

Medicinal and Dietary Supplements: Specialty Forest Products With a Long Tradition¹

Jim Chamberlain², A.L. Hammett³

ABSTRACT: Over the last five years forest products other than timber-based products have received a great deal of attention. The markets for medicinal plants that are collected from the forests are growing rapidly. Some reports suggest this segment of the non-timber forest products industry is expanding faster than the timber-based industry. Plants used for their therapeutic value are marketed either as medicinals or as dietary supplements, depending on the US Food and Drug Administration rulings. Though many of these plants have been used by people for hundreds of years, they can not be marketed as medicinal unless shown to be safe and effective. Even with this constraint, the market potential for dietary supplements may be greater than that for medicinals as peoples preferences' are shifting toward "natural products." To realize this potential, critical issues such as management of the resource and sustainable production must be addressed. This may require, among other things more judicious regulation of harvests or development of cultivation practices for plants traditionally collected from the forests.

This paper examines the trade and use of forest products that are marketed as medicinal and dietary supplements. It provides an historical and current perspective of a segment of the non-timber forest products industry that is experiencing tremendous growth and which is projected to continue. Critical issues and research needs that could affect the sustainable development of this segment are identified and discussed.

Introduction

The forests of the United States are a vast storehouse of a huge variety of products 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 dialogue. Major newspapers, including *The New York Times* (Goldberg 1996), *Wall Street Journal* (Petersen 1998), and *San Francisco Examiner* (Tanaka 1997), have presented analyses of these "other" forest products. At least five major meetings have been organized in the last few years 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.

A variety of 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 this paper, the term non-timber forest products (NTFPs) is 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 as components of decorative arrangements; fruits, fungi, and juices as edible delicacies; 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 may be further processed into consumer-oriented products. But often, little secondary processing is required. In some cases,

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²Graduate Research Assistant, Center for Forest Products Marketing and Management, Virginia Polytechnic Institute and State University

³Associate Professor, Center for Forest Products Marketing and Management, Virginia Polytechnic Institute and State University

particularly with specialty wood products, determining whether a product should be classified as non-timber is difficult.

People have benefited from these plants for many generations. NTFPs contribute significantly to local, regional and national economies. If the current trends continue and projections are achieved, the trade and use of NTFPs will grow substantially over the next decade.

Medicinal and Dietary Supplements

The number of plants used for their therapeutic value is staggering. Foster and Duke (Foster and Duke 1990) cataloged more than 500 medicinal plants, many of which are forest grown. In “A Guide to Medicinal Plants of Appalachia” Krochmal, Walters and Doughty (1969) describe over 125 medicinal plants of this region. Tyler (1993) presents the current knowledge on more than 110 medicinal plants that have a ready market and might be appropriate in agroforestry.

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. Plants used for their therapeutic value are marketed either as medicines or as dietary supplements. To be

marketed as medicines, plant products first must be proven safe and effective by U.S. Food and Drug Administration (FDA) standards. In 1976, Farnsworth and Morris estimated that about 25 percent of all prescriptions dispensed in the United States over the previous two decades had contained active ingredients extracted from higher order plants. 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 most strict FDA standards are marketed as dietary supplements in the United States. These products are legally considered food items and product labels can make no claims about their medical benefits. Foster (1995) 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 and marketed as dietary supplements. Table 1, lists well-known plant species marketed as dietary supplements.

A Brief History

The foundation for much of the herbal medicinal industry today is based on knowledge gained from native Americans (Ody 1993). According to Coon

Table 1. Forest harvested medicinal plants marketed as dietary supplements

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

Source: Foster 1995

(1979), 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 officinalis* (marshmallow), *Baptisia tinctoria* (wild indigo), *Polygonatum biflorum* (solomon's seal), *Agrimonia eupatoria* (agrimony), and *Spigelia marilandica* (snakeroot).

