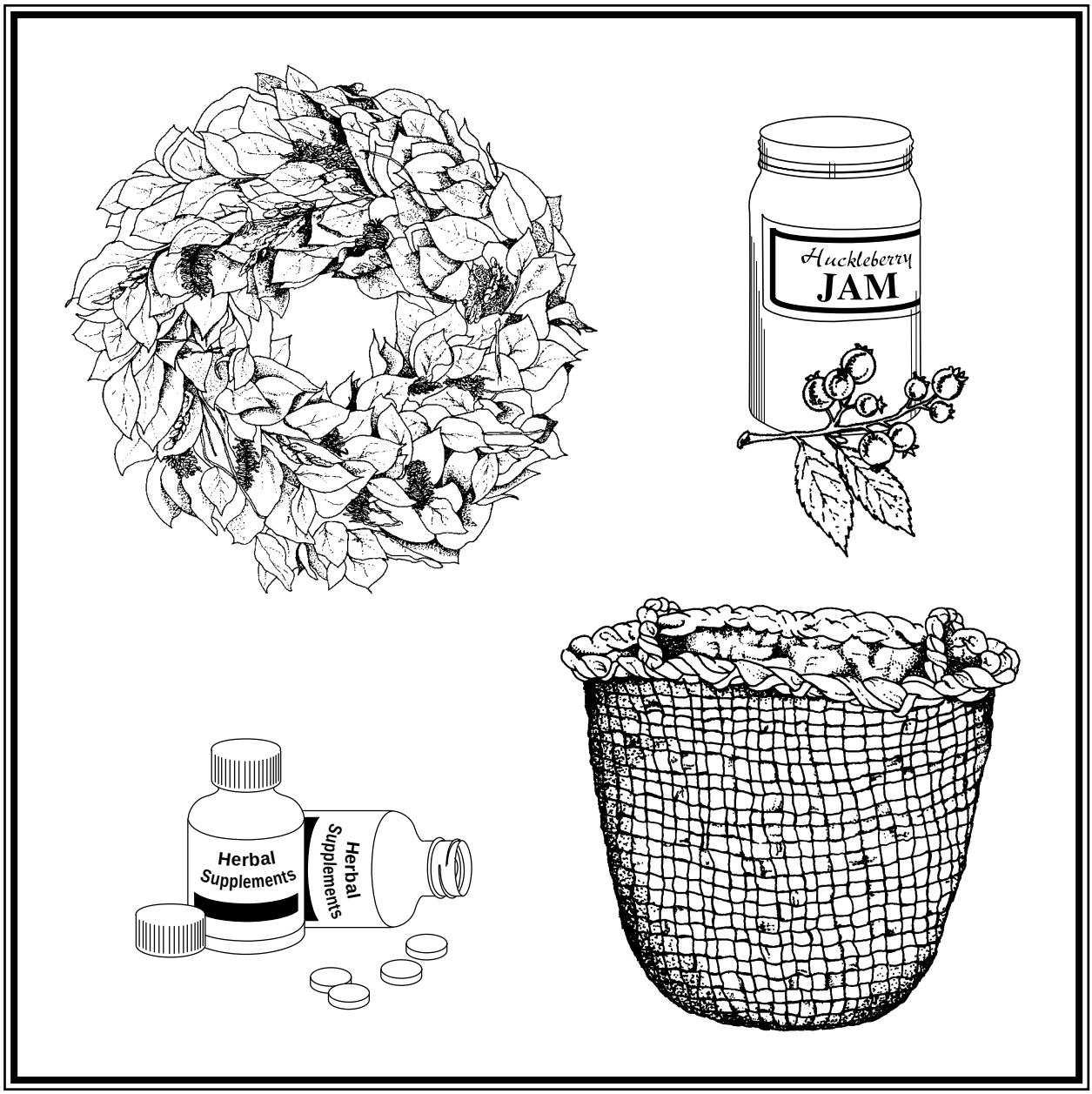

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Abstract

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Declines in timber harvests on public lands and new market opportunities have rekindled an interest in nontimber forest products. Such products as edible mushrooms, medicinal plants, and floral and holiday greens provide alternative sources of revenue and employment for rural communities. This paper describes and analyzes the contribution of the nontimber forest product industries in the Pacific Northwest from economic, social, and ecological perspectives. We conclude that promises of replacement for declining timber harvests has been largely unfulfilled: the nontimber forest product industries are seasonal, cyclical, and competitive, with generally low returns to harvesters. On the other hand, harvesting of nontimber forest products provides opportunities to those with the fewest options: recent immigrant groups and residents of economically distressed communities. The current economic contribution of nontimber forest products, however, may be considerably less than their future potential under management regimes that emphasize both timber and nontimber products. Forest management systems that emphasize a variety of forest products and services are generally higher in diversity, habitat value, recreation value, and aesthetic appeal.

Keywords: Nontimber forest products, special forest products, community development, employment, income.

