Non-Timber Forest Products

The *OTHER* forest products

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There are a great variety of products harvested from forests in the United States that are not timber-based. While often overshadowed by timber products, non-timber forest products are receiving increased attention in the popular press, professional conferences, and state and federal policy dialogues. Major newspapers, including *The New York Times* (14), *Wall Street Journal* (26), and *San Francisco Examiner* (37), have presented analyses of these "other" forest products. Recently, at least five major meetings have been organized to examine issues that affect these lesser-known forest products. Non-timber forest products were included in the discussions of many statewide forestry roundtables, held in preparation for the 1996 Seventh American Forest Congress. In February of this year, Senator Larry Craig of Idaho and other members of the U.S. Congressional Subcommittee on Forestry and Public Land Management convened a hearing in Washington, D.C., to explore opportunities and constraints of increased harvesting of non-timber forest products on National Forest lands in the Pacific Northwest.

Various terms have been used to describe non-timber forest products, including *secondary, minor, special or specialty non-wood,* and *non-traditional.* In many cases, however, non-timber forest products are neither minor nor secondary. Often they are not specialty products, but move through distribution channels as commodities. Many of the products have as long a tradition in human history as do timber products. For example, hunters and gatherers collected non-timber forest products long before they had the technology to cut timber.

In the remainder of this article, the term *non-timber forest products* (NTFPs) will be used to describe products generated from the forest that are not timber-based. NTFPs are plants and parts of plants that are harvested from within and on the edges of natural and disturbed forests. Unlike timber-based products, NTFPs come from a large variety of plant parts and are formed into a diverse set of products: leaves and twigs that may be components of decorative arrangements; food items such as fruits, fungi, and juices; wood carved or woven into pieces of art or utilitarian objects; and roots, leaves, and bark processed into herbal remedies or medicines. Like timber, NTFPs maybe further processed into consumer-oriented products. But often, little secondary processing is required. In some cases, particularly with specialty wood products, determining whether a product should be classified as non-timber is difficult.

Perhaps the biggest problem in describing these products is the lack of information concerning the distribution systems used to get the products to final consumers. NTFPs are found in a wide variety of outlets, unlike timber-based forest products. Walk into any health food store, pharmacy, convenience store, or mass merchandiser and you are likely to find forest-harvested edible products and herbal medicinal products. Visit a local craft shop or a weekend fair and you might find specialty wood products and edible forest products. Order a bouquet of fresh or dried flowers via the Internet and you may be presented with an arrangement complemented by forest-harvested botanical.

People have benefited from these plants for many generations. In some cases, NTFPs contribute significantly to local and regional economies. If the current trends continue and projections are achieved, the trade and use of NTFPs will grow substantially over the next decade. This article presents an overview of the products and product lines marketed by the industry, as well as historical and current perspectives of the trade and use of these products. Critical issues are identified that may affect the sustainability of the industry.

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Products and Product Lines

The number of products considered to be NTFPs is staggering. Emery (8) identified 138 products from 80 forest species in Michigan's Upper Peninsula. Foster and Duke (11) cataloged more than 500 medicinal plants, many of which are forest grown. More than 200 botanical forest products were identified in British Columbia (4). The United Nations' Food and Agriculture Organization claims that at least 150 non-wood products are found in international markets (41).

Classifying these products into like categories is an important first step in understanding the NTFP industry. NTFPs can be classified into four general product lines: edibles, specialty wood products, floral greens, and medicinal and dietary supplements (15).

Mushrooms are perhaps the most well-known edible forest product.

Edible Forest Products

Fungi, particularly mushrooms, are perhaps the most well-known and documented edible forest product. Examples of other edible forest products include berries, nuts, saps and resins, ferns, and wild tubers and bulbs.