Other tribes were found to rely on forest plants for medical remedies as well. Native Americans from North Carolina used infusions of *Ilex vomitoria* (yaupon holly) to stimulate the heart. They called the tea made from the leaves of this plant "black drink." In the early spring along coastal areas it was consumed as a health measure and a social activity. (Krochmal A., et al 1969). At the same time, the Dakota and Winnebago tribes were using *Monarda punctata* (horsemint) for heart ailments (Krochmal and Krochmal 1973). The Delaware tribe, used *Phytolacca americana* (pokeweed), while the Pawnee relied on *Ipomea leptophylla* (morning glory) for heart troubles. According to Coon (1979), Native Americans added at least 59 drugs to our modern pharmacopoeia including *Rhamnus purshiana* (cascara sagrada), *Lobelia inflata* (lobellia), *Chimaphila umbellata* (common pipsissewa), and *Rumex spp.* (dock mackie).

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.

As interaction between the two groups increased herbal medical practices of the European settlers and Native Americans began to merge. According to Coon (1979), much of this melding of knowledge was based on the publication of several guides, including "Indian Doctors Dispensatory, 1813; Selman's Indian Guide to Health, 1836; Foster's North American Indian Doctor, 1838." In the 20th century many Native American practices were accepted into "modern medicine." For example, Native Americans used club moss spores to help coagulate bleeding and the U.S. National Formulary listed this in 1960 as an acceptable medical practice for protecting tender skin (Krochmal and Krochmal

1973). In addition, The U.S. Dispensatory listed, in 1950, the use of mayapple roots as a laxative, a practice traditionally used by Native Americans (Krochmal and Krochmal 1973).

Soon after the establishment of the colonies, entrepreneurs began collecting, processing, and marketing products harvested from the forests of the New World to England and other countries.. Historians believe that one of the first exports from the New World to Europe was a cargo of sassafras (Coon 1979; Sloane 1965). 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 (1990), the financing of the Plymouth colonies was in part from the export of sassafras. Sassafras was widely used as a herbal medicine throughout the 1800s and into the mid-1900s until it was shown to have carcinogenic properties.

During the 1800s, the United States as well as the herbal medicine industry changed rapidly. Exploration and settlement of the western parts of the country resulted in the identification of new NTFPs that were then absorbed by 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 (Porcher 1970). The surgeon identified more than 400 substitute plant products. Porcher (1970) reported 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 herbal medicinal industry in the early 1900s. In the beginning of this century, there was an almost total rejection of medicinal plant remedies and a major shift of consumer preferences to synthetic drugs.

Peddlers of tonics, tinctures, and cure-alls swarmed throughout the country and medical frauds were common. The Federal government responded by enacting The Food and Drug Act of 1906 (U.S. Code 34 Stat 768) and the subsequent 1912 Sherley Amendment (U.S. Code 37 Stat 416). These pieces of legislation were instrumental in eliminating the mislabeling and adulteration of herbal medicines (Foster 1995).

Federal legislation continued to restrict the trade and use of medicinal plants. The Food, Drug, and Cosmetic Act of 1938 (U.S. Code 52 Stat 1040) increased the restrictions on trade of herbal medicines by requiring that drugs be proven safe before entering interstate commerce. The Drug Amendments of 1962 (U.S. Code 52 Stat 780) 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 (1995), of the 258 ingredients the government considered ineffective, most were botanical.

In the early 1990s a series of major conditions 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. Around the same time, bumper crops of edible mushrooms appeared on many National Forest lands in Oregon and Washington that had experienced major forest fires the previous year (Freed 1994). Displaced loggers and commercial pickers traveled to burnt-over areas to collect the 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., Mater 1992, 1993, 1994). Conferences and special seminar series were organized to help

unite the many diverse factions involved in the trade and use of NTFPs (Schnepf 1994; Vance and Thomas 1997).

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 (Eisenberg, et al. 1993.), 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 (Le Bars et al. 1997) and Scientific American (Stix 1998) on the benefits of *Ginkgo biloba* (to slow dementia) and *Hypericum perforatum* (St. John's Wort, to fight depression), respectively.

