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Forest Communities in the Third Millennium: Linking Research, Business, and Policy Toward a Sustainable Non-Timber Forest Product Sector

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Photo captions front cover:

A. A basket maker peels splints—the pliable wood strips that will form a basket—off a “pounded” black ash log. (Photo courtesy of Peggy Castillo)
B. Black ash basket making, from logs to finished baskets. (Photo courtesy of Peggy Castillo)
C. A future basket maker tries “pounding” a log. (Photo courtesy of Peggy Castillo)
D. Birch “poles” used by some stores for hanging clothing on display. (Photo by Elizabeth Nauertz, courtesy of Winter Woods, Inc.)
E. Two women sort cones for Christmas wreaths. (Photo by Elizabeth Nauertz, courtesy of Winter Woods, Inc.)
F. Ground pine (*Lycopodium dend.*) wrapped around a decorative holiday mailbox. (Photo by Elizabeth Nauertz, courtesy of Winter Woods, Inc.)

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Forest Communities in the Third Millennium: Linking Research, Business, and Policy Toward a Sustainable Non-Timber Forest Product Sector

Proceedings of meeting held October 1-4, 1999, Kenora, Ontario, Canada

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INTRODUCTIONS

Non-timber Forest Products: Local Livelihoods and Integrated Forest Management

Iain Davidson-Hunt[1], Luc C. Duchesne[2], and John C. Zasada[3]

NTFP: AN EVOLVING CONCEPT

In October of 1999 a conference was held in Kenora, Ontario, Canada, to explore the non-timber forest products (NTFPs) of boreal and cold temperate forests. Up to this time, the concept of NTFP, was one that had been developed largely for tropical and subtropical forests. An extensive body of literature exists on a wide range of topics for the NTFPs of tropical and subtropical forests. The Food and Agriculture Organization of the United Nations was one of the first agencies to promote NTFPs through their program on non-wood forest products (NWFP) (http://www.fao.org/forestry/FOP/FOPW/NWFP/nwfp-e.stm). Over the past 10 years, numerous other international agencies such as the World Bank, Canadian International Development Agency (CIDA) (http://www.worldbank.org), International Development Research Centre (IDRC) (http://www.idrc.ca), Center for International Forestry Research (CIFOR) (http://www.cifor.cgiar.org), International Union for the Conservation of Nature (IUCN) (http://www.iucn.org), and the Biodiversity Support Program (BSP) (http://www.bsponline.org), among others, have incorporated the concept of NTFP into their programming. The 1980s and the 1990s also led to an explosion in the research of and writing about NTFP from an international perspective. A quick scan of FAO reports and the bibliography of NTFP literature, both of which can be found on the FAO-NWFP Web site reveals the growth of international interest in the topic of NTFP for tropical and subtropical forests. While the main focus for NTFP has been the tropical and subtropical regions of the world, there has also been a parallel, albeit smaller, growth of interest in the NTFPs of boreal and cold temperate forests.

Although the widespread economic interest in the NTFPs of boreal and cold temperate forests may be new, a large amount of research in other fields of knowledge predate the concept of NTFP and apply to NTFP issues. While it is difficult to divide this literature into discrete categories, we suggest that the following seven categories roughly cover the main literature in which the NTFP concept has emerged.

1. Ethnographic Studies

The ethnographic record provides a rich set of historical and contemporary information on the collection and gathering of plants, animals, insects, minerals, and other biological organisms that people have used to maintain a livelihood in the boreal and cold temperate forest regions. Many ethnographies also include detailed information on the role of such biological organisms in the processes of nutrition, manufacturing, trade, rituals, ceremonies, and healing. Some ethnographies also provide information on the ways by which peoples of the boreal and cold temperate forest regions steward individual species and their local environments. Finally, many ethnographic studies have discussed the market structures through which NTFPs are traded and the sociological dimensions of harvesters and marketing cooperatives. Many contemporary journals contain discussions of cultural and social processes critical to a fuller understanding of NTFPs.

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2. Traditional Ecological Knowledge (TEK)

Traditional Ecological Knowledge is a broad term that can be used to capture diverse sets of interests including: people's perception, ordering, and naming of the environment and its components ("new ethnography"); people's understanding of individual components of the environment (ethnobiology, ethnoforestry (http://www .inef.org), ethnobotany, ethnozoology, ethnopedology, etc.); and people's understanding of the relationship among the components of the environment and related stewardship practices (ethnoecology) (Berkes 1999, and in this volume; Berkes and Davidson-Hunt, in this volume; Turner 1995, and in this volume). Although this area of study has usually focused on "local peoples" in relation to components of the environment, it has also looked at biochemistry to ascertain the nutritional status of species that people consume (Kuhnlein *et al.* 1982) and the medicinal properties of species that people use for healing (Marles *et al.* 1999, and in this volume; Turner and Hebda 1990). Many examples of this type of research relevant to the renewed interest in NTFP can be found in the *Journal of Ethnobiology* (http://www.ethnobiology.org) and in a recent issue of *Ecological Applications* (http://www.esa.sdsc.edu/esapubs/Applications_main.htm) devoted to the theme of TEK (*Ecological Applications*. 10(5).

3. Economic Botany

Economic botany is interested in the use of plant species by human communities since the late 1800s. The *Journal of Economic Botany* (http://www.econbot.org) provides an extensive source of information on specific plants that have been used in the past or have commercial potential.

4. Forest Management and Policy

Forest management has largely been associated with the management of timber resources. However, a recognition of the importance of NTFPs can be found as far back as the late 1800s when the British colonial government of India included minor forest products in its forest management plans. The inclusion of NTFPs in forest management policy in North America is perceived as novel; however, this is due to a lack of knowledge about the history of minor forest product policy and management in the temperate forests of northern India, and other European countries. Ideas on how NTFP can be included in forest policy and management are starting to show up in forestry journals such as the *Forestry Chronicle* (http://www.cif-ifc.org/chron.html) and the *Journal of Forestry* (http://www.safnet.org).

5. Biology and Ecology of Forests

The biology and ecology of forests have largely focused on the timber species found in the forest. However, forest research has recently begun to focus on the trees, shrubs, herbs, fungi, animals, insects, and the physical characteristics of forests and the interactions between the components. As the focus on the biology of forest organisms has broadened, and an ecological approach to the inventory of forested lands has begun, this area of research has started to generate information that is directly relevant to our understanding of NTFPs. Journals such as *Conservation Ecology* (http://www.consecol.org/Journal) and *Ecological Applications*, along with the forestry journals previously mentioned, are starting to carry research that has direct implications for our understanding of the biology and ecology of NTFPs.

6. Forest Products Research

An extensive set of literature has examined the chemical constituents of tree, shrub, and herb species for use in commercial applications. This extends back to some of the early work on latexes, saps, resins, and oils as well as more recent work on the pharmacological properties of medicinal plants. This type of work is being reported in journals such as the *Journal of Ethnopharmacology* (http://www.ethnopharmacology.org) and is carried out at research centers such as the Natural Resources Research Institute in Duluth, Minnesota, USA (http://www.nrri.umn.edu).

7. Business Organization and Marketing

The success of NTFP businesses is often related to the structure of the organization and the ability to plan marketing strategies. This area has remained relatively unexplored, but it does draw on previous work on harvesters' cooperatives, market structure of other small-scale forest products (i.e., rubber in the tropics), fair trade, and marketing of other natural products. This type of work is being reported in many of the aforementioned journals, but much of the work has been done by private research or economic development organizations such as The Taiga Institute (http://www.taigainstitute.org).

In the 1980s and 1990s, many of these diverse strands of interest began to be drawn together under the umbrella term of NTFP. One of the earliest inventories of NTFPs for boreal and cold temperate forest was that undertaken by Christine and Robert Prescott-Allen in 1986 (Prescott-Allen and Prescott-Allen 1986). They undertook an extensive examination of "wild" species in relation to the North American economy. By the 1990s, many reports were emerging that examined the commercial harvest of a number of different forest species. They were largely based upon the mushroom, bough, and berry harvesting of the Pacific Northwest rainforest. Much of this work has been recently compiled in an annotated bibliography put out by the Pacific Northwest Research Station of the USDA Forest Service (von Hagen *et al.* 1996). In Canada, a similar interest in NTFPs arose in British Columbia due to the harvest of mushrooms and boughs from B.C.'s public forests. This led to an overview of the NTFPs harvested from B.C. forests in 1995 (De Geus 1995). In this report it was estimated that over 200 different botanical species are actively harvested from B.C. forests. A similar report was also recently released for Ontario which again identifies the range of species harvested from Ontario's public forests (Mohammed 1999, and in this volume). Marla Emery (Emery 1998, and in this volume), of the USDA Forest Service, also undertook a detailed study of NTFP harvesting by households in the Upper Peninsula of Michigan. In Europe, a similar interest was emerging for boreal and cold temperate forests and which was summarized in a report issued by the European Forest Institute in 1998 (Lund *et al.* 1998). Along with these broad overview reports, numerous other reports were being released that detailed work on specific NTFPs, such as the Ambio Special Report #9 on chanterelle mushroom harvesting in the Pacific Northwest (Liegel *et al.* 1998).

As forest managers were trying to catch up with what people were harvesting from public forests, the impacts of harvesting on forest ecology and the potential benefits of harvesting, NTFP harvesters and businesses were harvesting, processing, and exporting NTFPs. Many agencies were also promoting NTFPs as a tool for economic development in regionally depressed forest community economies or as a means to reconcile biodiversity conservation and economic development. One agency that has been actively exploring the commercial potential of NTFPs for forest communities is the Model Forest Program, funded in part by the Canadian Forest Service. Such reports have been prepared by the Prince Albert Model Forest in Saskatchewan (Mater Engineering 1993); the Manitoba Model Forest (Mark Mitchell and Associates 1995); the Lake Abitibi Model Forest in northeastern Ontario (Arborvitae Environmental Services Ltd. 1997); and the Western Newfoundland Model Forest (Freeman 1995). These reports provide an important source of information on NTFPs across the western and eastern boreal forests in Canada. Numerous other studies have also reported on the commercial potential of NTFPs from other cold temperate and boreal forest regions: Minnesota (Mater Engineering, Ltd. 1994); the North Shore of Lake Superior (D.C. Brubacher and Associates 1998); British Columbia (Wills and Lipsey 1999); and north central Ontario (Duchesne 1995). Other reports have attempted to provide basic NTFP business organization and marketing information (Freed 1995, 1996; Thomas and Schumann 1993); impact of harvesting (Robbins 1998, Wood Sheldon *et al.* 1997); the relationship between NTFP harvesting and biodiversity conservation (Vance and Thomas 1997); and national or regional "guesstimates" of the value of NTFP harvesting (Duchesne *et al.* 2000, and in this volume; Schlosser and Blatner 1995; Schlosser *et al.* 1995). Best current guesstimates for NTFP commercial value are $241 million for Canada (Duchesne *et al.* 2000) and $200 million for the Pacific Northwest (Schlosser *et al.* 1991, 1995). Value estimates for NTFPs are beset by a

number of difficulties and thus our use of the term guesstimate.[4] By the mid-1990s it was apparent that the concept of NTFP was being used to describe a set of forest harvesting activities in boreal and cold temperate forests that, as Marla Emery (1998) described it, were previously "invisible."

NTFPs did not just begin to be harvested, marketed, and studied in the 1980s and 1990s in the boreal and cold temperate forest regions. In fact, as we noted previously, there was a lot of research being undertaken over the past couple of hundred years on NTFPs within discrete academic and research domains. An exploration of this research demonstrates that people have always held a diverse set of values in relation to the forest and actively harvested a variety of organisms for commercial and domestic purposes. Unfortunately, those values have not always been recognized or respected in the process of forest management. However, as the concepts of ecosystem management and integrated forest management became more accepted, forest management agencies in both the United States and Canada were required to consider a broader range of values for forest management. The NTFP concept appeared to coalesce a diverse set of interests in an attempt to reveal those "invisible" values and include them within an integrated forest management approach. This brought together an unlikely set of characters. Forest managers were inviting anthropologists, ethnobotanists, botanists, mushroom harvesters, berry harvesters, medicinal plant harvesters, chemists, economists, and various other researchers and harvesters to workshops and conferences. The concept of NTFP became an exciting area within which to work because traditional academic boundaries and the boundaries between research, practice, business, and management became blurred. Harvesters and NTFP business people often knew the biology, ecology, and marketing of specific forest species better than research scientists. Chemists knew that some plants in the boreal forest had constituents of commercial value. Forest managers did not always have a clear sense of the importance of commercial and/or non-commercial harvesting activities for the livelihoods of Aboriginal and other peoples. However, this set of people rarely have the chance to exchange ideas on more than a regional basis or across the divide between academics, managers, and harvesters. This was the intent of the conference held in Kenora during October 1-4, 1999. We wanted to bring together a non-traditional mix of researchers, forest managers, NTFP harvesters, Aboriginal peoples, business people, marketers, and anyone else interested in NTFPs, local livelihoods, and integrated forest management. The papers that follow in this volume reflect the breadth of interest that the concept of NTFP can bring together. This leads us to consider a definition of NTFP and the type of themes currently included in the concept of NTFP.