In a survey of the wild edible mushroom industry of Washington, Oregon, and Idaho, Schlosser and Blatner (31) identified more than 25 species of commercial value. Large-scale commercial harvests concentrated on six species: *Tricholoma magnivelare* (matsutake), *Morchella* spp. (morels), *Cantharellus cibarius* (chanterelles), *Boletus* (boletes), *Leucangium carthusiana* (truffles), and *Hydnum repandum* (hedgehogs) (1,27).

In many parts of the United States, local and regional economies are improved by the marketing of edible forest products. For example, the marketing of forest-harvested huckleberries in the Pacific

Many NTFP collectors are recent immigrants from diverse ethnic backgrounds. Here, a Hmong woman from Southeast Asia sells huckleberries along a street in Washington State.

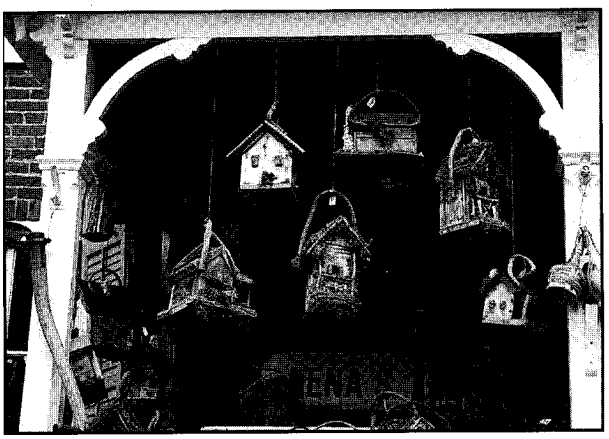
Northwest is supporting a cottage industry that employs many recent immigrants to the United States. In Appalachia, blueberries and blackberries constitute a significant portion of the edible forest product category. Maple syrup production in the northeastern United States is a traditional industry and provides jobs for many rural people. Fiddlehead ferns, wild ramps, and wild harvested watercress are a few herbaceous plants that may appear in fine restaurants.

Specialty Wood Products

Specialty wood products are considered nontimber if they are produced from trees or parts of trees, but not sawn wood. In other words, the tree may not need to be cut down to produce these items. For example, burls, twigs, branches, and cypress knees are processed directly into specialty wood products and bypass intermediate processing into lumber. Specialty wood products include handicrafts, carvings and turnings, utensils, and containers. Also included in this product line are furniture made from branches, twigs, and vines, as well as tools and musical instruments made from wood that is not sawn from logs.

Floral Greens

Many forest plants and parts of plants are used in decorative arrangements, to complement and furnish the backdrop for flowers, as well as for the main component of dried ornaments. The end uses for many forest-harvested floral greens include fresh/dried flowers, aromatic oils, greenery, basket filler, wreaths, and roping. A recent study in British Columbia (4) identified 19 floral greenery products generated from more than 30



Non-timber specialty wood products are difficult to differentiate from timber-based specialty wood products. It appears that these bird houses were produced from a combination of sawn wood and NTFPs. Chain of production analysis is necessary to be certain that specialty wood products are non-timber-based.
(Photo by A.L. Hammett, Virginia Tech.)

Spanish moss, in drying racks, will be exported to Europe to be used as packaging for flower bulbs that are sold in the United States.
(Photo by A.L. Hammett, Virginia Tech.)

species of forest plants.

Examples of forest plants collected in the Pacific Northwest for the floral industry include *Gaultheria shallon* (salal), *Caccinium ovatum* (evergreen huckleberry), *Berberis nervosa* (Oregon-grape), and *Xerophyllum tenax* (beargrass). *Tillandsia usneoides* (Spanish moss) is collected from the forests of Florida, Georgia, and Mississippi and exported to be used as packaging for flower bulbs imported from Europe. In southern Appalachia, *Vitis* spp. (grape vine) is collected from forests to make wreaths and other decorative products. Evergreen boughs cut from *Pinus strobus* (white pine), *Abies balsamea* (balsam fir), *Abies procera* (noble fir), and other coniferous species may be the largest portion of the floral greenery sector. Table 1 lists some plants that are harvested and used as floral greenery.