Introduction

Nontimber forest products have been receiving increasing attention in the Pacific Northwest. Timber harvests have declined sharply in public forests, and forest-dependent communities are seeking alternative sources of jobs and revenue (Jungwirth and Brown 1997). Land management agencies, state and local development agencies, and communities are considering nontimber forest products for their potential to help recoup a portion of lost timber revenues. Because many of these products are derived from species native to northern temperate forested ecosystems, conservationists are interested in the role nontimber forest products might play in providing economic incentives for forest conservation.

Nontimber forest products include nonwoody species, such as mushrooms, ferns, and other understory plants; nonwoody parts of trees, such as cones, fruits, bark, foliage, and sap; and woody material such as firewood, poles, and boughs. These products differ from timber in several important respects, such as greater variety in products and species, shorter frequency of harvest cycles, smaller yield per unit area in natural forest, and generally greater monetary value per unit weight. Harvesting of nontimber forest products generally requires more labor and less capital than timber harvesting, and it often has less ecological impact (Panayotou and Ashton 1992).

Nontimber forest products can be a significant source of subsistence and income, accounting for several billion dollars in world trade annually. In India, for example, nontimber forest products contributed 36 percent of forest revenues from national forests in 1980-81 (Panayotou and Ashton 1992), and in Finnish Lapland, mushroom and berry harvests yielded up to 11 percent of the value of timber harvests in the early 1970s (Saastamoinen 1992). Participation in nontimber harvests is frequently broad; a study of eight villages in Ghana found that 49 to 87 percent of households earned income from nontimber forest products (Chege 1994). Native Americans in the Pacific Northwest continue to use hundreds of nontimber forest products for food, clothing, building materials, and medicine (Turner 1996).

This paper explores the developing importance of nontimber forest product industries in the Pacific Northwest, with a focus on Oregon and Washington. First, the stakeholders and key conflicts are identified. Conservation-based development, which argues that successful long-term development is contingent on the preservation of natural, financial, and social capital, is presented as the organizing framework. Next, the primary sectors are described. The analysis that follows uses the framework of conservation-based development to identify the current state of knowledge and remaining questions from the perspectives of economic viability, social equity, and ecological integrity.

The Regional Context

A number of stakeholders are demanding effective regulation and management of nontimber forest products. Harvesting of nontimber forest products has been regulated generally at the local level and has been selectively enforced. As long as enforcement was light and harvesting was done by locals, inconsistent and conflicting regulations across different forests were not a major problem. With the increased activity and regionalization of harvesting, consistency is being demanded by participants (Delaney and Cowles 1997).

Both public and private forest owners are looking at nontimber forest products as potential sources of revenue to offset declining timber sales, which requires organizing and managing for profit generation. Environmentalists are concerned about the effects of increased resource use on the environment and want protective regulations implemented. Amateur mycologists are concerned that the development and regulation of commercial harvesting will limit their ability to forage for pleasure and research. Social activists are concerned about access and employment opportunities for disadvantage people. Native Americans are concerned that growing use and interest jeopardize long-used gathering areas and sacred sites and infringe on treaty rights. The public is concerned that the additional uses of the forest for commercial activity will decrease recreational values and forest safety. Against this backdrop of increasing and often conflicting resource demands, some critical policy and management questions emerge:

- What kind of incentives and regulations will encourage good stewardship on behalf of both harvesters and public and private land owners and managers? Is there a difference in stewardship by local and nonlocal pickers, and if so, what are the implications? If long-term leases and stewardship contracts are considered, how can they be structured so that lack of access to financial resources does not become a barrier to entry?

- What are the implications of alternative sale and lease arrangements for resource stewardship, distribution of benefits, returns to resource owners, and the ease and efficiency of resource use?

- How can administrative and policing costs be controlled and transferred, if appropriate, to participants in the nontimber forest product industries? Does community control, through extractive reserves, conservation easements, nontimber use permits or other mechanisms, offer a mechanism to transfer management costs in exchange for greater potential economic returns to the community?

- How does managing for nontimber forest products complement or conflict with management for timber, recreation, and other values? How can silvicultural practices be employed to promote production of nontimber forest products, and what is the appropriate geographical and temporal scale for planning of nontimber forest products resource management? Should particular stands be managed for nontimber forest products production (by controlled burns, for example, which Native Americans use to perpetuate huckleberry gathering grounds) or should managed production range over the entire landscape?

A Conservation-Based Development Perspective

These questions, which reflect a wide variety of economic, social, and ecological concerns, are being increasingly asked when economic development activities are proposed. The common sense notion that the health of human communities and natural ecosystems is inextricably linked and mutually reinforcing is gaining greater acceptance and replacing the premise that economic development and environmental health are competing goals (Power 1995). The current growth in the size and scope of nontimber forest products industries, coupled with the current lack of formal structure and the direct links of the industries to forest condition, product abundance, and access, provides an interesting context for evaluating the potential for conservation-based development. Conservation-based development is based on the premise that ecological integrity, economic opportunity, and community are inextricably linked in the long run. According to conservation-based development, long-term economic returns can be sustained only if natural capital—the stocks of natural resources such as forests, clean air, and clean water—is maintained or enhanced. In addition, the long-term economic viability of an industry is conditioned on how well it contributes to the health and vibrancy of communities in which it is involved.