[4] *Suffice it to say that there are two main problems that beset attempts at valuation of NTFPs. (1) Quantity of harvest: Some commercial NTFPs do have market prices but it is difficult to estimate the size of the harvest because the quantity bought and sold is not tracked through official markets. NTFPs that are not used commercially are not tracked through any measure of household consumption; (2) Market price: Some NTFPs used for household consumption are not bought and sold in a commercial market; therefore an imputed price must be determined. Furthermore, many people who harvest NTFPs for spiritual, pleasure, or other non-market values would not agree that the market price represents the value of their harvesting activities. The quantity question can be overcome through detailed household studies on a regional basis, for example, Emery (1998), Godoy and Bawa (1993), Godoy* et al. *(1993, 2000), Schlosser* et al. *(1991). The question of market or imputed value is a more difficult problem. See Jenne H. De Beer and Melanie J. McDermott (1996) for a thorough examination of this problem.*

PROBLEMS OF DEFINITION

NTFP has proved to be difficult to define due to some of the blurred boundaries between timber and non-timber products as well as the underlying difficulty in defining a forest. Most attempts at definition deal with three specific problems: (1) Scale of Industry, (2) Goods and/or Services and, (3) Origin of Product.

(1) Scale of Industry

The broadest definition of NTFP would include all biological materials harvested from forests for human use. The distinction between timber and non-timber has been

used in an effort to distinguish between different scales of enterprises that are harvesting biological materials from forests (De Beer and McDermott 1996). As Duchesne *et al.* (2000) report, the NTFP industry is only 0.4 percent (241 M) of the size of the timber industry (58.7 B) in Canada. Non-timber forest products are usually harvested by individual harvesters, households, or small cooperatives. Buying, processing, marketing, and exporting are usually undertaken by small firms (i.e., <$1 million gross sales/year) versus large multinationals. This is one of the greatest sources of confusion because the use of trees for the small-scale production of crafts, log houses, and/or domestic consumption is often included in the concept of NTFP.

(2) Goods and/or Services?

Another question to consider is whether NTFPs include only products (i.e., goods) or both products and services (i.e., non-market values). Lund *et al.* (1998) provided a detailed discussion on this point and chose in the end to use the term non-wood forest resources, thereby including all products, services, personal use values, aesthetic values, tourism values, and other values of forest lands, but excluding all wood products. In another example, the concept of NTFP has been broken into two product categories: (1) Special Forest Products, which are derived from trees and are regulated; and (2) Botanical Forest Products, which are not derived from trees and remain unregulated (De Geus 1995). At this point, there is no clear agreement on whether NTFPs should be narrowly defined as only products or more broadly referred to as resources.

(3) Origin of Product

Another question that has been raised is whether non-timber forest products are only those biological resources that originate from within natural forests. This raises a whole different set of questions as to how a natural forest is defined and whether the concept of NTFP should be tied to such a definition. Intractable and thorny questions arise such as whether a chanterelle harvested from a planted jack pine plantation is excluded while a chanterelle harvested from a natural regeneration, post-fire jack pine stand is included? Are Ericaceous species (e.g., *Vaccinium* sp.) harvested after mechanical disturbance excluded while all *Vaccinium* sp. harvested following a fire disturbance or from a mature forest included? Are species from managed "wildlands" included while the same species from managed tree plantations excluded? Ultimately, we suggest, that these distinctions will not prove viable as a means of forest classification and will create more problems than solutions for a definition of NTFP. The concept of NTFP has been left purposely broad so that all biological species gathered from a variety of ecosystems have been included while those grown as agricultural crops have been excluded.

As can be seen, there is probably no agreed upon definition for NTFP at this time. We have tended to support a loose definition of NTFP due to the evolving nature of the concept and the potential to bring together a diverse set of interests and experiences to the idea of integrated forest management. Our preferred term, at this time, would be non-timber forest resources, recognizing that the scale of harvesting activity is an important consideration while including a diverse set of interests and values in forest management. However, as pointed out above, the concept of NTFP has become well established and has been able to integrate the diverse set of values and interests necessary to move toward integrated forest management. In essence, the concept of NTFP refers to a consideration of the interests, values, and activities of people who have largely been excluded from forestry research, planning, and management. In sum, **we would suggest a broad definition of NTFPs as those biological organisms, excluding timber, valued by humans for both consumptive and non-consumptive purposes found in various forms of forested landscapes.** In the future, as we move toward integrated forest management and the diverse set of interests, values, and activities are integrated into forest management planning, it may be possible to move toward a holistic vision of forested landscapes and abandon the current emphasis on NTFPs. At this point, however, we still see more prospects in the integrating ability of the NTFP concept than in other concepts that have attempted to move toward integrated forest management.

THE RANGE OF NTFPS

Gina Mohammed (1998:2; and in this volume) provided a set of NTFP categories that give a useful overview of the types of products that can be included in the concept of NTFP. This set of categories, and the types of products they include, is replicated below. We have added one category to maintain consistency: non-consumptive products. In all categories, the use of the product may be commercial or it may be for personal consumption, aesthetic, or other non-market values as suggested in our final category.

Food Products
- Berries
- Beverages
- Essential oils
- Flavoring agents
- Herbs and spices
- Honey
- Maple/birch saps - syrups, sugars, taffy, butters
- Mushrooms
- Nuts
- Seeds
- Teas
- Vegetables

Materials and Manufacturing Products
- Adhesives
- Alcohol
- Candles
- Cloth
- Essential oils
- Fragrances
- Incense
- Lignosulfonates
- Resins
- Specialty wood products
- Stuffing material
- Thread and rope
- Turpentine

Health and Personal Care Products
- Aromatherapy oils
- Cosmetics
- Drugs
- Essential oils
- Herbal health products
- Nutraceuticals
- Perfumes and fragrances
- Pet care products
- Shampoos
- Soaps

Decorative and Aesthetic Products
- Christmas trees
- Cone crafts
- Bark crafts
- Wood crafts
- Carvings
- Floral arrangements
- Wreaths, garlands, swags
- Natural dyes

Environmental Products
- Biofuels
- Biopesticides
- Recycled products

Landscape and Garden Products
- Landscape trees
- Shrubs
- Wildflowers
- Grasses
- Mulches
- Soil amendments

Non-consumptive NTFPs
- Natural and cultural heritage tourism and education
- Biodiversity conservation
- Healing ceremonies
- Recreation
- Water quality

TOPICAL ISSUES OF NTFP

While NTFP incorporates a diversity of interests, values, and activities, we identified three current issues that appeared to be important at this time and that we incorporated into the conference. These three issues were: (1) NTFP and economic development, (2) the biology and ecology of NTFP, and, (3) NTFP markets and enterprises.

(1) NTFP and Economic Development

NTFPs are often cited as providing the potential for economic development in areas where the forest industry is in decline or the number of jobs provided by the forest industry is shrinking due to technological shifts (Clapp 1998). NTFPs, along with ecotourism, are also often promoted as a means to reconcile economic development with biodiversity conservation (Vance and Thomas 1997). However, we need to be careful of the potential that NTFPs offer

forest communities for economic development. Ricardo Godoy's detailed studies of NTFP harvesting in the tropics demonstrated that the value of NTFP harvests is not always sufficient to offset the loss of income from timber harvesting (Godoy and Bawa 1993; Godoy *et al.* 1993, 2000). Although Godoy does not suggest that timber harvesting is the only option for forest communities, he does say that offering NTFP enterprises and/or ecotourism will not necessarily provide enough benefits to forest communities to offset the losses from giving up timber harvesting. He suggests that communities will also need to receive monetary compensation for the loss of timber harvesting benefits. It is clear that NTFPs are not a replacement for a timber industry.

While some NTFPs do emerge to become large industries, the role that NTFPs seem to play more often in economic development is that they provide supplemental income for regions that are experiencing declining levels of employment (Emery 1998, McClain *et al.* 1998). The people who benefit from the harvest of timber are not always the same as those who benefit from the harvest of NTFPs. In some cases, people who live in areas where the employment provided by the forest industry has declined and who don't want to leave an area to which they are attached explore NTFPs as a way to supplement their income. In other cases, people who have not been able to obtain access to forest industry employment harvest NTFPs as a way to supplement small incomes. NTFPs are often marginal forest resources but are extremely important sources of income for the people who harvest them. In some cases it may be possible to foment the emergence of harvester cooperatives and local processing facilities (i.e., value-added enterprises) as a means of economic development. In this case, certification becomes an important consideration for NTFP enterprises (see Patrick Mallet, this volume). However, the absence of such infrastructure and/or formal organizations does not mean that NTFP harvesting is not playing a significant role in terms of local economies and livelihoods (see Alexander, Chapeskie, Greet, this volume).

Other people would not see NTFPs as a tool for economic development but would see them as critical to their way of life. For instance, many First Nations people in Canada may not see much potential economic benefit from NTFPs but do see the ability to harvest medicines, berries, barks, and other things from the forest as integral to their way of life. Medicines are important for healing processes; some barks and plant species are integral to healing ceremonies while the ability to gather together in berry harvesting camps is necessary for the maintenance of a collective identity. While economic development is an important consideration of NTFP, we should remember that commercial utilization is not the only activity that gives value to NTFP.

A key purpose of this conference was to explore the commercial potential of NTFPs and the different perspectives of First Nation and other harvesters toward commercialization.

(2) The Biology and Ecology of NTFPs

NTFPs are often considered to be the black box of integrated forest management. While we have reams of data on the growth and yield of many tree species, we know very little about the ecology and biology of shrubs, herbs, and fungi that are found in forest ecosytems. The biology of NTFPs would include such questions as what factors control their distribution and their establishment, what physiological and morphological aspects control their usefulness and/or potency as NTFPs, as well as how these factors control the sustainability of their harvest.

The ecology of NTFPs focuses on where NTFPs occur within forested landscapes in space and time. We have found that many NTFP harvesters have a greater sense of the ecology of NTFPs then do many research scientists. This is an area where the active collaboration between research scientists and harvesters may reap great dividends. As forest inventory science has begun to move away from timber-based inventory systems toward systems of ecological land classification, which include shrub and herb species, it has become possible to use this research to understand the ecology of NTFPs. There are two important issues

regarding the location of NTFPs in space and time: (1) not all NTFPs occur in mature forests as is often assumed, and (2) while many NTFP species occur across a great range of forest types, they are often more abundant in some types than others. By understanding the ecology of NTFPs, we may actually be able to influence the abundance of NTFPs within the forest landscape through a variety of different management techniques. For instance, it may be possible to undertake prescribed burns of logging residue in such a way as to stimulate berry production on certain soil types. From a spatial point of view, we may be able to recognize especially rich mature forest habitats for specific NTFPs and ensure that they are not completely cut out. From a temporal point of view, we may be able to identify early post-disturbance vegetative communities that provide specific NTFPs and ensure that they are not sprayed with herbicides. It is possible to use the ecological processes to change the spatial and temporal distribution of NTFPs for the benefit of local economies and livelihoods—something that Aboriginal peoples of boreal and cold temperate forests have known and practiced for a long time (Berkes 1999, Johnson 1994, Lewis and Ferguson 1988, Turner 1999).

Similar statements can be made about the physiological, morphological, and anatomical aspects of NTFPs. There has been little work in the northern forest directly related to the underlying plant biology of NTFP production. However, there is much information on plant growth and development in general that is very relevant to NTFPs and their sustainability. As harvesters often know more about the ecology of NTFPs, the same can be said about harvesters' knowledge about NTFP biology. NTFP harvesters often know much about the limits of harvest as they relate to the potential for future production. Collaboration among scientists and harvesters offers many productive opportunities for increasing our understanding of the biology of NTFP and their sustainable harvest.

As previously noted, NTFPs are often considered to be marginal resources. Therefore, except for those NTFPs that have unusually high market value, it is unlikely that large research programs will be established to examine their biology and ecology. Fortunately, a lot of research undertaken for the broader purposes of forest biology and ecology may be amenable to answering critical questions about NTFPs. For instance, the ecological land classification of Ontario has made it possible to estimate, with a probability of error, whether an NTFP will occur in a particular forest type at a given age. It has also become possible to identify where an NTFP may occur across the landscape. In other words, an inventory system undertaken for forest land management can be used for rapid NTFP inventory and assessment without the need for an extensive biometric survey of NTFP. There is also the potential for close collaboration between harvesters and scientists in this regard. Many harvesters know with great intimacy the type of habitat preferred by certain NTFPs so that NTFP habitat profiles can be constructed for a given NTFP. This habitat profile can then be matched against ecological land classification profiles to determine where the NTFPs may occur across the landscape. Given that it is unlikely that much primary research will be done on NTFPs, these types of collaboration for mutual benefit allow for exciting new paradigms of biological and ecological research to emerge.

Exploring the current state of the biological and ecological knowledge of NTFPs was also a key purpose of this conference as well as examining the potential for collaboration between researchers, harvesters, and entrepreneurs (see Flaster; Marles; Turner; Huang and Barl; Duchesne *et al.*; Nauertz and Zasada, in this volume).