Medicinal and Dietary Supplements

The use and trade of herbal medicines derived from forest products has a long history and may constitute the highest valued segment of the NTFP industry. Forest-harvested plants used for their therapeutic value are marketed either as medicines or as dietary supplements. Plants that have been tested for safety and efficacy and meet strict U.S. Food and Drug Administration (FDA) standards are marketed as medicines or drugs. According to Farnsworth and Morris (9), 25 percent of all prescriptions dispensed in the United States over the last two decades have contained active ingredients extracted from higher order plants. Some well known examples of plant-derived medicines include taxol from *Taxus canadensis* (Pacific yew), digitalis from *Digitalis purpurea* (foxglove), and lobeline from *Lobelia inflata* (Indian-tobacco).

Plants and plant products that do not meet the strict FDA standards are marketed as dietary

Table 1. Plants commonly harvested for the floral greenery segment of the NTFP industry (38).

Agave stars	Deer tongue	Manzanita	Rhododendron
Alder tops	Dogwood	Mistletoe	Salal
Baby's breath	Dragonwood trees	Mountain hemlock	Scotch broom
Beargrass	Dwarf Oregon-grape	Mountain laurel	Smilax
Birch tops	Evergreen huckleberry	Ocotillo stems	Spanish moss
Bittersweet	Fir boughs	Oregon boxwood	Sphagnum moss
Blueberry	Galax	Pachistima	Spruce boughs
Brittlebrush	Gopherwood	Palmetto spears	Sumac
Cattails	Holly	Pepper berries	Sword fern
Cedar boughs	Ironwood tops	Peppergrass	Teasel
Cedars	Leucothoe	Pine boughs	Vine maple
Chaparral stems	Lotus pods	Princess pine	Wax myrtle
Club moss	Magnolia	Pussy willow	White birch bark

Table 2. Forest harvested medicinal plants marketed as dietary supplements (10).

Scientific name	Common name	Plant type	Part used	Reported medicinal value
Caulophyllum thalictroides	Blue cohosh	Herb	Root	Anti-inflammatory
Cimicifuga racemosa	Black cohosh	Herb	Root	Anti-rheumatic
Coptis groenlandica	Goldthread	Herb	Root	Analgesic
Crataegus monogyna	Hawthorne	Shrub	Berries	Cardiac tonic
Hamamelis virginiana	Witchhazel	Shrub	Bark, leaves	Astringent
Hydrastis canadensis	Goldenseal	Herb	Root	Antiseptic
Mahonia nervosa	Oregon-grape	Herb	Root	Antiseptic
Panax quinquefolius	Ginseng	Herb	Root	Improve health
Podophyllum peltatum	Mayapple	Herb	Root	Cathartic
Prunus serotina	Wild cherry	Tree	Bark	Expectorant, coughs
Quercus Alba	White oak	Tree	Bark	Astringent
Rhamnus purshiana	Cascara sagrada	Tree	Bark	Laxative
Salix alba	Willow	Tree	Bark	Anti-rheumatic
Sanguinaria canadensis	Bloodroot	Herb	Root	Emetic, stimulant
Serenoa repens	Saw palmetto	Shrub	Berries	Combat enlarged prostate
Ulmus rubra	Slippery elm	Tree	Bark	Demulcent, sore throats and colds
Urtica dioica	Nettle	Herb	Root, leaves	Astringent
Valerian officinalis	Valerian	Herb	Root	Tranquilizer

supplements in the United States. These products are legally considered food items and product labels can make no claims about their medical benefits. Foster (10) identifies more than 25 tree species, 65 herbaceous plants, and 29 shrubs that have been listed by the United States Pharmacopoeia for their medicinal value. Table 2 lists some well-known species marketed as dietary supplements.