As described above, knowledge about nontimber forest products industries is generally fragmentary. In addition, the industry as a whole is in the throes of a major transition with expanding interest and entry by new and different players, changes in industry structure, and new product developments (Mater 1997). As a consequence, an analysis of the conservation-based development potential can be only preliminary and inconclusive. After key nontimber forest product sectors are described, the industry is viewed through economic, social, and ecological lenses to assess the current state of knowledge and the key questions remaining unanswered.

The entire nontimber forest product industry consists of a dozen or more industrial segments, each different in seasonality, harvesting techniques, conservation issues, markets, comparative advantage, pricing, and structure. This analysis will touch on four of the largest segments in the Pacific Northwest: holiday greens, floral decoratives and greens, wild edible mushrooms, and medicinal plants.

Key Nontimber Forest Products Sectors

Holiday greens include coniferous boughs, cones, and holly and are harvested almost exclusively during fall and early winter for use in holiday decorations. Noble fir (*Abies procera* Rehd.) is the preferred coniferous species for wreaths and swags, although subalpine fir (*A. lasiocarpa* (Hook.) Nutt.) and Pacific silver fir (*A. amabilis* Dougl. ex Forbes) also are used. Western redcedar (*Thuja plicata* Donn ex D. Don) is used for garland chains; other fir, pine, incense-cedar, and juniper species are used as accents. This is a relatively stable sector of the nontimber forest products industry. Markets are primarily regional but include wholesalers who supply dependable retail markets nationally. Regional businesses have a strong comparative advantage in the Pacific Northwest due to lower freight costs and product perishability relative to competitors outside the region.

Floral decoratives and greens are supplied by species that include salal *(Gaultheria shallon* Pursh), evergreen huckleberry (*Vaccinium ovatum* Pursh), bear grass (*Xerophyllum tenax* (Pursh) Nutt.), baby's breath (*Gypsophila paniculata* L.), sword-fern (*Polystichum munitum* (Kaulf.) Presl), and mosses (various species). They are used primarily by florists and in floral crafts; mosses also are used by the nursery industry to protect plants during transport. Markets are regional, national, and global. Moss, salal, and evergreen huckleberry are especially popular with florists in Germany and the Netherlands.

Wild edible mushrooms are gathered both commercially, for food and medicine, and recreationally. The top four in terms of gross value are chanterelles (*Cantharellus* species), boletes (*Boletus* species), morels (*Morchella* species), and matsutake (*Tricholoma magnivelare*). Mushroom availability is highly seasonal and cyclical, and markets are volatile. Domestic markets are growing, but mushrooms are sold primarily overseas with chanterelles, morels, and boletes destined for Europe, mainly Germany and France, and matsutake for Japan.

Mushrooms are not evenly distributed in the forest, so knowledge of where mushrooms have been found in the past is closely guarded, valuable, competitive information (Molina and others 1993). The volatility of prices and availability, the knowledge needed to find mushrooms, and the relative high economic value per pound all contribute to a highly secretive, cash-based industry with high turnover in harvesters and processors. In addition, the Pacific Northwest is a small player in the global markets for the four main mushrooms. The Pacific Northwest is generally farther away from key markets than are its competitors, such as Poland and Korea, which are, respectively, the primary suppliers of chanterelles and matsutake. Supplier relations are thus fragile and also closely guarded.

Data on the size of the medicinal plant sector—really two different sectors, the phytopharmaceutical and the botanical or herbal—are limited (Brevoort 1996). Although less is known regionally about the herbal medicine sector, knowledge of global markets is better developed (Lewington 1993). The herbal medicine sector is based on dietary and herbal supplements and alternative health care, and it is increasing rapidly in size, economic strength, and diversification (Foster 1995). The phytopharmaceutical sector is characterized by its historical development of single-compound-based products, the level of investment, and developmental capabilities that set it apart. Pharmaceutical companies engage in plant-based drug development through global sourcing of biodiversity, high-tech screening capabilities, joint ventures, and international agreements (Vance 1995). Conventional pharmaceuticals are subject to Food and Drug Administration (FDA) regulations, whereas the herbal products are regulated under the Dietary Supplement Health and Education Act. Under this act, the product does not claim to "cure" a disease but rather to affect "structure or function," or aid in general well-being.

Important herbal products in the Pacific Northwest, based on a survey by Whole Foods magazine, are cascara sagrada (*Rhamnus purshiana* DC.), St. John's wort (*Hypericum perforatum* L.), and valerian (*Valeriana sitchensis* Bong.), which are

among the top 20 in herbal supplement sales in natural food stores (Richman and Witkowski 1997). Other species actively harvested for herbal medicines include dwarf Oregon grape (*Berberis nervosa* Pursh), prince's pine (*Chimaphila umbellata* (L.) Bart.), yarrow (*Achillea millefolium* L.), and horsetail (*Equisitum* spp.). The harvesters send most of their product to regional wholesalers that supply the large retail herbal product and nutritional supplement segments of the marketplace.