(3) NTFP Markets and Enterprises

In a study by D.C. Brubacher and Associates (1998), it was found that one of the dominant market structures for NTFP consisted of many harvesters selling to regional buyers, who in turn sell to centralized processors and exporters. They found very few examples in which the processing and marketing of NTFPs were handled by local enterprises. One of the conclusions reached by the authors was that the market structure was a reflection of the "patchy" nature of many NTFPs. The boreal forest is noted for the cyclical nature of biological species across time and their uneven

distribution in space. A mushroom harvest may be excellent one year and non-existent the next; the harvest may be excellent in one region and non-existent in another. Harvesters, buyers, and processors of these types of resources tend to be mobile or able to switch their harvesting effort from one resource to another in different years. This makes it difficult to build a processing facility or establish exporting enterprises, both of which require a consistency of harvest from year to year: a finding that is well known to those who have worked with the marketing of agricultural products. In light of this ecological characteristic of many NTFPs, harvesters and regional buyers tend to have little capital investment in their harvesting activities. In addition, NTFP processors and exporters, by necessity, acquire NTFPs from a large catchment area. If mushrooms are good in Newfoundland one year, they will buy from there; if good in B.C. then they will buy from there. The patchy nature of many NTFP resources requires that harvesters, processors, and brokers not be attached to a particular region so that they can obtain a livelihood or meet the demands of their markets. D.C. Brubacher and Associates (1998) found that the ability to provide, or access, a consistent supply of an NTFP was often the limiting factor for NTFP enterprises.

NTFPs in boreal and cold temperate forest are often patchy; however, not all NTFPs are as patchy as others. For instance, wild rice/manomin (*Zizania* sp.) has been able to support local harvesting cooperatives with their own processing and exporting enterprises in many boreal forest regions. An example of this was provided at the conference in a presentation and display by Kagiwiosa-Manomin of northwestern Ontario (http://www.manomin.on.ca). While the yields may vary from year to year, they do not have the same dramatic swings as is evident for some fungus and berry species. The surplus from some years can also be easily stockpiled for years in which the harvest is not abundant. Other NTFP products that exhibit this profile are the maple and birch syrups (*Acer* sp., *Betula* sp.), boughs, essential oils, and resins. NTFPs with this ecological profile may be able to provide consistent yields and/or storage characteristics to support non-mobile harvesting, processing, and marketing enterprises along with the inversion of capital. For this type of NTFP, processing and marketing often become the limiting factor as demand may exceed supply.

Based on the presentations made by NTFP businesses, such as Frontier Natural Products Cooperative (http://www.frontierherb.com) and Winter Woods (http://www.winterwoods.com), it is apparent that more attention should be given to the relationship between the biology/ecology of NTFPs and the appropriate form of organizational structure to ensure successful NTFP enterprises (see Letchworth, Cameron, Krantz, and Polson, in this volume). NTFPs characterized by widely fluctuating yields from year to year require an organizational structure that follows one of two strategies: (1) mobility, the ability to move to areas of abundant harvest or purchase from a large catchment area, or (2) diversity, the ability to switch harvest effort from one product to another depending upon the year. In the former, there is an emphasis not to sink capital into a regional center. Processing and marketing are carried out from a more centralized location that can draw upon harvesting and brokering operations that span the great northern forest. Access to markets and transportation networks require that the processing occurs near the market as opposed to a regional center. This provides a successful model of an NTFP enterprise, but it does not offer many possibilities for regional value-added enterprises although it can support smaller harvesting and brokering operations located in northern forest communities. The diversity strategy requires that the enterprise invest in intellectual capital because it will need to have a broad knowledge of the ecology and markets of many different NTFPs. This model offers more possibilities for regional economic development although the type of enterprises that result will probably be small family businesses that support a network of harvesting as opposed to large processing facilities. The model that offers the most potential for regional economic development are those NTFPs that can be harvested from year to year within a region at levels that can sustain a buying, processing, and marketing capacity. In all cases, the ability to transform the raw product into something with enhanced storage properties is needed to smooth out the effect of cyclical NTFP yields and offer their customers the same quantity and variety of products from year to year. The conference provided an opportunity for researchers, harvesters, processors,

and marketers to understand the linkage between the biology, ecology, and marketing of NTFP.

Finally, the conference also explored some new ways in which NTFPs are being used to support people's livelihoods in the northern forest. In Canada there is an increasing market for natural and cultural heritage tourism. For example, whale watching on the north shore of the St. Lawrence River in Quebec has grown to a $1 million per year industry, and visits to Canada's National Parks Network have been increasing at the rate of 4 percent per year. Brokenhead First Nation in Manitoba described how they have created a small business called the Brokenhead Ojibway Historic Village (BOHV) (http://www.manitobamodelforest.net), which takes people on excursions to view the natural and cultural heritage of a region. BOHV and the Mi'gMag Aboriginal Heritage Garden, located in Eel River First Nation, New Brunswick, also described how they have created infrastructure, such as teaching centers or botanical gardens, which offer workshops and interpretive tours so that people can learn about the northern forest and how to turn plants into things such as medicines and crafts. Other participants, such as Eel Ground First Nation in New Brunswick, stressed that NTFPs are not just inputs to production processes or only the potential base of many permutations of ecotourism enterprises, but also an integral part of a way of life and other personal use values for which the term product does not comfortably apply.

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Introductory Remarks from the Treaty #3 Territory

Lance Sandy[1]

Boozhoo. On behalf of the 25 First Nation Communities in the Treaty #3 Territory, I welcome you to our homeland. Our territory covers 55,000 square miles of the Lake Winnipeg watershed in northwestern Ontario and southeastern Manitoba. These lands, forests, and waterways have sustained our people from time immemorial, and even today we continue to live in the forest. These lands are part of our spirituality. We, the Anishinabeg of Treaty #3, accept the responsibility from the Creator to protect these lands, and in the words of your conference, "sustain the land and its resources."

Our role as protectors of these lands has been a frustrating one for us since the signing of our treaty with Canada in 1873. Since then we have witnessed, and continue to experience, the loss of our traditional land use, erosion of our rights, loss and impairment of the environment, societal breakdown, and impoverishment of our people. My people have been repeatedly evicted from the forest by non-Aboriginal governments and by private entrepreneurs. My people are marginal participants in the forest industry, the primary driver of the economy in northwestern Ontario. The views of my people were not heard when the exploitation of the forest was planned by provincial and federal governments. Now the provincial government has delegated the care of the forests to the forest industry, which is driven by economic objectives and the bottom line—not by long-term sustainability of the forest environment. We are not confident that this delegation of responsibility is a good thing for the future of our forests and the protection of our forest values.

We believe that we need to put the past behind us and direct our focus towards the protection and sustainability of our homeland and its resources, and to become more involved in the sustainable economy of our forest. This includes taking a protective role in the development of our territory with the Trus Joist MacMillan hardwood mill, which presents a unique opportunity for sustainable economic and employment benefits—an opportunity we are currently pursuing.

I believe that your objective of utilizing and marketing non-timber forest products will be similarly constrained and challenged by the power of the timber products industry and that you face major hurdles in achieving an appropriate balance. Collectively, many of your objectives appear to be similar to those of my people: first, a recognition of a broad range of values and resources in the forest, and second, a recognition that use of these resources requires a respect for their sustainability and protection. I am pleased that your steering committee has put together such an exciting and international agenda, and I compliment the committee on the broad range of subject material to be covered. We are interested in hearing about successes in other parts of the world and about business opportunities that may have applications to our Treaty #3 community. I am pleased to see that representatives of Kagiwiosa Manomin will be in attendance. I believe that the efforts of Joe Pitchenese in creating a sustainable wild rice harvesting operation provide a path for others to follow within our territory. I know the conference attendees will benefit from this success story.

In closing, welcome to Treaty #3 Territory, and I wish you every success in your discussions over the next few days.

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Introductory Remarks from the National Aboriginal Forestry Association

Harry M. Bombay[1]

On behalf of the National Aboriginal Forestry Association (NAFA), I have appreciated the opportunity to be part of the planning committee for this conference. As an invited speaker, I'd like to pay particular respect to the Anishinabeg people of the Treaty #3 area as it is in their traditional territory where we have chosen to discuss the matter of non-timber forest products (NTFPs). Considering the importance of the topic, the presence of Elder Clifford Skead is acknowledged and appreciated. As I am a member of the Rainy River First Nation, located about 150 km south of Kenora, this conference and the trip here provide me with an opportunity to visit with my home community and to renew some old friendships.

Although I grew up eating wild rice, bannock, berries, fish, rabbit, and other wild game from the forests of this region, my current lifestyle is not a good example of how to preserve the traditions of my people. I work in Ottawa. As Executive Director of NAFA, my diet consists of meetings, national forest policy processes, multi-stakeholder fora, and travel to workshops and conferences—lots of them.

The objective of NAFA is to promote and support increased Aboriginal involvement in forest management and related commercial opportunities. In pursuit of this goal, NAFA is committed to multiple use forestry that, from the Aboriginal perspective, implies a different weighting of values; that is, a stronger leaning towards non-timber values. Tribal Chief Sandy last night spoke of the need for sustainability not only in general, but also within the forest industry in Ontario, which has continually neglected the needs of Aboriginal communities. He noted a greater congruence in philosophy between Aboriginal peoples and those promoting the development of NTFPs.

In the past few years, NAFA has been more active in encouraging Aboriginal communities to develop forest-based businesses with a focus on NTFPs. Recently we were involved in a study of NTFP potential with the North Shore Tribal Council. In our work, we have noted the growth in demand generated by consumer preference for natural products in areas such as alternative health care, specialty foods, and interior decor. Although Indigenous peoples throughout the world are not considered a significant market segment, we have had a preference for these natural products for hundreds of years.

Aboriginal people in Canada, because of the location of our communities and the knowledge our people possess about the properties of numerous plants and herbs, have a unique advantage in establishing commercial businesses based on NTFPs. Notwithstanding the issues that surround intellectual property rights and the lack of appropriate mechanisms to protect traditional ecological knowledge, Aboriginal communities should be assessing NTFP potential in their traditional territories. My rationale for this suggestion is fourfold:

1. If Aboriginal people don't do it, someone else will.
2. Most NTFP development does not require the disclosure of traditional ecological knowledge.
3. NTFP harvesting and production should be viewed as a traditional land use activity and therefore a means by which our Aboriginal and Treaty rights within traditional territories can be further substantiated.
4. Producing NTFPs is a means of retaining traditional knowledge, thereby strengthening our cultures within a contemporary context.

A further benefit is that we contribute to biodiversity preservation, provided there are management practices that ensure sustainability over time.

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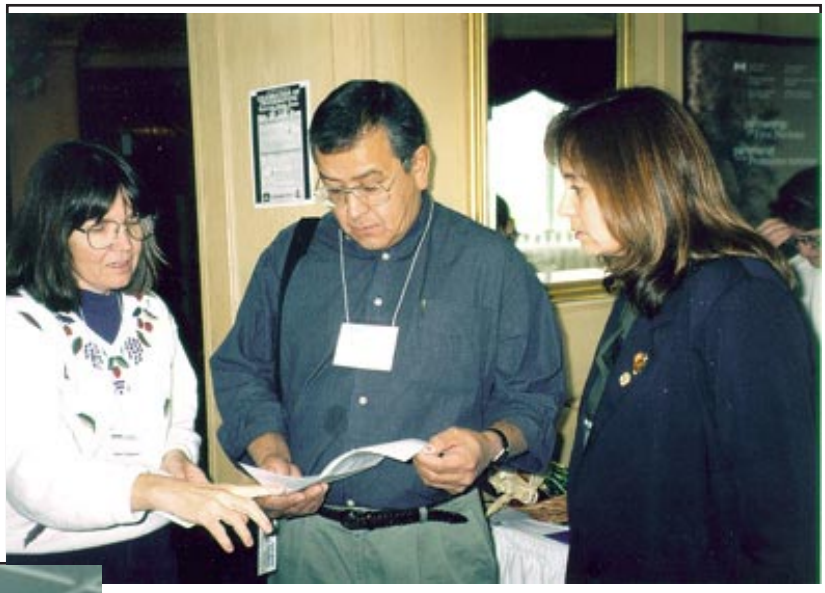
Another matter I would like to discuss is food security, which was raised last night by Paul Vantomme of the FAO (Food and Agriculture Organization of the United Nations). He pointed out that one group of Indigenous people in Africa, the Pygmies, have to compete with logging companies for a fruit from a certain type of tree, which is part of their daily food intake. Other Indigenous peoples have the same problem. In South America, the Mapuche people depend on a pine nut as a basic food staple, although both government and industry have only seen the value of the timber from this particular species of pine. Other resource use conflicts are less direct, such as the inadequate attention given to the effects of timber harvesting on NTFP production, which is presently not adequately provided for within timber management plans.