A Brief History

Native Americans traditionally used forest plants for tools, food, medicine, and religious ceremonies. They used bark for housing, branches and stems for utensils and tools, and wood for containers and other household products. The roots of white spruce were used to sew together "planks" of birch bark for canoes that were sealed with resin from balsam fir (35).

The first European settlers brought with them items essential to sustain their lives: a supply of food, tools to make shelters, seeds to start crops, and herbal medicines to cure ailments. When these stores were depleted, the settlers looked to local resources and learned from the native Americans that the forests had value well beyond that of timber.

Much of the knowledge gained from native Americans is the foundation of the herbal medicinal industry today in the United States

Much of the knowledge gained from native Americans is the foundation of the herbal medicinal industry today in the United States (25). According to Coon (3), in the late 1600s John Jocelyn identified many herbal remedies used by native Americans. Another reporter listed 30 plant species of value to native Americans, while an English observer of the Iroquois tribe listed 35 important medicinal plants. Some of the plants identified as important to these tribes included *Sassafras albidum* (sassafras), *Althaea officinlis* (marshmallow), *Baptisia tinctoria* (wild indigo), *Polygonatum biflorum* (solomon's seal), *Agrimonia eupatoria* (agrimony), and *Spigelia marilandica* (snakeroot).

As interaction between native Americans and early settlers increased, forest-harvested plants became commonplace in households. Before long, forest-harvested foods were served in the homes of settlers and household pharmacies became stocked with herbal remedies from native American plants. Entrepreneurs began colletting, processing, and shipping to England products harvested from the forests of the New World.

Historians believe that one of the first exports from the New World to Europe was a cargo of sassafras (3,35). In 1603, an Englishman explored and

named the island of Martha's Vineyard, off the coast of Massachusetts. In reports to his homeland, the explorer discussed the abundance of sassafras and wondered of its market potential. According to Foster and Duke (11), the financing of the Plymouth colonies was in part from the export of sassafras. Sassafras was widely used as an herbal medicine throughout the 1800s and into the mid-1900s until it was shown to have carcinogenic properties.

During the 1800s, both the United States and the NTFP industry changed rapidly. Exploration and settlement of the western parts of the country resulted in the identification of new NTFPs that were then absorbed into NTFP markets. The political turmoil in the United States during the mid-1800s increased the need to explore the forests for new and substitute products. In the South, there was a particularly acute need to find substitutes for imported products. By 1863, due to port blockades, the South was in dire need of many medicinal products that had been purchased from abroad. A field surgeon was pulled from his duties to explore the forest resources of the Confederate States for plants that might be used instead of European imports (28). The surgeon identified more than 400 substitutes. Percher (28) reports that species "to be collected by soldiers while in service in any part of the Confederate States" included: *Cornus* spp. (dogwood, a quinine substitute), *Liriodendron tulipifera* (tulip poplar, for fevers), *Liquidambar styraciflua* (sweetgum, for diarrhea), and *Podophyllum peltatum* (mayapple, a laxative).

The discovery of synthetic materials that could be substituted for natural products changed the NTFP industry in the early 1900s. In the beginning of this century, there was an almost total rejection of medicinal plant remedies and a shift to synthetic drugs. Peddlers of tonics, tinctures, and cure-ails swarmed throughout the country and medical frauds were common. The Federal government responded by enacting The Food and Drug Act of 1906 (43) and the subsequent 1912 Sherley Amendment (44). These two pieces of legislation helped eliminate mislabeling and adulteration of herbal medicines (10).

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Federal legislation continued to restrict the trade and use of medicinal plants. The Food, Drug, and Cosmetic Act of 1938 (45) increased the restrictions on trade of herbal medicines by requiring that drugs be proven safe before entering interstate commerce. The Drug Amendments of 1962 (46) required that drugs be proven safe and tested for their efficacy. As a result, in 1972 the Federal government initiated a comprehensive review of more than 300,000 over-the-counter drugs. According to Foster (10), of the 258 ingredients the government considered ineffective, most were botanical.