Economic Viability

Size and structure

Basic information on the scope and structure of the nontimber forest products industry is beginning to emerge through surveys of industry participants. Schlosser and others (1991) surveyed floral and Christmas greens activity in the Pacific Northwest in 1989 and report on key commercial greens. They used a mail survey to sample floral and Christmas greens producers west of the Cascade Range in Washington, Oregon, and British Columbia. The industry was estimated to consist of about 60 businesses, located primarily in Washington; to employ about 10,300 full- and part-time workers; and to lease about 673,000 acres for nontimber forest products harvesting. Sales were estimated at $128.5 million, consisting primarily of $47.7 million paid for plant materials, a payroll of $23.8 million, and overhead expenses of $48.5 million.

Schlosser and Blatner (1995) also conducted a survey of commercial activity in wild edible mushroom markets in 1992. Survey results indicated that the wild edible mushroom industry contributed over $41 million to the regional economy and employed over 11,000 people, full or part time, in that year. The survey also yielded information on years in business, number of employees, volume, cost, and location of mushrooms purchased, by species, seasonality of operations, harvester characteristics, and markets. The authors used the survey results to estimate other operating expenses, such as payroll taxes, utilities, and depreciation, to arrive at a total financial contribution by the wild edible mushroom industry.

Additional descriptive information on key nontimber forest product species is emerging from agencies, universities, and nonprofit organizations (von Hagen and others 1996). Large gaps remain in our understanding of the structure and dynamics of the nontimber forest product industries and we continue to rely on data that are almost a decade old. Not only is there a high level of new entrants into the market, but the products are changing also. Schlosser and others (1991) estimate that 40 percent of the floral greens identified in the 1989 survey were new to the industry; for example, beargrass, which was second only to salal in value, was not a significant product just a few years before. A recent example of a new entrant to the U.S. herbal market is St. John's wort, a weedy plant widespread throughout the Pacific Northwest, notable for eradication efforts by forest land managers. It is being widely researched for antidepressant and antiviral properties in both the United States and Europe. In 1998 it provided thousands of dollars of income to harvesters in the Northwestern United States because of high demand created by the successful marketing and broader consumer acceptance of botanical products. On the other hand, the demand for cascara from the United States, an important local contributor to medicinal markets for many years, fell sharply and suddenly when a competitive product from Eastern Europe and Russia flooded the market. This could happen with St. John's wort as well, as it is a circumboreal species that grows in countries where labor costs are lower than in the United States.

The continuing growth of interest and activity in nontimber forest products speaks to the need for periodic surveys of the floral greens, Christmas greens, wild edible mushroom, and medicinal, botanical, and specialty industries. The need to use information-gathering techniques other than direct surveys is highlighted, however, by the growing reluctance of harvesters and buyers of nontimber forest products to share information on the industry with researchers. Industry participants feel that providing information increases the risk of more legislation, regulations, and restrictions on the industry.[1] As the industry matures and becomes more formalized, attempts should be made to capture industry information under other data collection systems, such as the covered employment and payrolls reports produced quarterly by state employment divisions. This would be facilitated by the assignment of unique standard industrial classification (SIC) codes to key segments of the nontimber forest product industries.

The market for herbal products in the United States was about $1 billion in 1992 and has been growing at a rate of 13 to 15 percent per year (Mater 1997). In 1996, sales grew 37 percent, reaching an estimated $2.5 billion (Klink 1997). Of the 25 top selling botanicals in U.S. commerce, over 50 percent are plant species found in the United States. Markets in the past were primarily overseas, but the growing domestic interest in alternative medicines is creating a large U.S. market. The current explosion of interest in alternative and herbal medicines highlights the need for an initial industrial survey of the medicinal and botanical industry. The herbal market is showing several growth characteristics such as more consolidation and buyouts of companies, more emphasis on the pharmaceutical model of standardizing and quantifying active ingredients, and an increased emphasis on quality as mainstream companies enter the marketplace (Brevoort 1996). This suggests that pressure will increase on local harvesters to supply large volumes of raw product to brokers. But this market sector also can be viewed by independent entrepreneurs located close to the resource as having high potential for value-added processing (Mater 1994).

In developing methods for identifying promising nontimber forest products, past use may be an important predictor of potential products. The commercial use of nontimber forest products has a long and important history in the Pacific Northwest. Ethnobotanical research among Native Americans is also a fertile source of information on potentially useful nontimber forest products. Tribal people, however, are not in agreement about sharing their intellectual property and traditional and treaty rights to these products and resources.

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[1] Personal communication. 1997. K.A. Blatner, Washington State University, P.O. Box 646410, Pullman, WA 99163.

Comparative Advantage

Understanding the structure, scope, and dynamics of the different components of the nontimber forest product industries in the Pacific Northwest is only the beginning of the research agenda. For the most part, the supply and demand characteristics of nontimber forest product markets are determined globally. To compete effectively, information on global consumption patterns and trends is needed, as are assessments of relative seasonality (i.e., does the Pacific Northwest product season compete with or complement the product seasons of market leaders), relative storage, spoilage and transportation costs, wage differentials, and expected returns to industry participants, including public and private land owners and managers. In addition to primary research, a review of the scientific and business literature in key nontimber forest products markets, such as Europe and Japan, is needed, as is ongoing contact with economic development agencies in key markets.