The point I'd like to make here is one of sustainability. From the perspective of NAFA, development is not sustainable unless it sustains the forest use of Indigenous peoples. Sustainable forest management is directly related to the food security of Indigenous peoples. Foods from the forest are NTFPs. Indigenous peoples should not have to compete for foods that they have used for centuries and that are essential to their survival.

Materials from the forest have been, and will continue to be, extremely important to Aboriginal people. My father was a hunter, a trapper, a guide for tourist operations, and occasionally a logger. However, I don't recall my mother ever asking him, upon his return from the trap line, if he was bringing home any NTFPs. Times are changing. Aboriginal communities need economic opportunities compatible with their values. The production of NTFPs holds considerable promise. The challenge on our part is for us, as Indigenous peoples, to become more market-oriented in what we produce. As well, we have to work collectively to address issues pertaining to intellectual property rights and look at how traditional knowledge can be shared for our mutual benefit. Intellectual property rights regimes that protect traditional knowledge, as well as ensure that Indigenous peoples benefit from its use, are a fundamental element of sustainable forest management.

These are some of the issues that underlie the advancement of non-timber forest products and that are of importance to Aboriginal people in Canada. Thank you for the opportunity to raise them here.



Karen Chapeskie (left), Taiga Institute, discusses the conference agenda with Harry Bombay (center), and Janet Pronovost (right), National Aboriginal Forestry Association. (Photo courtesy Bobbie Harrington)

A group of conference goers, part of the Sweat Lodge teachings field trip, warm their hands over the fire at Iskatewizaagegan #39 Independent First Nation in Shoal Lake, Ontario. From Left to right Dave Downing, Timberline Forest Consultants; John Lavois, Manitouwadge, Ontario; Trish Flaster, Botanical Liaisons; Pat Rasmussen, Counterpart International; Brian Walmark, Megwekob; Maureen McIlwrick, Canadian Forest Service; Edgar Lavois, Greenstone Economic Development Corporation; and Dale Hutchinson, Indian and Northern Affairs Canada. (Photo courtesy Bobbie Harrington)

Stuart Hill, God's Lake First Nation, talks to the group about traditional ecological knowledge and intellectual property rights. (Photo courtesy Bobbie Harrington)

NON-TIMBER FOREST PRODUCTS: ECONOMICS, SOCIETY, AND CULTURE

Who, What, and Why: The Products, Their Use, and Issues About Management of Non-timber Forest Products in the United States

Susan J. Alexander[1]

Abstract.—Non-timber forest products in the United States include floral greens, Christmas ornamentals, wild edibles, medicinals, crafts, and transplants. Non-timber forest products are important to many people for many reasons. People harvest products from forests for personal use, cultural practices, and sale. The tremendous variety of species harvested for the many markets stands in stark contrast to our poor knowledge of the biology, prices, or responses to harvest and habitat change for most of the species. The diversity of species harvested, lack of knowledge about the plants or their use, and inadequate institutions to ensure sustainable harvesting complicate policymaking and law enforcement.

INTRODUCTION

Definitions of what constitutes non-timber forest products, and even what to call them, differ. De Beer and McDermott (1989) included wildlife, fuelwood, and rattan in their discussion of products in Southeast Asia. The Food and Agriculture Organization (FAO) of the United Nations does not include fuelwood but does include household income in its definition (Wickens 1991). Key words to look for include non-wood forest products, non-timber forest products, and special forest products. This paper on non-timber forest products in the United States uses the categories floral greens, Christmas greens, wild edibles, medicinals, crafts, and transplants.

Non-timber forest products are important to many people for many reasons. Long historical use of many plants and fungi from forests is part of many regional cultures in the United States. Native Americans have used plants and fungi for food, medicine, housing, arts, and many other cultural and traditional purposes for thousands of years, and continue to do so. Other groups, as they came to the United States, brought traditions of forest use with them. Many groups have, for example, harvested boughs for seasonal decoration and foods for traditional and subsistence uses. Commercial markets have developed for numerous forest products (Alexander and McLain 2001, Savage 1995, and others). Medicinal plants and fungi have been harvested and traded for a long time; several species such as American ginseng (*Panax quinquefolius*) and goldenseal (*Hydrastis canadensis*) are mentioned specifically in state laws. Markets for some products, like wild edible mushrooms, are more recent and are growing rapidly. Some of these emerging markets have tremendous potential. Many of the species are not well understood, and current cultural and recreational uses have not received much formal attention. Promoting these products for economic development needs to take into account issues of forest ecosystem sustainability and species conservation, impacts on rural communities, and issues about public and private land use and property rights.

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FLORAL AND CHRISTMAS GREENS

One of the largest non-timber forest product markets consists of the floral and Christmas greens industries. In the U.S., significant

plants in the floral industry include salal (*Gaultheria shallon* Pursh), evergreen huckleberry (*Vaccinium ovatum* Pursh), and beargrass (*Xerophyllum tenax* (Pursh) Nutt) in the Pacific Northwest, *Smilax smallii* and *Tillandsia usneoides* in the Southeast, *Kalmia latifolia* in the Northeast, and various *Phoradendron* and several moss and fern species in many parts of the country. These products are harvested in the forest by local people and by workers who travel from one place to another throughout the season. People may harvest alone, in family groups, or in crews. The products are sold to "sheds" and then shipped to urban markets. Floral products from the U.S. are used in floral arrangements sold throughout the world; next time you are in a supermarket, take a close look at the floral section. Prices paid to harvesters for floral products in the western United States have been reported by Blatner and Alexander (1998), Blatner and Schlosser (1998), Douglass (1970), and others. Products rise and fall in popularity because the floral greens market depends on trends and tastes in the floral industry. Many products such as salal and evergreen huckleberry have been commercially produced since the early 1900s, however, and have held a place in the market. Floral greens are harvested year-round except in the spring when the new growth is tender. Christmas greens are harvested primarily in the fall and winter as they are used in traditional products for the winter holidays. Commercial species include many trees from which boughs are harvested, such as noble fir (*Abies procera* (Rehder)), Douglas-fir (*Pseudotsuga menziesii* (Mirbel) Franco), and western redcedar (*Thuja plicata* Donn.) in the Pacific Northwest, and balsam fir (*Abies balsamea*), Fraser fir (*A. fraseri*), and Virginia pine (*Pinus virginiana*) in the Midwest and eastern United States. The boughs are used to make wreaths, swags, and other products. Many floral greens are exported (Savage 1995). In 1989, Schlosser *et al.* (1991) surveyed 60 floral and Christmas greens businesses in Washington, Oregon, and southwestern British Columbia. The businesses employed about 10,300 people and sold $128.5 million worth of floral and Christmas greens. Emery (1998) reported use of boughs in Michigan for many purposes, including grave blankets. The harvest of florals, boughs, and Christmas trees for personal use is an important tradition in many families. Many people harvest small forest trees for use as Christmas trees and cut boughs for personal use.

WILD EDIBLES

Wild edibles are also important to many people. Markets for wild edibles, such as berries, fruits, nuts, tree sap, and fungi have existed for a long time. Some of the markets have expanded somewhat in the past two decades. The harvest of wild huckleberries, blueberries, and cranberries (*Vaccinium* species) has been and remains important to Native Americans. Many people pick wild huckleberries for personal use, and going to the forest to pick berries is an important late summer activity in many states. Wild huckleberries are harvested commercially and exported from both the west and east coasts of the United States to several countries, including Canada, Australia, Germany, and Japan. National forests in the Northeast, Midwest, and Pacific Northwest have initiated berry management treatments including burning and overstory removal to enhance berry production in traditional picking areas (Thomas and Schumann 1993, Alexander *et al.* 2001). Maple syrup production has been an important activity in the northeastern and midwestern U.S. for centuries. In 1995, 4.1 million liters of maple syrup were produced in the United States, with an estimated value of $25 million (U.S.) (Viana *et al.* 1996).

The wild mushroom industry has existed for quite some time at a small scale but has been expanding considerably since the early 1980s (de Geus 1992, Denison and Donoghue 1988, Molina *et al.* 1993). In the Pacific Northwest, the four most important commercial mushrooms are morels (*Morchella* species), chanterelles (*Cantharellus* species), boletes (*Boletus* species), and pine mushrooms, also called matsutake (*Tricholoma magnivelare* (Peck) Redhead). Many people enjoy picking mushrooms for personal use, and many others pick for incidental income. As with floral greens, people pick alone, in family groups, and even with crews. Most commercially harvested wild mushrooms are exported, but domestic demand is rising. Values for mushrooms and other wild edibles have been reported by Schlosser and Blatner (1995) and Blatner and Alexander (1998). Policy issues about mushrooms have been discussed by Denison and Donoghue (1988), McLain *et al.* (1998),

Molina *et al.* (1993), Pilz *et al.* (1999), Richards and Creasy (1996), and others. In part because the industry has expanded so fast, permit systems, fees, access, property rights, and other regulatory and rights issues are of concern to gatherers and property owners.

MEDICINALS

Native Americans and other people have harvested medicinal plants and fungi for centuries. Growing interest in holistic medicine has increased demand for wild plants and fungi from U.S. forests (Alexander and McLain 2001, Vance 1995). The economic value of medicinal products can be substantial. Prices for ginseng root in 1994 ranged from $25 (U.S.) per pound for domesticated root to as high as $300 (U.S.) per pound for wild root. Ginseng exports in 1994 were valued at more than $75 million (U.S.) (Viana *et al.* 1996). Current medicinal plant and fungus use among Native Americans has not been extensively documented because of concerns about intellectual property rights and privacy issues. Many of the plants and fungi are poorly known biologically; for example, responses to harvesting or habitat change may be unknown. The diversity of species harvested and lack of knowledge about medicinal plants and fungi among many forest land managers complicate policymaking and law enforcement. Demand for medicinal plants and fungi is on the rise, and harvest pressure on the resource is increasing. The medicinal market will likely face more debates similar to the one about access to yew (*Taxus breifolia*) bark in federally managed forests in the Pacific Northwest during the late 1980s and early 1990s.

CRAFTS AND TRANSPLANTS

Gathering and use of forest materials for crafts and transplants is an old, varied, and ongoing activity. Transplants are used in landscaping throughout the U.S. Xeric landscaping has become popular as water has become scarcer; the use of native plants in landscaping allows less use of water and makes survival of the plants used more likely. Plants removed from areas with planned activities such as underburning or tree harvest can be transplanted or used for craft activities (such as green manzanita (*Arctostaphylos patula* Greene) plants or branches). Use of forest materials for crafts has been reported by many authors in the United States, including Cohen (1989), Densmore (1974), and Emery (1998). Stems of vine maple (*Acer circinatum* Pursh) and red alder (*Alnus rubra* Bong.) are harvested and sold for use as tree trunks for the plastic-leaved creations sold in department stores and used by restaurants and resorts. Birch (*Betula papyrifera* Marsh.) bark is used to make baskets, vases, and Christmas ornaments, among other things. Twigs are used to make buttons and give form to wreaths; bark is used to make baskets, planters, and birdhouses; and cones are used to make ornaments and decoration for wreaths. The uses and opportunity for artistic expression are endless. Crafts may be made for personal use or for gifts, or they may be sold in a variety of ways. Crafts are an expression of the individual, the culture, and the region. They are an important part of American life and traditions.

SUMMARY

When we speak of non-timber forest products in the United States, we embrace a tremendous variety of products and species. The issues are as variable as the products. From an economic standpoint, products traded in commercial markets can have highly variable prices within a season or from one season to the next. Price may be a function of international supply and demand, market saturation, competing imports from other countries—all the effects felt by domesticated agricultural products. Ephemeral products such as mushrooms are particularly subject to year-to-year variations in availability. Social issues have also received some attention. Harvesters of NTFPs are often categorized as traditional, recreational, or commercial users, but most have some combination of reasons to harvest and use non-timber forest products. Another important issue about non-timber forest products is the lack of published information on the biology, supply, demand, or prices for most of the plants and fungi sought by harvesters. Harvesters and others in the industry are knowledgeable about the species and products, but the information is not generally available—the knowledge has either been discounted by those outside the non-timber forest products industry or has been withheld as proprietary information. The topic of non-timber forest products is fascinating in its diversity and in

the number of issues embedded in the study of the products, their harvest, use, marketing, regulation, and management. As more people ask more questions, some of the issues may be resolved while others are brought to light. The only solution is to keep asking questions.

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Non-timber Forest Products and Livelihoods in Michigan's Upper Peninsula

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Abstract.—Non-timber forest products (NTFPs) are increasingly looked to as potential income sources for forest communities. Yet little is known about the existing livelihood uses of NTFPs. Drawing on a case study in Michigan's Upper Peninsula, this paper describes the contemporary contributions of NTFPs to the livelihoods of people who gather them. First-hand use of products from over 100 botanical species was documented during a year of ethnographic research. These products contributed to gatherers' livelihoods through both nonmarket and market strategies. The paper suggests the need for a broad view of economic activity to fully understand existing NTFP livelihood uses and anticipate the effects of developing markets for wild plant material on individuals and households in forest communities.