In the early 1990s, a series of major factors helped spark a renewed interest in NTFPs. Pressure from environmental groups concerning clearcutting, road construction, and the loss of critical wildlife habitat resulted in restricted timber harvesting on most National Forests in the West. Because of this, unemployment in some areas soared. At approximately the same time, bumper crops of edible mushrooms appeared on many National Forest lands in Oregon and Washington, as a result of major forest fires (12). Displaced loggers and commercial pickers traveled to burnt-over areas to collect highly valued NTFPs. Because of this surge in activities, the USDA Forest Service, Canadian Forest Service, several state forestry departments, and private companies commissioned studies on the market potential of NTFPs (e.g., 20-22). Conferences and special seminar series were organized to help unite the many diverse factions involved in the trade and use of NTFPs (33,48).

Also during the early 1990s, the findings of medical research were presented that helped to increase demand for NTFPs. The positive results of taxol on various cancers greatly increased demand for this drug and Pacific yew, the tree from which it was initially derived. By 1994, taxol was approved by the FDA for treatment of ovarian cancer and some forms of breast cancer. Further interest in herbal medicinal products was spawned by a 1993 Harvard Medical School study (7), which reported that millions of Americans regularly used alternative medicines. Further fueling the renewed interest in botanical medicines were reports by the *Journal of the American Medical Association* (19) and *Scientific American* (36), on the benefits of *Ginkgo biloba* (to slow dementia) and *Hypericum perforatum* (St. John's Wort, to fight depression), respectively.

The Industry Today

The total value of the NTFP industry is difficult to determine. Much of the industry is based on informal markets where transactions are made on a cash basis, and few if any records are kept. Some segments are widely fragmented with many small suppliers, while others are dominated by a few large companies. The few studies that have focused on NTFPs suggest an industry that adds a great deal of value to local, regional, and even national economies.

Edible Forest Products

Examining the mushroom industry in the Pacific Northwest illustrates the value of edible forest products to the United States. During 1992, an estimated 3.9 million pounds of mushrooms were harvested from the forests of Idaho, Oregon, and Washington (30,31). The total estimated economic contribution to these states from the sale and processing of these mushrooms was more than $40 million. Although this analysis is limited to the Pacific Northwest, it illustrates the potential size of the wild harvested mushroom industry throughout the United States.

Examples of the value of other edible forest products illustrate the size and importance of this product line. According to Jim Jones (18), Vice President of Hammons Product Company, more than 25 million pounds of wild-harvested black walnuts are processed each year, generating about $2.5 million for the collectors. In 1997, maple syrup production, which is based in 10 major producing states, totaled almost 1.3 million gallons, valued at more than $30 million (24).

Specialty Wood Products

Non-timber-based specialty wood products are a segment of the handicraft industry, The value of the handicraft market was projected to be approximately $600 million in 1996 (42). Determining the value of the non-timber specialty wood products segment of this market is particularly problematic because differentiating between non-timber and timber-based specialty wood products is very complex. The task is further exacerbated because the handicraft market is extremely fragmented with innumerable small-scale producers.

Floral Greens

Conifer boughs are, perhaps, the most widely sold floral greenery product in the United States. A study of the segment of the floral industry that deals with forest-harvested greens in the Pacific Northwest found that processors purchased $47.5 million worth of conifer boughs and other floral greens (32). This segment contributed $128.5 million to the regional economy at the wholesale level in 1989, and supported more than 10,000 seasonal and permanent jobs. In Minnesota, the bough and wreath business exceeds $10 million (38). One pine roping company in southwest Virginia uses more than 3.1 million pounds of pine boughs and generates annual sales in excess of $1.5 million (16).

The production of pine roping and other conifer products provides jobs in rural America. (Photo by A.W. Hauslohner, *The Gazette*, Galax, Va.)