Research of this kind is beginning to emerge. Weigand (1997) analyzed trade data on the imports of matsutake mushrooms to Japan and identifies the Pacific Northwest as the most significant supplier outside of East Asia. The harvesting of matsutake, a traditional fall food of the Japanese, has been spurred in the Pacific Northwest by long-term economic growth in Japan coupled with a decline in domestic harvests. Weigand analyzes the market share of various importers to Japan, computes price and income elasticities of demand, and develops an econometric model to estimate demand for matsutake. The study suggests that the amount of Pacific Northwest matsutake demanded varies considerably as a function of price; the more expensive domestic and South Korean matsutake are preferred by Japanese consumers, leaving the lower priced Pacific Northwest matsutake to more price-sensitive buyers. This suggests that controlling costs may be a key to expanding the market opportunities for Pacific Northwest suppliers.

With basic product and market information in hand, an assessment of the market potential of each of the key pacific Northwest nontimber forest products should be prepared, perhaps with a focus on the top 20 products. This might include, for each nontimber forest product, a review of consumption levels and trends, existing and potential substitutes, and price elasticities of supply and demand similar to the matsutake study described above. Once the market potential is determined, an evaluation of the investment needed to attain the market potential should be made. To the extent that nontimber products yield public benefits, investments in infrastructure should be considered, such as the development and maintenance of roads, airstrips, and cold storage facilities, as well as investments in training programs and administrative and regulatory systems. These investments should be evaluated by their contribution to conservation-based development or, in other words, on the basis of economic opportunity and efficiency, social equity, and ecological integrity.

A better understanding also is needed of industry structure and trends and the necessary attributes for a successful business. There seems to be continuing vertical (among business activities such as harvesting, buying, processing, and shipping) and horizontal (across product lines) integration in the nontimber forest product

industries, which results in large firms that operate throughout the region, sell a wide variety of products, and have formal or informal arrangements with a mobile work force[2] (Molina and others 1993). There also is high turnover in the various industries, reflecting the effects of changing industry dynamics, relatively low entry costs, and highly volatile prices. Of a sample of 125 processors of nontimber forest products known to be operating in 1995, almost 60 percent had moved, changed hands, or gone out of business by 1997 (see footnote 1).

Given the seasonal differences on product availability in the region, which for many products extends from British Columbia to northern California regional firms are able to provide their customers with a wider and more diverse product line. In addition, these firms frequently employ recent immigrants, who often accept a lower wage than will local residents. Research is critically needed on whether community-based nontimber forest product firms, buying products from local pickers and local forests, can compete successfully with the regional firms described above.

Social Equity

Nontimber Forest Products and Forest-Dependent Communities

Nontimber forest product industries with relatively low entry costs and high labor requirements seem to be good candidates for community-based economic development, particularly in forest-dependent communities. Knowledge of local forests and experience in forest-based industries make the nontimber forest product industries a logical opportunity for forest-dependent communities to consider. Low entry costs and opportunities for adding value could contribute to local economic diversity and self-sufficiency. Other attributes that should be explored relative to these questions are relative wage rates, potential job satisfaction, opportunities for advancement and entrepreneurship, opportunities to add value, and the diversity of the jobs created. Better knowledge of the market potential of key nontimber forest products and the process of vertical and horizontal integration, as described above, will help predict the relative success of community-based companies.

Understanding the compatibility of the nontimber forest product industries with other economic activities also is needed. Relevant questions include: Does the industry as a whole provide opportunities for unemployed or underemployed residents or will the opportunities draw new people to the area? Do the nontimber forest product industries complement or compete with the resources needed for other activities, such as warehouses or transportation resources for other agricultural products? Do the seasons of nontimber forest product harvesting and processing complement or compete with other activities, such as tourism, agriculture, and timber extraction?

Race and Ethnicity

Newspaper headlines about conflicts in the woods over mushrooms have focused land manager attention and research on mushroom harvesters. The increasing number of Southeast Asians and Latinos harvesting mushrooms also has drawn the interest of sociologists and anthropologists who are documenting conflicts arising from differing values, attitudes, and uses of land among groups of different ethnicity and race (Hansis 1996, Richards and Creasy 1996). Increased unemployment and underemployment in timber-dependent communities has increased the potential for conflict over nontimber forest products, just as Latino and Southeast Asian entry into the

[2] Personal communication. 1998. T. Love, Department of Sociology and Anthropology, Linfield College, McMinnville, OR 97128.

nontimber forest product industries has accelerated. For Latinos, the gathering of mushrooms and other nontimber forest products seems to fit comfortably into the cycle of harvesting cultivated fruits and vegetables in the Pacific Northwest. Although gathering cultivated crops may be more lucrative, nontimber forest products provide rare opportunities for entrepreneurship. Southeast Asians, which include Cambodian, Mein, Thai, Laotian, Vietnamese, and Hmong immigrants, have formed extended family units that follow mushroom harvests around the region and are highly efficient harvesters (Hansis 1996). Many of the Southeast Asian harvesters have limited command of English and few employment or income options. Matsutake harvesters interviewed in the Klamath region of northern California felt that mushroom harvesting reminded them of village life in their home countries (Richards and Creasy 1996).