INTRODUCTION

As a small number of North American non-timber forest products (NTFPs) enter the international market, there is mounting interest in their potential as livelihood resources for forest communities. While NTFPs seem like a "new" opportunity to many, they are, in fact, one of the first sources of the food, medicine, fiber, and other substances that have sustained human beings throughout the millennia. Even in the industrial and post-industrial worlds, they continue to provide important material and cultural resources for many. Yet little is known about NTFP contributions to the livelihoods of people who currently rely on them. This lack of understanding on the part of policymakers and rural economic development entities creates a danger that well-meaning efforts to promote NTFPs could displace existing livelihood strategies even as they try to improve the economic well-being of forest communities.

In response to that concern, this paper examines the role of NTFPs in household livelihoods in Michigan's Upper Peninsula. Taking a broad view of economic activity, the case study demonstrates that the livelihood values of NTFPs go well beyond the numbers captured by market statistics. I begin with a brief description of the case study location and methods. A list of products gathered in the Upper Peninsula is followed by a discussion of their functional uses. Next, a brief theoretical interlude on a broad view of economic activity introduces information on the economic context of the region and the household livelihoods of individuals who participated in the study. This theoretical background and grounded information leads to a discussion of the specific livelihood uses of NTFPs in the case study and generalized characteristics of their livelihood uses. The paper concludes with three questions, which I hope will provide food for thought as we contemplate active promotion of NTFPs as livelihood strategies for forest communities in the Third Millennium.

CASE STUDY LOCATION AND METHODS

The Upper Peninsula (UP) is located in the north central United States. Bordered on three sides by Great Lakes—Superior, Huron, and Michigan—it is part of the U.S. state of Michigan, although its only land link is with the state of Wisconsin. Archaeological evidence suggests seasonal human occupation of the

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region since the Woodland era, circa 3,000 to 300 years B.P. (Cleland 1992). Permanent year-round settlement appears to be relatively recent, dating to sometime around the early 1600s (Cleland 1983). The present-day population includes people of European and Aboriginal ancestry. Average human population density in 1990 was less than 18 persons per square mile (U.S. Census Bureau 1990). Forest cover in 1993 was 8,812,500 acres (83.9 percent of the total land base) of mixed hardwood and coniferous species in largely second- and third-growth stands. Located between 47° and 45° North latitude, the average annual growth of UP forests was a comparatively slow 150.2 million cubic feet during the period 1980 through 1992 (Schmidt *et al.* 1997).

Between August 1995 and July 1996, I conducted over 400 hours of semi-structured interviews with gatherers, buyers, and public and private land managers in the UP to learn what NTFPs were harvested there and what role they play in gatherers' household livelihoods. The results reported here are based on information provided by 43 individuals about their personal gathering activities and experiences. Gatherers were identified through a networking, or snowball sampling, technique. Of these, 10 identified themselves as Native American and 33 as European American. Questions asked during the interviews focused on what the individual gathers, how each NTFP is used, what ecological characteristics are associated with products, what harvesting techniques and norms are used, and how the gatherer learned these skills.

UPPER PENINSULA NON-TIMBER FOREST PRODUCTS AND THEIR USES

By the end of the field year, I had compiled a list of 140 NTFPs that gatherers reported personally harvesting in the region's forests and associated open lands (table 1). This plant material and fungi come from over 54 botanical families and 87 genera, including more than 100 species. Gatherers use them as edibles and medicinals, for ceremonial and cultural purposes, and as raw materials for crafts and other decorative items. Many species are used in multiple ways. Edibles, such as berries and mushrooms, were mentioned most frequently by gatherers (102 occurrences), followed by floral/nursery/craft items such as birch bark and boughs with 85 occurrences; medicinals like flag root (*Iris versicolor*) and balm-of-Gilead (*Populus balsamifera*) with 51 occurrences; and ceremonial/cultural uses with 18 occurrences (Emery 1998).

A BROAD VIEW OF ECONOMIC ACTIVITY

Economic history and anthropology suggest a view that looks beyond the formal market and individual actors to a more inclusive definition of economic activity (Gudeman 1986, Halperin 1988, Hart 1986, McGuire *et al.*1986, Smith and Wallerstein 1992). From this perspective, the economy is constituted by any undertaking that provides the material means for human existence (Polanyi 1977). People endeavor to ensure their survival and meet their needs, as they perceive and define them, by pursuing a variety of what are termed livelihood strategies. These include both activities in the formal and informal markets—such as wage labor, barter, and petty commodity production and sale—and nonmarket approaches—subsistence activities, gifts, and government transfers such as Social Security pensions and public assistance (table 2). As social creatures, human beings generally reside in groups and put together a living by pooling the resources of the household. At any given time, most households will derive livelihood resources from multiple individuals and strategies. The mix of livelihood strategies pursued by a household varies with its demographic composition and economic conditions. This mix of strategies at any one time and over the course of time may be thought of as "livelihood diversity."

The informal economy literature documents the reality of livelihood diversity in urban settings throughout the world (Mingione 1994, Portes *et al.* 1989, Roberts 1994, Smith 1994). A smaller body of work has begun to explore the diverse strategies that rural households in the United States use to secure their survival and the role of location in natural resource-rich areas in those efforts (Dick 1996, Glass *et al.* 1990, Jensen *et al.* 1995, More *et al.* 1993, Tickamyer and Duncan 1990). Read together, these bodies of work point to four important characteristics of diverse livelihoods: 1) the often critical role of subsistence goods; 2) the importance of even small amounts of cash income for low-income households; 3) the primacy of culture and social relationships in much economic activity; and 4) the critical advantage of flexibility for

Table 1.—*Upper Peninsula NTFPs*

Latin name	Common name	Latin name	Common name
Abies balsamea	balsam, boughs	*Fraxinus nigra*	black ash
Abies balsamea	balsam, cones	*Ganoderma applanatum*	artist conk
Abies balsamea	balsam, needles	*Gaultheria procumbens*	wintergreen, berry
Abies balsamea	balsam, pitch	*Gaultheria procumbens*	wintergreen, leaf
Acer saccharum	maple, sap	*Gaylussacia* spp.	huckleberries
Acer spp.	maple, twigs	*Hericium coraloides &/or ramosum*	hedge hog mushroom
Achillea millefolium	yarrow	*Hierochloe odorata*	sweet grass
Acorus calamus	wiikenh/bitterroot/flag root	*Inonutus obliquus*	sketaugen
Agaricus bisporus	button mushroom	*Iris versicolor*	flag root
Allium tricoccum	wild leek	*Laetiporus sulphureus*	sulphur shelf mushroom
Amaranthus spp.	pigweed	*LAMIACEAE*	mint
Amelanchier spp.	juneberries	*Laportea canadensis*	stinging nettles
Amelanchier spp.	juneberry twigs	*Ledum groenlandicum*	Labrador tea
Anaphalis margaritacea	pearly everlasting	*Lycoperdon* spp.	puffball mushroom
Anemone cylindrica	thimbleweed	*Lycopodium obscurum complex*	princess pine
Anthemis spp.	chamomile	*Matteuccia struthiopteris &* spp.	fiddleheads
Arctium spp.	burdock, leaf	*Mitchella repens*	partridge berry
Arctium spp.	burdock, root	*Morchella* spp.	morel mushroom
Arctostaphylos uva-ursi	bearberry	*Nuphar variegata & advena*	yellow waterlily
Armillaria mellea	honey mushrooms	*Picea* spp.	spruce, boughs
Artemisia spp.	sage (woodland)	*Picea* spp.	spruce, cones
Asclepias syriaca	milkweed	*Picea* spp.	spruce, gum
Betula papyrifera	birch, bark	*Picea* spp.	spruce, needles
Betula papyrifera	birch, root	*Picea* spp.	spruce, tips
Betula papyrifera	birch, sections	*PINACEAE*	pine cones
Betula papyrifera	birch, twigs	*Pinus banksiana*	jack pine, cones
Boletus spp.	bolete mushroom (various)	*Pinus resinosa*	red pine, boughs
Caltha palustris	cowslip	*Pinus resinosa*	red pine, cones
Calvatia gigantea	giant puffball mushroom	*Pinus strobus*	white pine, boughs
Cantharellus spp.	chanterelle mushroom	*Pinus strobus*	white pine, cones
Carpinus caroliniana	ironwood, twigs	*Pinus strobus*	white pine, needles
Cladonia & Cladina spp.	reindeer moss	*Pleurotus* spp.	oyster mushroom
Comptonia peregrina	sweet fern	*POACEAE*	grasses, various
Coprinus comatus	shaggy mane mushroom	*Polygonatum pubescens*	Solomon's seal
Coptis trifolia	gold thread	*Populus balsamifera*	balm-of-Gilead
Cornus sericea	red willow, bark	*Prunus americana &* spp.	plums, feral & wild
Cornus sericea	red willow, sticks	*Prunus pensylvanica*	pin cherries
Cornus spp.	dogwood twigs	*Prunus pensylvanica*	pin cherry twigs
Corylus cornuta	hazelnuts	*Prunus serotina*	black cherries
Dentinum repandum	sweet tooth mushroom	*Prunus* spp.	cherry bark
Dipsacus spp.	teasel	*Prunus virginiana*	choke cherries
Epigaea repens	trailing arbutus	*PTERIDOPHYTA*	ferns, various
Erythronium americanum	trout lily root	*Pyrus malus*	apples, feral & wild
Eupatorium maculatum	Joe-pye weed	*Pyrus* spp.	crabapples
Fagus grandifolia	beechnuts	*Quercus* spp.	acorns
Fistulina hepatica	beefsteak mushroom	*Rhus typhina & glabra*	sumac berries
Fragaria virginiana	strawberries	*Ribes* spp.	gooseberries
Fragaria virginiana	strawberry leaves	*Ribes* spp.	currants

(Table 1 continued on next page)

(Table 1 continued)

Latin name	Common name	Latin name	Common name
Rorippa nasturtium-aquaticum	watercress	*Trifolium pratense*	red clover
Rosa spp.	rose petals	*Trifolium repens*	white clover
Rosa spp.	wild rose hips	*Tsuga canadensis*	hemlock, bark
Rozites caperata	gypsy mushroom	*Tsuga canadensis*	hemlock, boughs
Rubus idaeus	raspberries	*Tsuga canadensis*	hemlock, cones
Rubus idaeus	raspberry leaves	*Typha* spp. *& hybrids*	cattail
Rubus parviflorus	thimbleberries	*Typha* spp. *& hybrids*	cattail, corn
Rubus strigosus	blackberries	*Typha* spp. *& hybrids*	cattail, down
Rudbeckia hirta	black-eyed Susan	*Typha* spp. *& hybrids*	cattail, flour
Rumex acetosella	sheep sorrel	*Typha* spp. *& hybrids*	cattail, roots
Salix spp.	willow, twigs	*Typha* spp. *& hybrids*	cattail, shoots
Suillus luteus	slippery jack mushroom	*Ulmus* spp.	elm bark
Syringa vulgaris	lilac blossoms	*Unidentified*	cinnamon top mushroom
Tanacetum vulgare	tansy	*Vaccinium* spp.	bilberries
Taraxacum spp.	dandelion greens	*Vaccinium* spp.	blueberries
THALLOPHYTA	lichens	*Vaccinium* spp.	bog cranberries
Thuja occidentalis	cedar, boughs	*Verbascum thapsus*	mullein
Thuja occidentalis	cedar, cones	*Viburnum* spp.	high bush cranberries
Thuja occidentalis	cedar, foliage	*Viola* spp.	violets, flowers & leaves
Thuja occidentalis	cedar, switches & tips	*Vitis* spp.	grapevine
Tilia americana	basswood bark	*Zizania* spp.	wild rice

Table 2.—*Livelihood strategies*

- ♦ Market strategies
  - Wage labor
  - Rent (of land, houses, goods, etc.)
  - Petty commodity production
- ♦ Nonmarket strategies
  - Subsistence (personal consumption)
  - Gifts
  - Government transfer

surviving economic change. For many households in the Upper Peninsula, NTFPs are an important part of livelihood diversity strategies.

REGIONAL ECONOMY AND HOUSEHOLD LIVELIHOODS

Beginning in the second half of the 19th century, the Upper Peninsula was a source of natural resources that helped fuel the territorial expansion and economic development of the United States. Timber from the region and other parts of the forested upper Midwest was fundamental to settlement of the largely treeless prairies to the west (Cronon 1991). UP iron mines provided material for transcontinental railroads, and copper mines were considered vital to national security during World War II because they furnished one of the primary materials for defense communications systems. However, by the late 20th century, the regional economy based on these resources had contracted drastically. Few mines remained open and employment in the timber industry was a shadow of its former numbers. Populations, which had swelled in the late 1800s and early 1900s, shrank (Catton 1976).

By the last quarter of the 20th century, unemployment rates in the region were fluctuating much more than national and state levels (fig. 1) and were at times nearly double that of the nation as a whole (13.4 percent and 7.0 percent, respectively in 1986: fig. 2). Median household incomes were 67 percent lower than the national figure, while the percentage of households with no earnings or living on fixed Social Security incomes (i.e., government pensions) was at least 50 percent higher. Strikingly, the percentage of households accepting public assistance such as welfare and Aid to Families with Dependent Children was virtually identical to that in the rest of the state and country (table 3).