Other floral greenery products are also important economic contributors. In the Pacific Northwest, harvesters were paid in excess of $13 million for salal greens and $11.5 million for beargrass (32). The regional sale of evergreen huckleberry amounted to more than $1.7 million, while sword fern generated more than $1.5 million in sales. In 1995, U.S. exports of commercial forest-harvested moss and lichens amounted to more than $14 million (14).

Forest-harvested floral greens are integral components of many floriculture products. Therefore, examining the overall floriculture industry provides insight into the value of the forest products that complement these products. The Economic Research Service (6) estimates that retail expenditures for all floriculture crops (cut flowers, cultivated greens, potted flowering plants, potted foliage, and bedding and garden plants) reached $16 billion in 1996. Overall expenditures on floriculture products has grown 5 percent annually since 1989. Cut flowers and greens constituted the largest share, with retail expenditures valued at $6.5 billion in 1996. Supplies of cut greens have paralleled the steady increase in demand for floral products. In 1996, an estimated 2.3 billion cut green stems were utilized. NTFPs used as complements to floriculture products are likely to have experienced comparable growth.

Table 3. Estimated market for herbal medicines in 1996 (13).

Market location	Value
	(billion $U.S.)
Europe	7.0
Asia	2.7
Japan	2.4
North America	1.6
Rest of world	0.3
Total global market	14.0

Medicinal and Dietary Supplements

By far, the largest segment of the NTFP industry, in terms of value, is the medicinal and dietary supplements segment. By some estimates, the worldwide market for herbal medicines is valued at $7.5 to $8 billion, and is expected to grow to between $12 and $14 billion by 2000 (23). Other studies suggest that this segment already exceeds $14 billion (13).

Table 3 presents the estimated values of the global markets for herbal medicines in 1996. Europe is, by far, the largest market for these products, representing one-half of the worldwide demand. Within Europe, the top three markets are Germany ($3.5 billion), France ($1.8 billion), and Italy ($0.7 billion). Asia and Japan, combined, constitute approximately one-third of the global market. The estimated value of herbal medicinal sales in North America varies between $1.6 billion and $2 billion (13,26). According to Petersen (26), U.S. sales of herbal medicines were approximately $2 billion in 1997, almost double that of 1993.

Retail sales of specific dietary supplements provide insight into the value of this segment. For example, in 1997, sales of *Ginkgo biloba* totaled $90.2 million, while sales of *Hypericum perforatum* (St. John's Wort), a weed in many parts of the western United States, exceeded $47 million (26).

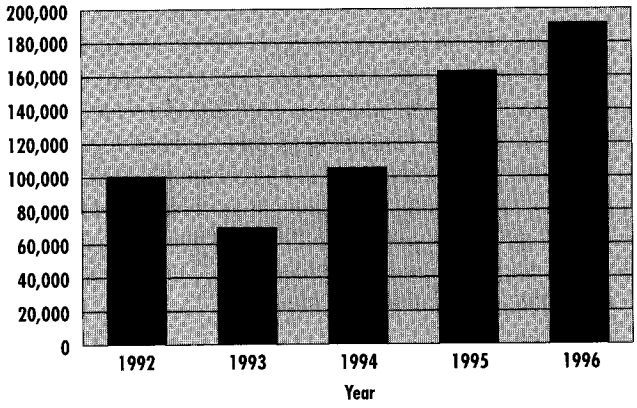

Figure 1. Exports of wild harvested *Panax quinquefolius* (ginseng) from the United States: 1992 to 1996 (53).

In 1988, the sales of *Podophyllum peltatum* (mayapple) were valued at $1.5 million (21). Over the last decade, the sales of mayapple have grown approximately 25 percent.