Access to Resources

An issue of paramount importance to both local and migrant harvesters is access to forest lands. Managers of public forest lands, which include those managed by the USDA Forest Service, the U.S. Department of the Interior, Bureau of Land Management, and individual states and counties, have long neglected management of nontimber forest products.[3] More recently, the combined effect of decreased timber harvests, a shift to ecosystem management, increased harvesting activity, racial conflicts, and the vocal outcry of amateur mycologists unaccustomed to competition for mushrooms have prompted enforcement of existing regulations as well as creation of many new regulations. Some public land managers have restricted commercial harvests completely, and others restrict the place, time, species, and quantity of harvest. Regulatory mechanisms include permits for specified activities and quantities and leases that establish preferential, and sometimes exclusive, access to specific resources or areas. With few exceptions the reduction in timber revenues from public forests has reduced the funds available to manage nontimber forest products.

Exclusive long-term leases can provide incentives and accountability to the lease holder for resource conservation but seldom are used in public forests except for bough harvesting, which is often tied to a tree pruning contract. Although long-term leases may be beneficial from a resource conservation perspective, they may favor well-captalizated firms, thereby shutting out both local residents and migrant harvesters who have limited capital. One ameliorating strategy might be to set aside forest land for local communities through preferential bidding processes or through the establishment of a community forest; however, this would put migrant harvesters—generally Latinos and Southeast Asians—at a competitive disadvantage. Another approach would be to provide access to capital for both resident and migrant groups through targeted, revolving loan funds and other mechanisms to level the playing field.

Even though the current tangle of regulations and inconsistent enforcement is highly inefficient, standardization of regulations and increased formalization of the industry has its dark side. In their ethnographic study of lichen, chanterelle, and narcissus harvesters in the Massif Central region of France, Larrere and de la Soudiere (1985) warn that public investment in market development and ensuring consistent regulations can force out marginal harvesters and concentrate access and control of the resource. The overall inefficiency of the current system has to be balanced by the

[3] Personal communication. 1998. R.J. McLain, University of Washington, Seattle, WA.

economic opportunities provided to low-income local residents and immigrants with few economic alternatives. Changes should take into account not only overall economic efficiency but also distribution of economic benefits. A critical question is whether institutionalizing nontimber forest products will displace subsistence harvesters and existing cottage industries.

These cottage industries includes community-based initiatives that have explicit goals for conservation and social equity. These new organizational approaches include for-profit and not-for-profit ventures, such as cooperatives (for example, Trinity Alps Botanicals in Hayfork, CA), economic development corporations, community development corporations, and community forests. Many of these initiatives have received or applied for public funding through the Community Economic Revitalization Team process and other programs. A systematic review of these businesses would be very helpful in guiding future development and investment decisions. Evaluation should include the necessary capitalization levels, size, and geographic and product focus. In addition, the proliferation of community-owned businesses offers an excellent case study in whether the necessary entrepreneurial conditions for success can be created without a direst profit motive to the principals.

Other potential structures might be adopted from the European and tropical experience in organizing the access and harvesting of nontimber forest products to meet economic development and resource protection objectives. Suggested mechanisms include extractive reserves, communal reserves, pharmaceutical screening contracts, royalty payments for genetic resource conservation, market development, and training programs (Fearnside 1989, Harkonen 1988, May 1991, Pinedo-Vasquez and others 1990, Simpson and Sedjo 1992).

Conflicts With Recreation and Other Forest Uses

The value of nontimber forest products is not restricted to their commercial value or to their potential role in community development. There are many recreational foragers of mushrooms, medicinal plants, edible greens, and other products. The size, structure, and dynamics of this recreational market are poorly understood. Clearly, the value of mushroom foraging to a recreational harvester cannot be adequately captured by the purchase price of chanterelles at the grocery store, just as the value of fly fishing is not captured by the purchase price of salmon. Research on the uses and values of nontimber forest products should include recreational as well as commercial uses and values. In the absence of market signals, the travel-cost method can be used whereby the transportation and time costs for engaging in an activity are used to estimate willingness to pay; for example, Myer (no date) uses the travel-cost method to explore the recreational value of matsutake harvesting and finds that it greatly exceeds the commercial value of harvested matsutake.