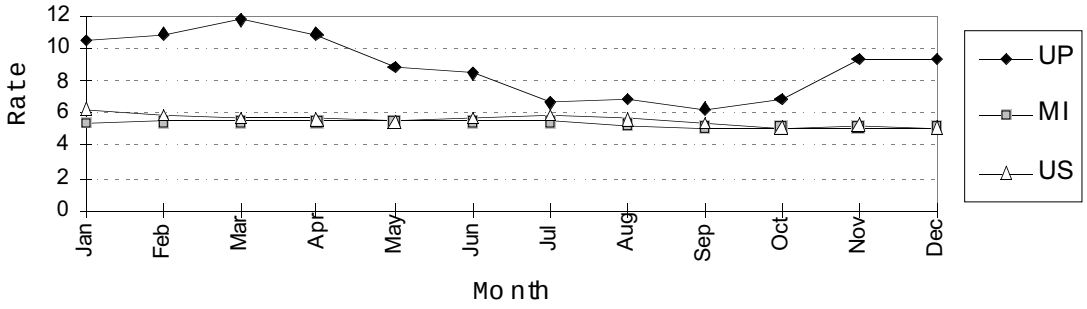

Figure 1.—*1995 unemployment—Upper Peninsula (UP), Michigan (MI), and U.S. rates (in percent).*

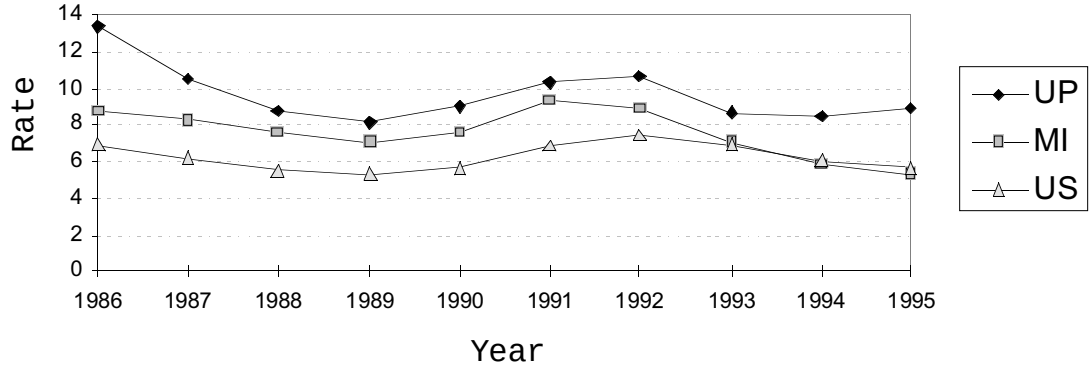

Figure 2.—*1986 - 1995 average annual unemployment—Upper Peninsula (UP), Michigan (MI), and U.S. rates (in percent).*

Table 3.—*1989 income and government transfer payments*

	Median income[1]	Percent of households		
		No earnings	Social Security	Public assistance
Upper Peninsula	$20,194	31	39	9
Michigan	$31,020	21	27	10
United States	$30,056	20	26	8

Source: U.S. Census Bureau

[1] In U.S. dollars.

Upper Peninsula gatherers make a living within this regional economic context. Gatherers are both women and men, Native Americans and European Americans. They are people of all ages, most often with longstanding linkages to the places where they live and gather. In the face of low wages and a chronically erratic formal employment market, they put together livings through a variety of strategies. Table 4 details the cash income sources of gatherers and their households for the year in which they were interviewed. Fewer than 25 percent of gatherers had full-time formal employment and even fewer (22 percent) had formal part-time employment. Twenty-three percent were living on Social Security payments (i.e., government pensions). Fully 80 percent were engaged in some form of self- or informal employment. The prevalence of episodic, part-time, and fixed sources means that they must simultaneously and sequentially pursue a number of strategies to meet their needs. For gatherer households, NTFPs are one of these livelihood strategies.

LIVELIHOOD USES OF UPPER PENINSULA NTFPS

NTFPs contribute to gatherers' livelihoods through both nonmarket and market strategies. Nonmarket strategies include subsistence (that is, personal consumption), barter, and gift giving. Market uses may be either sale of the plant matter in a raw form, with little or no modification, or sale in a processed form, most frequently as crafts or foodstuffs. The gatherers interviewed for this research make extensive nonmarket use of the wild plant matter they harvest. Nearly two-thirds (64 percent) of the livelihood uses mentioned took place entirely outside the market. Edibles were being consumed directly as valued and important parts of gatherers' diets. Medicinals were used by some to treat themselves and family members. Ceremonials were important in preserving culture and traditional practices. Florals and craft materials added beauty to people's lives and were often given as gifts.

Table 4.—*Household cash-income strategies of Upper Peninsula gatherers*

	Full-time year-round employment	Full-time seasonal employment	Part-time employment	Self or informal employment	Other work	Social Security[2]	Other transfer payments
Gatherers[1]	9	3	8	30	2	10	4
Household	7	2	3	23	0	3	4
Total	16	5	11	53	2	13	8

[1]Figures reflect data collected from 42 individuals (valuable information was collected from 43 people, but data from 1 person could not be used); 31 of the 42 lived in households that included one or more additional persons.

[2]Government pensions.

A bit more than a third of the livelihood uses of NTFPs (36 percent) were market based.[2] Earnings from market uses were rarely equivalent to income from a minimum wage job, when all time and expenses were factored in. However, NTFP contributions to individual and household livelihoods were often very important. In general, people gathered to meet specific needs. Among the frequently mentioned ends were property taxes, holiday celebrations, and basic living expenses. Once these targets were met and needs fulfilled, gatherers generally stopped harvesting and selling plant materials.

Results from the UP case study reveal aspects of the role of NTFPs in gatherers' livelihoods that correspond closely to the four characteristics of diverse livelihoods discussed in the economic activity section above. 1) Subsistence uses are widespread and often critical, accounting for the greatest number of species uses (although probably not the greatest volume of plant material). 2) Even small cash earnings from the sale of NTFPs can be critical to meeting household needs. 3) Gifts made from NTFPs or purchased with income from their sale help maintain the social relationships that are critical to both physical and emotional well-being. In addition, gathered plant materials and/or the observance of special harvesting practices are often central to important cultural practices. 4) One of the key values of gathering as a livelihood strategy is the roughly equal ease with which a knowledgeable person can turn to it in times of need or not engage in it when other pursuits occupy working hours and provide adequate resources.

FOOD FOR THOUGHT

In light of the characteristics described above, it may be worth our while to pause in the headlong rush to promote NTFPs as commodities and consider how this may affect existing NTFP livelihood practices. Many more species currently contribute in small but important ways to households than are traded in formal commodity markets. If we are to avoid the unintentional elimination of such existing livelihood values, we must adopt a broader view of economic activity. The well-being of forest communities is not captured adequately by industry sales figures and county or provincial tax receipts. To be certain, these are important statistics. But they tell us little to nothing about the distribution of those economic benefits. Nor do they represent the nonmarket and informal economy contributions that are so important at the individual and household level.

As this case study demonstrates, NTFPs have long provided important livelihood resources to forest communities and continue to do so. In the interest of enhancing those opportunities rather than limiting them, we will do well to consider three interrelated questions:

> What kinds of new social and economic interests would be introduced by the creation of additional markets for NTFPs?
>
> What kinds of policies would likely be introduced in response to these new interests?
>
> How would they interact with livelihood uses and values of existing NTFPs?

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[2] *This figure reflects the* number *of times gatherers mentioned a livelihood use for a plant species rather than the* amount *of plant matter being used. While the research described here did not attempt to quantify volumes of NTFPs harvested, it is likely that the greatest amount of biomass is used for sale in a raw form.*

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Northern Homelands, Northern Frontier: Linking Culture and Economic Security in Contemporary Livelihoods in Boreal and Cold Temperate Forest Communities in Northern Canada

Andrew J. Chapeskie[1]

Abstract.—This paper highlights the environmental pressures that have historically been brought to bear on the northern forests of Canada. It then presents the idea of the northern frontier forests of Canada as Indigenous landscapes whose ecological diversity and abundance have historically been nurtured in no small measure by their original inhabitants. It then proposes how contemporary community-based resource management institutions might embody customary Indigenous resource stewardsip practice to provide a contemporary foundation for a northern sustainable forest economy supporting local Community Economic Development (CED) initiatives that benefit all Canadians.

INTRODUCTION

Canada is often said to be an expression of "northern-ness." Some say that the historical aproach of the country to reconciling diverse regional interests through decentralist and pluralist institutions is how its 'nordicity' is embodied. For many Canadians the "northern-ness" of the country is a truism that is sometimes said to be too obvious to be worth repeating. However, the extent to which the expansive northern cold temperate and boreal forests that blanket much of Canada remain integral to the cultural identity of the country cannot be underestimated. These forests have simultaneously been considered by most Canadians as representing the "wilderness" of their country as well as constituting much of its "natural wealth." In this context, few Canadians have questioned that the natural wealth contained in the forests could be "exploited" to support the economic well-being of the country and that, at the same time, there would always be vast forest regions that could be preserved as wilderness.

This is now changing. Contemporary trends in environmental awareness coupled with immense changes in the resource-based economy of northern Canada, not least of these being a rapid expansion of the rate of industrial extraction of timber resources, are now leading many Canadians to debate the future of their forest landscapes. "Remote" and "wild" northern forests in Canada are no longer so remote and wild. Which of the forest landscapes of the country should be protected in their natural state? Which should be developed for forestry? These are the dominant questions driving the debate over the future of northern Canadian forests.

Such questions could be seen as important as far as they go. However, this paper proposes that these questions do not go nearly far enough to address the historical and contemporary ecological and social reality (the two are inseparable) of northern Canada. This reality is far more complex than these questions can hope to address. Indeed, this reality challenges old prejudices and assumptions about the historical and contemporary nature of the northern forest landscapes of Canada and the First Peoples who have lived in them since time immemorial. Further, it is a reality possessed of latent possibilities for conserving both cultural and biological diversity, maintaining ecological resilience, and promoting economic security for northern forest communities in Canada. It is a reality that will be ignored by Canada at its own risk.

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NORTHERN CANADA: FOREST HOMELANDS, FORESTRY FRONTIER

In southern Canada, where most of the population of the country lives, the debate over the future of northern forest landscapes centers around which areas should be developed for industrial forestry and which should be preserved in their "natural state." Nothing highlights this debate, as well as pointing to the biases and assumptions that lie beneath it, better than a July 1999 report of the World Wildlife Fund Canada (WWF Canada) entitled *Forests for Life - Canada's Commitment to Forest Protected Areas: a WWF Status Report* (World Wildlife Fund Canada 1999). The first map in the report (WWF Canada 1999, 3) and shown here as figure 1 illustrates the vastness of the Canadian forest landscape—especially of the boreal forest regions of the country. This is a map of the forest regions of Canada (Forest Regions of Canada map by J.S. Rowe, reproduced by permission of the Canadian Forest Service, Natural Resources Canada). The second map in the report (WWF Canada 1999, 5) is a compilation of data indicating the allocation of commercial forestry tenure on the provincial forest landscapes of Canada. Figure 2 in this paper dramatically indicates this "final frontier" of industrial forestry across the country. The development of the last pristine or old growth or primary growth regions of the boreal forest in Canada (when examined in relation to the boreal forest region shown on the map in figure 1) is now looming large on these landscapes.