Panax quinquefolium (ginseng) is widely exported, particularly to Taiwan and China. Although not supported by clinical evidence, ginseng is believed to be beneficial in maintaining good health, as an aphrodisiac, and in increasing resistance to stress. It is perhaps the highest valued NTFP on the market today. In a good year, wild ginseng diggers have received more than $450 per pound of dried root (17). The market growth that wild ginseng has experienced is illustrated in Figure 1, which shows the volume of wild harvested ginseng exported from the United States between 1992 and 1996. In 1993, the U.S. exported approximately 70,000 kg of wild harvested ginseng, valued at almost $22 million. Within 3 years, the exports totaled 191,500 kg worth more than $32.4 million. It should be noted that exports of cultivated ginseng are considerably higher in comparison (674,000 kg in 1996 (47)).

The Industry's Future

Undoubtedly, some segments of the NTFP industry are growing rapidly and have great potential to continue to grow. In many aspects, the NTFP industry may be growing faster than the timber industry. In a *New York Times* article (14), Catherine Mater, Vice President of Mater Engineering, Ltd., stated that "the market for forest products other than trees has mushroomed by nearly 20 percent annually over the last several years." As an example of the potential growth, sales of medicinal herbs in the United States are projected to reach $5 billion in 2000, more than a three-fold increase from 1995 (5,14,37).

Demographic conditions and consumer preferences in the United States are encouraging for continued growth in the trade and use of NTFPs: 1) in general, there is a "changing belief that things organic and natural are inherently better" (40); 2) baby boomers are increasingly concerned with their health; many are beginning to experience ailments typical for older ages and are looking for treatments that will enhance their lives; and 3) frustrated with the high costs of western medicine, millions of Americans are looking for alternatives (7,34).

Understanding the demographics of the NTFP segments can lead to increased sales through improved marketing strategies. For example, according to the *Chain Drug Review* (2), "nearly 40 million male baby boomers will be turning 50 over the next decade, and more than one-half will likely experience normal prostate dysfunction." Many of

The berries of saw palmetto may bring relief to millions of men around the world who are troubled by benign prostatic hyperplasia. (Photo courtesy of Steven Foster Group, Inc., Fayetteville, Ark.)

these men will choose alternative treatments, including *Serenoa repens* (saw palmetto), which has been shown to be effective against benign prostatic hyperplasia (39,49). This huge potential consumer base certainly is encouraging for increased sales of saw palmetto if appropriate marketing strategies can be developed and implemented.

Critical Issues

The NTFP industry contributes to local, regional, and national economies and has the potential to continue providing benefits to those involved. For the industry to function, three critical issues — resource management, regulation, and consumer characteristics — must be considered. For the industry to flourish and realize its greatest potential, environmental and social issues must be fully addressed and incorporated into management and marketing strategies.

Resource Management

Most forest management strategies are focused on timber-based products. There is a wealth of knowledge on managing forests for wood products. The science of managing forest-based wildlife populations is also well defined, i.e., management of many large game animals, such as deer, is understood throughout the United States. But, very little information exists on managing forests for edible, medicinal, or floral products. Silvicultural prescriptions for natural forest ecosystems that include NFTPs are severely lacking. Some agroforestry systems are available, such as windbreaks, and alley-cropping, that include an NTFP component. However, much more work is needed to develop a comprehensive body of knowledge on how to manage forest resources for NTFPs.

Regulation

The lack of regulation regarding the harvesting of NTFPs could negatively impact the NTFP industry. It could lead to over-harvesting, degradation of the resource, and increased tensions among stakeholders. Efforts have been initiated by the federal government and some state governments to regulate the collection of many NTFPs on public lands. Several mechanisms are being evaluated, including long-term leases and harvest permits. The development, however, of appropriate and effective regulatory methods is still in its infancy. Models do exist for other products, particularly wildlife, that could prove helpful in developing appropriate regulatory schemes for NTFPs. Some existing models are designed to regulate harvest, generate revenues for the management agencies, and provide significant disincentives for over-harvesting. Undoubtedly, regulations can be developed and implemented that will improve the management and marketing of NTFPs.