Ecological Integrity

Our understanding of the basic biology and ecology of species that furnish nontimber forest products needs much improvement before sustainable harvest levels can be determined and management schemes implemented with any level of confidence. Harvest effects can be complex, involving not only direct effects on the harvested population but indirect effects on food webs and general forest health. For example, mycorrhizal fungi—such as chanterelles and matsutake—extend the nutrient-absorbing area of their tree partners' roots, increase host drought tolerance, and protect

against pathogens. Conversely, the tree host provides energy; some sources estimate that as much as 70 percent of the net annual productivity of the host tree may be transferred to roots and associated mycorrhizal fungi (Perry 1994). Saprophytic fungi, such as morels, perform essential ecosystem functions by decomposing organic matter and recycling nutrients. Mushrooms and truffles are an important food source for deer, elk, bear, voles, flying squirrels, and mollusks. Some rodents, such as the California red-backed vole (*Clethrionomys californicus*) and the northern flying squirrel (*Glaucomys sabrinus*), rely on mushrooms and truffles for the bulk of their food supply (Maser and others 1978). Voles and flying squirrels are in turn a primary food source for the endangered northern spotted owl (*Strix occidentalis caurina*) (O'Dell and others 1996). Many birds and mammals also forage extensively on the berries of commercially harvested floral greens, such as salal and huckleberry, and the foliage is browsed by deer and elk (Schlosser and others 1992). Moss harvest from vine maple in the coastal forests supplies a $14 million export market, but it removes up to 35 species of bryophytes and lichens (Vance and Kirkland 1997) and does not discriminate among the common and the rare species or the importance of individual species to wildlife. Other concerns include the effects on pollinators of harvesting flowering plants, sensitivity of wetland and riparian habitats to plant excavations, and removal of plants to levels that will not sustain viable populations.

Biology and Ecology of Key Species That Furnish Nontimber Forest Products

Several research agendas have been outlined (Amaranthus and Pilz 1996, Love and others 1993, Molina and other 1993, U.S. Department of the Interior 1992) that would aid in the development of resource management plans. Research needs identified include:

- Information on the life histories of species that provide nontimber forest products and of understory species in general, including information on production and regeneration rates.

- Baseline and ongoing inventories of the abundance and distribution of key nontimber forest product species and through geographic information systems and other techniques, an understanding of the relation of the abundance and distribution of species to key landscape features.

- Research on the interrelations of nontimber forest product species to other ecosystem components, and the contribution of nontimber forest products to the biodiversity, health, resilience, and structure of regional ecosystems.

- Identification and monitoring of nontimber forest product species that are successful indicators of forest health and site and habitat disturbance.

Effects of Harvest and Environmental Conditions on Yield

Harvesters take foliage, roots, bark, stems, or the entire plant for medicinal purposes. Such harvests potentially may be a greater threat to species viability than mushroom harvests, which involve only the fruiting body of the organism. Even harvest of fruits or flowers may have ecological consequences for wildlife or pollinators. Harvest technique will have an effect on the maintenance of a viable plant. When whole plants are harvested, the population dynamics of the plant community must be considered. Many techniques used by American Indians were designed to promote vigorous regrowth of the plant. But effects of mechanical harvest are not well understood. For example, cascara, a widely used cathartic, is derived from the bark of the deciduous

tree, buckthorn (also called cascara; *Rhamnus purshiana* DC.). Typically harvesters cut the tree, leaving a stump, and strip the bark. The stump may sprout profusely and grow into a many-stemmed tree. Studies are needed to determine if this weakens the tree's vigor, increases disease susceptibility, or has an effect on reproductive processes. Studies on yew stump sprouting indicated that a proportion of stumps from cut trees do not sprout (Minore and Weatherly 1996), and it remains to be seen if that is also true with cascara. Other plant-harvest considerations are season, frequency, and location of harvest, which may affect concentration of active compounds and the plant's habitat as well.

In addition to the research on proper harvesting techniques and postharvest growth responses, research on basic biological and ecological functions and dynamics also is needed. There are few data on the effects on regeneration and site disturbance of harvesting nontimber forest products. Both direct and indirect effects of harvesting need to be explored, especially given the symbiotic nature and complicated life histories of many edible fungi species, and the fact that many floral green species are used intensively by wildlife for forage and habitat.

Appropriate harvesting technique and management systems to ensure that the appropriate techniques are consistently applied should be determined before implementation of management systems. Potential management systems discussed in the literature to control harvest levels include spatial or temporal harvest restrictions, restrictions on the number of individuals (plants or fungi) harvested per unit of land and limits on the leaves harvested per plant. In addition, research is needed on how to harvest plants and fungi in ways that reduce stress and encourage regeneration.

Other than the Oregon Mycological Society's study of the effects of harvesting on chanterelles yield (Norvell and others 1994, 1996), little information is available on the relations between harvest levels and yields for other products in the Pacific Northwest. Insights can be gained, however, from Europe, Japan, and other temperate areas where several long-term assessment and monitoring studies are being conducted (Budriuniene 1988, Cherfas 1991, Jansen and de Vries 1988). In Japan, for example, production of matsutake declined from a high of around 6500 metric tons in 1950 to about 200 metric tons in 1995, which helped to catalyze the growth of the matsutake harvesting industry in the Pacific Northwest and elsewhere (Weigand 1997). In addition, various studies are underway or under review that will provide needed insights on production and harvest effects on selected nontimber forest products (chanterelles, matsutake, beargrass, moss, and Oregon grape), as well as inventory and monitoring techniques (Amaranthus and Russell 1996, Hosford and others 1997, Love and others 1993, Pilz and others 1996, Vance 1997, Vance and Kirkland 1997). Clearly, this is an area needing research investment and the establishment and monitoring of permanent study plots over time and space.