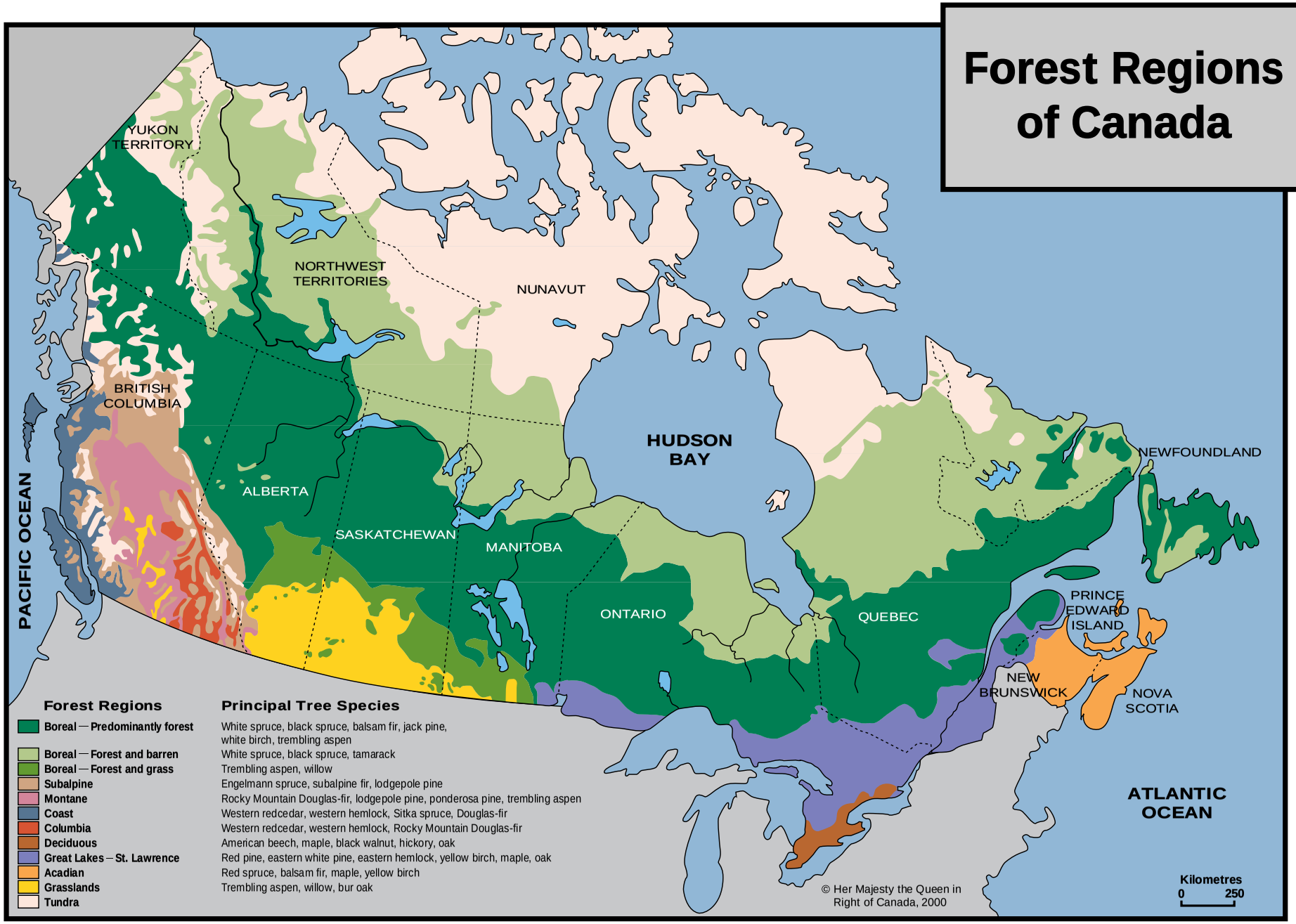
The second map illustrates the debate within dominant "settler society" over development and protection with respect to the forests of Canada. This debate is rooted in the concept of the resource cycle in forestry, which holds that, in a market economy, it is "...economically rational to exhaust resources with a slow annual growth rate, converting natural resources to economic capital for reinvestment in other industries with a shorter time horizon" (Clapp 1998, 130). In forestry, the dynamics of the resource cycle are said to lead to the liquidation of high value old-growth forest resources and a "falldown" in yields of wood per hectare in the transition from old-growth to second-growth timber on forest landscapes (Clapp 1998, 136). The case of the liquidation of the Great Lakes white pine forests is often cited as being emblematic of the resource cycle in forestry (Clapp 1998, 130). This is the type of industrial environmental impact that the environmental movement has sought to mitigate through establishment of ever more and larger protected areas in the forest landscapes of northern Canada. Throughout the debate, however, it is legitimate to ask: Where are the Indigenous peoples of northern Canada?

The importance of this question cannot be underestimated in the Canadian context. Aside from the issue of whether the ecological effects of industrial forestry could or should be addressed, even in part, through the creation of more protected areas, there remains a more fundamental question: Where and how do Indigenous peoples living within these landscapes fit in? These questions pertain to the very nature of Indigenous societies and the customary livelihood relationships these societies maintained with the landscapes of their forest homelands.

For many within the environmental movement as well as within the forest industry, arguments both for forest protection and development in Canada are predicated on the assumption that the country's northern forest landscapes are "natural". WWF Canada states this about Indigenous people in Canada who live in forest regions:

> "... almost 80 percent of the Aboriginal people of Canada are settled within forest regions, their livelihood still drawing **on the natural bounty** and diversity of these homelands" (WWF Canada 1999, 2).

It is true that 80 percent of Indian Reserves are located within the forest regions of Canada (in provinces such as Ontario and Manitoba, the majority of status Indians—people recognized as Indians by the Government of Canada under the Federal Indian Act—actually live in urban centers). But there are more fundamental questions embedded within this reality: What are the customary relationships of Indigenous peoples to these homelands in the forest regions of Canada? Have "Indigenous forests" always been "natural" and "wild?" If they have not always been "wild" or "natural," what is the significance for the promotion of sustainable livelihoods today? In the context of customary Indigenous relationships to land, what role should Aboriginal people play in the development or protection of the forests in which they live? Do the members of these societies even find such a dualism intelligible, let alone practical?



Natural Resources Canada
Canadian Forest Service
Ressources naturelles Canada
Service canadien des forêts

Figure 1.—*Forest Regions of Canada (Forest Regions of Canada map by J.S. Rowe, reproduced by permission of the canadian Forest Service, Natural Resources Canada).*

Canada

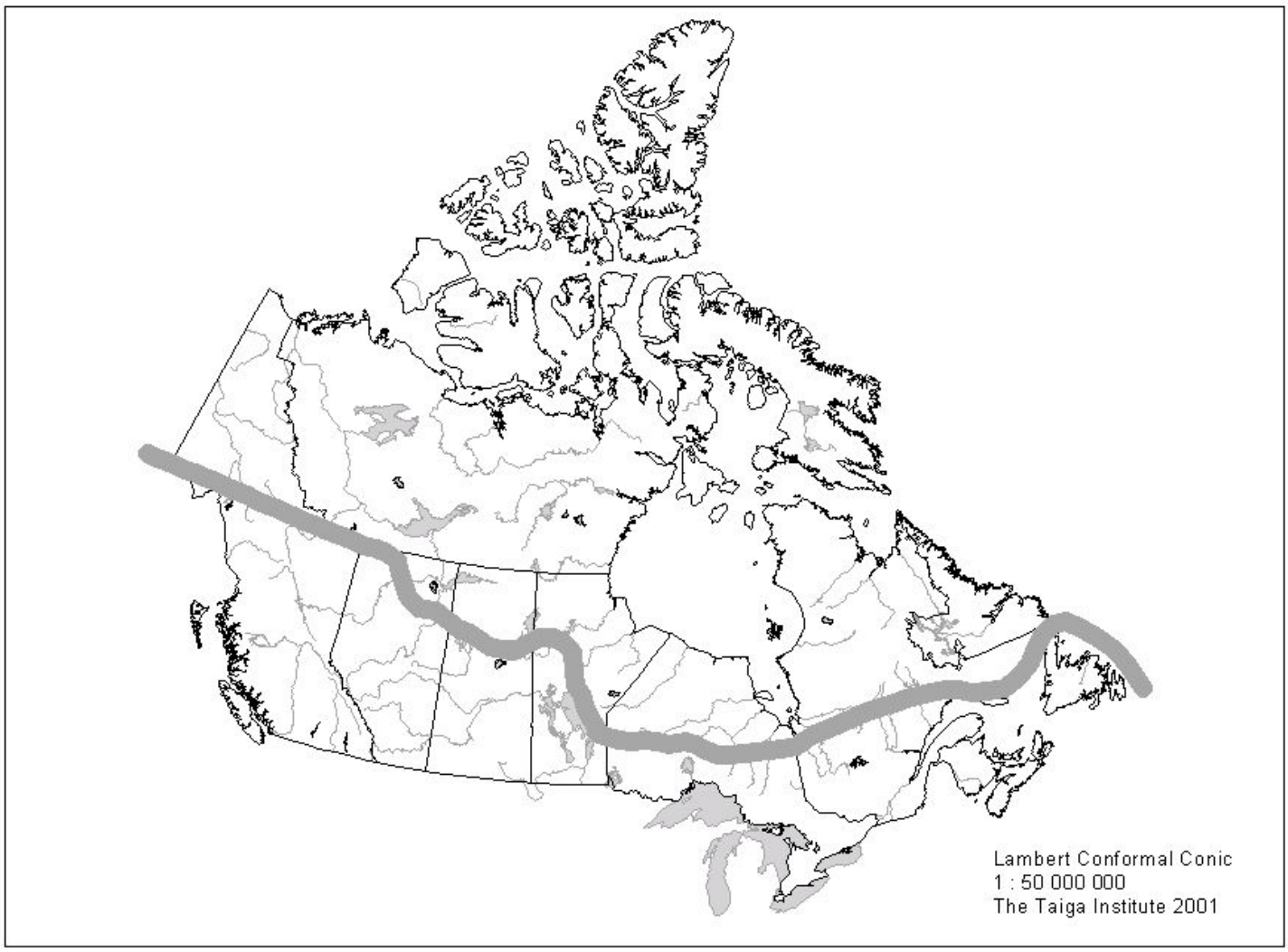


Figure 2.—*Forest allocations in Canada.*

WWF Canada notes in *Forests for Life* that "94 per cent of Canada's forest land is publicly owned, 71 per cent by the 10 provincial governments and 23 per cent by the federal government" (WWF Canada 1999, 4). However, it is critically important to note another fact on the ground: Indigenous people constitute a majority of the population within many of the northern Canadian forest landscapes. Nothing illustrates this better than figure 3, which is a map indicating languages spoken "on the ground" in North America as of 1980 (Academic American Encyclopaedia 1980). Additionally, in many areas where Indigenous peoples are not the majority of the people actually living within forest landscapes of northern Canada, they constitute rapidly growing (see figure 4), and in many cases already large, minorities. What are Indigenous interests in these forests landscapes? Why are Indigenous peoples not the owners or stewards? How has the dominant assumption that "traditional" Aboriginal societies drew on the "natural" bounty of their forest homelands allowed for questions of "ownership" or "stewardship" of forests to be ignored (it is certainly not addressed in the WWF Canada report)? Can we continue to hold such assumptions?

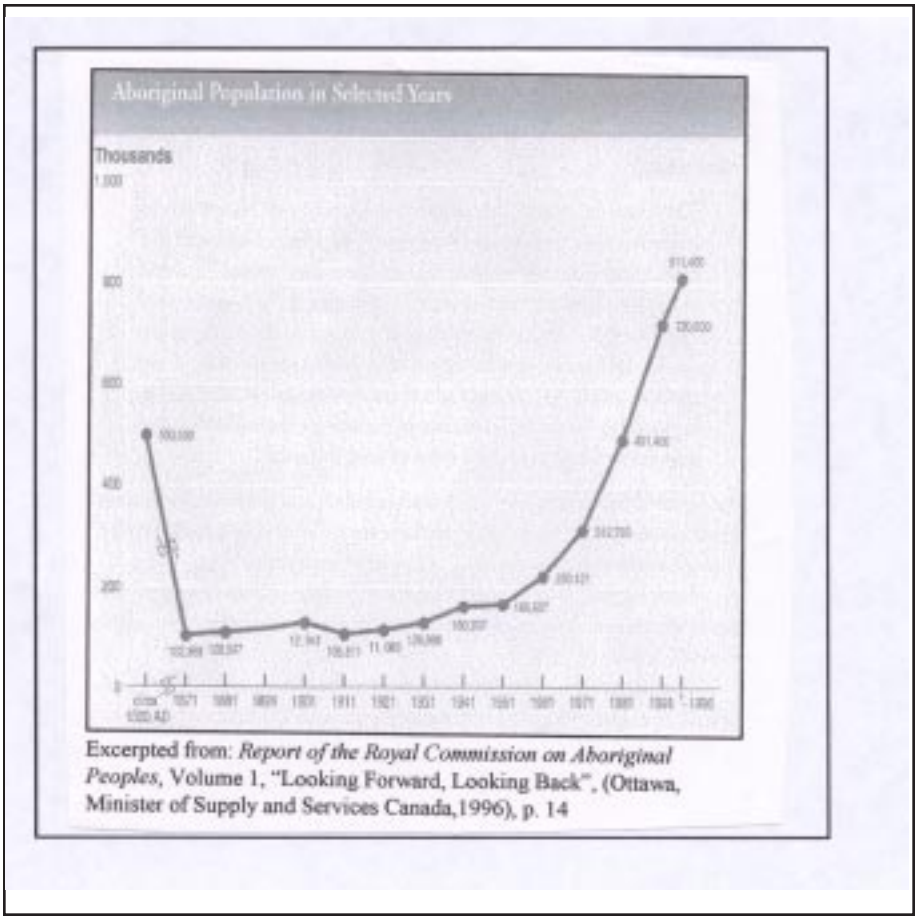
THE PEOPLE AND THEIR LANDSCAPES RECONSIDERED

In the changing context of the resource-based economy of northern Canada, one crucial aspect has not changed. In spite of a much greater awareness of "native issues" among non-Aboriginal Canadians in recent decades, most Canadians still generally appreciate northern Indigenous societies as "traditional."