Consumer Characteristics

Perhaps the most critical factor that will affect the future of the NTFP industry is the nature and temperament of consumers. These characteristics include demographics (age, income, etc.) and psychographics (preferences, aversions, opinions, etc.). The tremendous growth in the industry is being driven by a segment of the population that shares similar demographics. In many cases, this segment constitutes the "baby-boomers" of America. As this group ages, and passes on, the demographics of the market will change.

The psychographic characteristics of the consumers also affect product demand. Products that are preferred today may be rejected tomorrow! For example, products shown to come from endangered species may lose favor with consumers concerned about the environment. An herbal medicine that is shown to have dangerous side effects can disappear from the market quickly. On the other hand, herbal products that show promise may have enormous increases in popularity. Monitoring and understanding consumer characteristics is essential for the long-term sustainability of the NTFP industry because only by understanding the psychographic attributes of the consumer base can appropriate marketing strategies be developed.

Environmental and Social

Continued harvesting without prudent management could lead to degradation of the forest and social ecosystems. Decline of the forests could

result in loss of habitat and availability of products. Already, there are examples where habitat degradation has led to increased restrictions. Reports of conflicts between groups of collectors are becoming more common as products become more valuable and collection increases.

The natural occurrence of *Panax quinquefolium* (ginseng) and *Hydrastis canadensis* (goldenseal) has been notably reduced due to over-harvesting. Wild ginseng has been listed as threatened or endangered by the Convention for International Trade in Endangered Species (CITES), and monitored by the Fish and Wildlife Service for almost a decade (29). Goldenseal was recently added to the CITES list. The Convention allows for close monitoring of species, and can lead to severe restriction of trade if species are considered at extreme risk.

Without equitable and judicious regulation of access and harvest rights, tensions between stakeholders could become more serious. Problems between ethnic groups of collectors have been reported in several Western locations. In some places, these tensions have resulted in violence. At the same time, there is increasing concern for the property and resource rights of native Americans, whose lands are protected by treaties. Although most of the attention is focused on pressures between stakeholders who harvest on public lands, access and harvesting on private forest lands also present serious social problems. The stresses created by increased demand for access and harvesting are putting severe strain on the agencies responsible for management of the resource. To help alleviate social tensions, stakeholder participation in developing and implementing regulations is needed.

Research Needs

NTFPs are important components of the overall forest products industry. They have a history longer than many timber-based products but have not been recognized for their contributions until just recently. There is tremendous potential for NTFPs to remain significant elements in the forest products industry, but a general lack of information is inhibiting this potential.

Much more is known about all aspects of medicinal and dietary supplements than the other product lines. Information on specialty wood products and edible forest products is particularly lacking. Additional basic and strategic research is needed in all aspects of NTFPs. Some information is available concerning the NTFP industry in the western United States, but for a comprehensive understanding of the industry, additional regional research is needed.

To ensure the sustainability of the NTFP industry, research should explore consumer characteristics. By understanding these traits, marketing strategies can be developed that address the perceived needs and interests of the ultimate consumers. For example, if consumers are found to have strong concerns for social equity or environmental quality, and if appropriate programs can be developed to alleviate these concerns, the overall performance of the industry maybe improved.

Finally, much more effort is needed to document and share the knowledge regarding NTFPs that exists throughout the world. For example, because the importance of NTFPs has been recognized longer in many developing countries, these countries may have more knowledge and expertise regarding these products, which could help efforts in other areas of the world.

People have been trading and using NTFPs for generations. The market trends and projections suggest continued growth into the next century. To help ensure an expanding market for these products, greater efforts will be required to address the critical issues and research needs discussed in this article.

The authors are, respectively, Research Associate, Associate Professor, and Associate Professor, Dept. of Wood Science and Forest Products, Virginia Tech, Blacksburg, Va. Special credit must be given to Keith Blatner, Washington State University, Pullman, Wash., for his assistance in obtaining the photographs not specifically designated with a photo credit.

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