The Industry Today

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 ("Natural product ..." 1997). Other studies suggest that this segment already exceeds \$14 billion ("Germany ..." 1997).

Table 2 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

Table 2. Estimated market for herbal medicines in 1996

Market Location	Value (billion U.S. dollars)
Europe	\$7
Asia	\$2.7
Japan	\$2.4
North America	\$1.6
Rest of World	\$0.3
Total Global Market	\$14.0

Source: Genetic Engineering News 1997

America varies between \$1.6 billion and \$2 billion (13,26). According to Petersen (1998), U.S. sales of herbal medicines was 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 (Petersen 1998). In 1994, the anti-cancer properties of *Podophyllum peltatum* (mayapple) were discovered; in 1988, the sale of mayapple was valued at \$1.5 million (21). Over the last decade, the sale of mayapple has 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 (Hufford 1997). 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 (U.S. Department of Agriculture 1998).

The Industry's Future

Undoubtedly, the medicinal and dietary supplements segment of the NTFP industry is growing rapidly and has great potential to continue to grow. In many aspects, this segment may be growing faster than the timber industry. In a New York Times article (Goldberg 1996), 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 is projected to reach \$5 billion in 2000, more than a three-fold increase from 1995 ("Alternative pharmacy." 1997; Goldberg 1996; Tanaka 1997).

The demographic conditions and consumer preferences in the United States are encouraging for the continued growth in the trade and use of NTFPs. In general there is a "changing belief that things organic and natural are inherently better" (Tyler 1997). Baby boomers are coming of an age when they are increasingly concerned with their health. Many are beginning to experience ailments typical of older age, and many are looking for treatments that will enhance their lives and well being. Frustrated with the high costs of western medicine, many Americans are looking for alternatives. Slezak (1998) suggests that more than 60 million Americans have taken botanical supplements, regularly. A recent study by scientists at the Harvard Medical School, found that nearly 40 million Americans have tried alternative medical treatments, including herbal products (Eisenberg, et. al. 1993).

Understanding the demographics of the consumers of the medicinal and dietary supplements segment can lead to increased sales through improved marketing strategies. For example, according to the Chain Drug Review (1998), "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 these men will choose alternative treatments, including *Serenoa repens* (saw palmetto), which has been shown to be effective against benign prostatic hyperplasia (Tyler 1993; Williamson and Wyandt 1997.). 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 medicinal and dietary supplements segment contributes to local, regional, and national economies and has the potential to continue providing benefits to those involved. At the same time, many of the plants may be fragile but critical components to healthy forest ecosystems. For the industry to function well, at least three critical issues must be fully addressed and incorporated into management and marketing strategies. These include management and regulation of the resource, understanding the characteristics, preferences and intentions of the consumers, and the environmental and social impacts of increased pressures on the forest resource.

Management and Regulation

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 medicinal or dietary supplements forest products. Silvicultural prescriptions for natural forest ecosystems that include NTFPs 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 including medicinal plants in natural forest management, as well as including them in managed systems like agroforestry.

The lack of regulation on the harvesting of medicinal could negatively impact the 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

One of the most critical factor that will affect the future of the medicinal and dietary supplements market 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 herbal medicinal 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 (Robbins 1998). 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

In general, herbal medicinal forest products 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 these forest products to remain significant elements of the forest products industry, but a general lack of information is inhibiting this potential.

Additional basic and strategic research is needed on all aspects of the medicinal and dietary supplements segment. Some information is available concerning the products generated from forests in the western United States, but for a comprehensive understanding of the industry, additional regional research is needed.

To ensure the sustainability of the 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 may be 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 herbal medicinal forest products 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.

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Figure 1. Exports of wild harvested *Panax quinquefolius* (ginseng) from the United States: 1992 to 1996 (source: USDA, Foreign Agricultural Service 1998)