Rainkist: An Example of a Conservation-Based Development Enterprise

What might a nontimber forest product enterprise look like if it were concerned not only with financial returns but also with the "triple bottom line" of conservation-based development; that is, economic opportunity, social equity, and ecological integrity? Rainkist[4] was launched in 1998 by Shorebank Enterprise Pacific, a nonprofit organization providing market, business management, and financial resources to emerging conservation enterprises in the coastal temperate rain forests of North America. Rainkist, whose central premise is that economic equity and a healthy forest ecosystem are achievable through market forces, is structured to be spun off as a for-profit company once it achieves profitability.

Rainkist is primarily a marketing company, currently marketing 72 value-added products including wreaths, baskets, ornaments, walking sticks, and furniture. Manufacturing and assembly is contracted to over 20 processors, many of whom have established small groups of assemblers to perform piece work to complete orders. Supply of raw material is coming increasingly from harvesters who have completed stewardship training on low-impact harvesting techniques. From modest beginnings in southwest Washington, Rainkist hopes to eventually source products throughout the coastal forests of North America. As sales and the supply network grow through the recruitment and training of harvesters and assemblers, Rainkist and its partner organizations plan to enter into long-term harvest leases on private and public lands to secure nontimber forest products and to provide conservation and nontimber forest product management services.

In addition to its own success as a profitable company providing well-designed, high-quality products, Rainkist will evaluate its success on the following triple bottom-line objectives:

Economic opportunity: By accessing market opportunities for value-added products, Rainkist is providing additional employment for assemblers—primarily low-income women—and manufacturers in the region. In addition, through loans and technical assistance from Shorebank Enterprise, harvesters, assemblers, and manufacturers have the resources to move up the value chain (for example, from harvesting to assembling) and to further develop their entrepreneurial capacities.

Social equity: Rainkist and its partners are targeting recent immigrant groups—Latinos and Southeast Asians—for harvester training. These groups have been involved in nontimber forest product harvesting but have limited opportunities to move to higher value-added activities in the industry because of language and culture barriers. In addition, relations have been established with the Quinault and Makah Nations around product assembly and manufacturing.

Ecological integrity: In partnership with the Olympia-based Northwest Natural Resource Group, Rainkist has developed a stewardship guide which describes general ecologically sensitive behavior when working in the woods and harvesting guidelines

[4] The use of trade or firm names in this publication is for reader information and does not imply endorsement by the U.S. Department of Agriculture of any product or service.

for individual species. The guide provides the basis for harvester training and certification. Future plans include establishment of permanent research and monitoring plots on harvesting impacts and techniques. In addition, Rainkist works with its suppliers to help them improve their environmental and financial performance around areas such as energy conservation and recycling. Finally, Rainkist and the Northwest Natural Resource Group intend to secure long-term conservation harvest leases on private and public lands, which will be subleased to trained harvesters and will include other conservation services, such as monitoring road and culvert conditions and pruning for stand improvement.

Conclusion

The growing interest in nontimber forest products reveals the need for relevant information. Critical data on distribution and abundance of important nontimber forest product species and on appropriate management strategies are lacking. In addition, local markets are nonexistent or underdeveloped for many nontimber forest products, and the Pacific Northwest is generally not a significant player in most global nontimber forest product markets. The expectation that declining timber harvests would be offset by economic diversification through development of alternative forest-based resources has been largely unfulfilled; the nontimber forest product industries are seasonal, cyclical, and competitive, with generally low returns to harvesters. In addition, the long tradition of using forests primarily for large-scale capital-intensive timber harvesting has left us with institutions that have not fostered the management and marketing of nontimber forest products.

Harvesting of nontimber forest products is providing opportunities, however, to those having the fewest options: recent immigrant groups with limited language skills and residents of economically distressed communities. Nontimber forest products have the potential to make a greater economic contribution than is being realized currently through, for example, local business development, value added, and other strategies that expand the economies of communities.

If forests were managed jointly for timber and nontimber products, the contribution of nontimber products could enhance the total ecological, economic, and social returns from forest management. For example, simulations of a linked resource production of mushrooms, timber, decorative cones, conifer boughs, and Christmas trees in high-elevation forests of the southern Cascade Range yielded positive cash flows under most of the scenarios considered (Weigand 1997). From a conservation perspective, forest management systems emphasizing a variety of forest products and services are generally higher in diversity, habitat value, recreation value, and aesthetic appeal. The economic benefits also are distributed over a wider group of beneficiaries than they are when only timber values are maximized. Emerging companies and initiatives such as Rainkist and the coproduction experiments described above offer insights and opportunities for forest management that may enhance the economic, social, and ecological returns from Pacific Northwest forests.

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Declines in timber harvests on public lands and new market opportunities have rekindled an interest in nontimber forest products. Such products as edible mushrooms, medicinal plants, and floral and holiday greens provide alternative sources of revenue and employment for rural communities. This paper describes and analyzes the contribution of the nontimber forest product industries in the Pacific Northwest from economic, social, and ecological perspectives.

Keywords: Nontimber forest products, special forest products, community development, employment, income.

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