Figure 3.—*Languages in North America-1980. (Photo courtesy of Academic America Encyclopedia, Grolier Inc., Danbury CN.*

The idea of traditional peoples inhabiting these forests is intimately related to the corresponding view that forests are wild and fragile as much as they are remote and vast. Such a romantic (or sometimes instrumental?) view of Aboriginal societies is rooted in what are probably ancient prejudices about hunter-gatherer societies. Chief among these prejudices is that traditional people could not tame or conquer wilderness because of their "primitiveness." These societies lived in a "state of nature," and remnants of these ideas are still with us today. Consider the following statement:

> For most of the time that human beings have inhabited the earth, they have been hunters. As **palaeolithic hunters**, they developed an assortment of life-sustaining spiritual, material, and strategic arts and accumulated a detailed knowledge of the environment and of the animal species in it. **They stalked mammoth, elk, bison and other great quarry tens of thousands**



Excerpted from: *Report of the Royal Commission on Aboriginal Peoples*, Volume 1, "Looking Forward, Looking Back", (Ottawa, Minister of Supply and Services Canada,1996), p. 14

Figure 4.—*Aboriginal population in selected years.*

> **of years ago**, using meticulously crafted arrow points. They trapped and fished, employing ingenious implements and techniques, in order to capture smaller wild game for food. Even today, in an often harsh and unforgiving world dominated by modern technology, tiny islands of **neotraditional** existence remain. **There are places, however imperiled, where hunters still venture out, much as they have in the past - into lush tropical Malaysian or Amazonian jungles, across sun-baked Australian or African grasslands or plains, along ice-choked Arctic shores - in order to supplement their diets with the high-quality protein of freshly killed animal flesh**. (Knudtson and Suzuki 1992, 81-82).

It is disconcerting to many Indigenous peoples living in forest communities today that such images can help foster a paternalistic attitude of "protection" (or practices of domination and neglect) on the part of "technologically advanced" industrial societies. This is directed not only towards Indigenous peoples, but also towards the wild and fragile landscapes evoked in the statement above.

Too often, these externally imposed attitudes and practices have been blind to the complexity of historical and contemporary customary Indigenous relationships to land within forest regions. Nothing highlights this more than the statements of Indigenous people themselves. I would like to refer to, and then reflect upon, two such statements—one from a cold temperate forest landscape in northern Ontario (Temagami region) and another from a boreal forest landscape in northern Alberta.

Consider the following words from the autobiography of Madeline Theriault, an Ojibwe woman who was raised in the Temagami region of northern Ontario. This is a region where environmentalists and forest companies have hotly contested how external control (through the provincial government) should be exercised over its ancient forests, many of which contain remnant stands of old-growth, wild, white pine forests.

> WHITE MAN MAKES A FARM to grow hay to feed his animals. He also grows vegetables for food. Indians also feed their animals, only in a different way. Around the middle of April, the Indian trapper looks around to find a bare spot, mostly up on the rocks where the snow goes first, where there is still a lot of snow at the bottom of the hill. They set a match to this bare spot and only burn where it is dry and bare, so there's no danger of a big forest fire because the fire stops when it reaches snow.
>
> Two years later you would find a big patch of blueberries in amongst the bushes. And you would see all the hungry animals of all kinds feeding on those blueberries; fox, wolves, black bear, partridge, squirrels, chipmunks, and all kinds of other birds. No doubt they were happy to find those berries. It was the trapper that got it for them by setting the fire.
>
> This is what I mean when I say Indians feed their animals too. The berries were for our own benefit too. As we would preserve them for our winter use. After a few years, young trees would grow on that burnt place. Then the rabbits would get to feed from those young bushes. In later years, the little trees would get bigger. Then the moose and deer get to feed from it. So, you see the setting of these small fires can go a long way in feeding many animals (Theriault 1992, 74-75).

This statement is deeply revelatory about customary Ojibwe livelihood relationships to forest landscapes. Not only does it say much about the "nature" of the Temagami forests in which the Ojibwe people have lived, it also encodes many of the objectives of customary Ojibwe "forest management." It is clear from the statement that the customary landscape management practices referred to were derived from an intimate understanding of resource energy cycles and ecological succession patterns. Indeed, it celebrates the diversity of these cycles and patterns. More than this, it celebrates how human interaction with forest landscapes—interaction that creates indigenous anthropogenic landscapes—can actually nurture resource abundance and diversity. It is clear that this statement reflects forest management practices focused on much more than timber resources. I will say more about this later in relation to the idea of pursuing economic security through a broader range of forest resources in contemporary forest communities in northern Canada.

Consider also the words of Indigenous elders recorded by Henry T. Lewis in the boreal forest region of northern Alberta. This is a region where environmentalists have questioned the ecological consequences of new forest harvesting activities by the pulp and paper industry.

> It used to be all prairie here; now it's mostly forest. My father told me that long time back there were plenty of buffalo here, all the way (north) to Cold Lake. We were Plains Cree, not like those bush people up north. Now it's all bush here too (Cree, 72, Frog Lake Area) (Lewis 1982, 24).
>
> They used to burn places where they think it was very useful. Like, for instance, the places where the horses used to winter in order to have plenty of good feed for them on grass; and then where there's lakes, around lakes, where there's muskrats, so they could always have real fresh roots. (Muskrats) live on grass roots mostly to keep them nice and fresh. If they don't (burn) the roots will spoil and rot you know, and then they'll die off every so many years. Places where there's moose and where the moose usually like to roam around. They burn the brushes there so that they'll have good green leaves and things to live on in summer. And, places where the Indians live close to...they'll be brushes like you see around, poplars growing in one place, eh. That's where they used to burn (Beaver woman, 69, High Level area) (Lewis 1982, 29).

These statements are as revelatory as those of Theriault from the Temagami region in Ontario. They demonstrate how Aboriginal peoples employed customary landscape management practices—using Indigenous pyrotechnology—to transform large landscapes for livelihood purposes. They confirm intimate Indigenous knowledge of ecological succession patterns and their control for human purposes. In this context as well, they celebrate the value of

diversity and abundance, as well as the possibility of nurturing both simultaneously. What is clear from the foregoing statements is that there is more to the "nature" of the forest landscapes of northern Canada than seemingly meets the eye of the outsider—in this case the "settler society."

How could customary Indigenous relationships to land, the need for economic security, and the need to promote ecological sustainability converge into a new paradigm of forest livelihoods in northern Aboriginal communities in Canada? To begin with, statements such as those referred to should lead non-Aboriginal society to acknowledge that Indigenous landscapes characterized the "New World," even *Before the Wilderness* (Blackburn and Anderson 1993) of it arose in the consciousness of settler society. After the coming of the Europeans, this "New World"

> ...was less virgin than it was widowed. Indians had lived on the continent for thousands of years, and had to a significant extent modified its environment to their purposes. The destruction of Indian communities in fact brought some of the most important ecological changes which followed the Europeans' arrival in America. The choice is not between two landscapes, one with and one without a human influence; it is between two human ways of living, two ways of belonging to an ecosystem (Cronon 1983, 12).

The historical reality of "wilderness" landscapes across North America is that "...[i]n fact, enormous areas of the continent's forests and grasslands were very much cultural landscapes, shaped profoundly by human action" (MacCleery 1996, 44). This history must become part of the popular consciousness of settler society in Canada.

It is necessary, however, to go even further than this. The contemporary value of customary Indigenous knowledge systems and institutions for promoting sustainable resource stewardship and economic well-being for northern Aboriginal forest communities in Canada should also be realized. This can happen, however, only when dominant settler society acknowledges that customary Indigenous Knowledge systems constitute valuable forms of "technology" or "technological knowledge" (Lewis 1989, 940). If we ever are to fully acknowledge the sophistication and complexity of "traditional" Indigenous customary relationships to land, we must neither conveniently nor "...inadvertently overlook the artifice behind technology in favour of the artifacts that it produces....[T]echnology should be seen as a system of knowledge rather than an inventory of objects" (Riddington 1982, 471). That societies have been able to achieve economic security as well social and cultural well-being by other means—affluence without materialism—should not blind us to the contributions that these knowledge traditions and social institutions can make to sustainable resource management today.

In western boreal forest landscapes, for example, the research of Henry Lewis has demonstrated that "...the hunter-trapper-gatherers of northern Alberta both increased and diversified available natural resources with the use of controlled burning" (Lewis 1982, 7). Are such practices anachronistic today? Certainly, they continue to have value as strategies that could be employed to increase biological diversity and abundance in forest ecosystems. More than this, they may well have value towards maintaining or restoring the very integrity of some of our most cherished ecosystems. This aspect of customary Indigenous resource stewardship must be grasped by the "popular mind:" The powerful image of the primeval forest causes some otherwise well-informed people to propose systems of inviolate preserves where human intervention is prohibited. Yet in most fire-prone ecosystems, continued human interaction will be essential to maintain them in a pre-European condition. A prime example of such an inviolate preserve is the Boundary Waters Canoe Area Wilderness in northern Minnesota [bordering on Quetico Provincial Park in Ontario]. As the late Miron "Bud" Heinselman, USDA Forest Service ecologist, demonstrated, the exclusion of fire from the Boundary Waters has doomed large stands of nearly pure red pine and white pine. In the decades ahead, they will be taken over by spruce and fir (MacCleery 1996, 48). The value of customary Indigenous pyrotechnology in these types of settings makes it understandable that Lewis and Ferguson would use the form of a prescription to entitle a paper on this topic in relation to the boreal forest: *Yards, Corridors, and Mosaics: How to Burn a Boreal Forest* (Lewis and Ferguson 1988, 57).

Indigenous resource management practices such as those outlined above have typically been embedded in local institutions of resource management. Such institutions are the means by which diverse, resilient, and abundant landscapes have been maintained by local groups in various parts of the world (Berkes 1989, 74-76). It should now be clear that these Indigenous landscapes are, in fact, the result of customary Indigenous resource management knowledge and practice that profoundly impact the environment.

Why should Indigenous customary resource institutions be so often found to nurture resource abundance and diversity? In no small part, it is because these local institutions have typically been embedded in practices of cooperation and equity (Chapeskie 1999). Through cooperative practice at the local level, communities can create adaptive strategies that maintain "...relatively high levels of diversity in the managed landscape" (Berkes *et al.* 1993, 4). Local institutions of cooperative resource management are able to prevent tragic losses of diversity in several ways. Among the most significant of them is that such institutions are based on traditions of equity and cooperation that discourage resource "overexploitation" in local unenclosed landscapes. These institutions are also sensitive and able to incorporate ecosystem feedback information. What, then, is their meaning for forest landscapes in northern Canada today?

A NEW PARADIGM FOR SUSTAINABLE FOREST LIVELIHOODS IN NORTHERN FOREST COMMUNITIES IN CANADA

Achieving economic security for Indigenous peoples within the forest landscapes of northern Canada constitutes a distinct challenge for the whole country. Could this challenge also be an opportunity to develop a new paradigm of "best practices" for sustainable forest resource use? The value of customary Indigenous "common property" relationships to land for promoting biodiversity conservation and sustaining ecological resilience is now well recognized and supported by expansive scholarly literature, of which only a fraction has been referred to in this paper.

However, this is only part of the story. The fact remains that, in northern Canada, Indigenous peoples have precious little voice in how the natural resources of their ancestral forest homelands are managed. There is not a single instance of Indigenous tenure for any forest resource (timber or non-timber forest products), for example, in northern Manitoba or Ontario. In most provinces in Canada, there is not even a legal framework for recognizing NTFP tenure in general, let alone Indigenous tenure in particular. In spite of the fact that Indigenous peoples constitute the majority of people living within the northern landscape, the vast bulk of forest tenure in existence is held by "outsiders." Given current demographic patterns in northern forest communities, this Aboriginal majority is rapidly increasing.

For Aboriginal communities in northern Canada, this issue has now become one of cultural survival. In adapting to the influence of the outside world, Aboriginal communities have been working their own particular praxis of contemporary community-based economic development. The Community Economic Development (CED) paradigm emerging out of this praxis is not based on isolation or cultural separation, but on mutuality. It is broadly participatory and even invitational in character. It promotes the idea of partnership between Indigenous communities, public, and private sectors. It expresses the urgent need to establish appropriate contemporary livelihood opportunities for Aboriginal people living in forest communities, but it also seeks to do this on terms allowing for local adaptation and cultural survival. The model that it employs is one of consensus-based economic decision-making for forest-based livelihoods where outside partners—often large corporations—work together with Indigenous people.

This new CED paradigm is being increasingly expressed by various Indigenous leaders and groups. It is expressed well in the words of Romeo Saganash, an official with the Grand Council of the Cree in Quebec, cited in a major Quebec newspaper:

> "First of all, most projects, if not all projects, in the territory were undertaken without the consent of the Crees beforehand. That consent element in the new approach is something that is worthwhile for us. It is definitely new. And it forces us to take some time to reflect on what we can do with this new situation. Part of the new Cree situation involves an influx of 500 young people entering the job market every year for

> the next decade," Saganash said. "Whether the new jobs will come from tourism, forestry or Hydro-Quebec projects involving Cree partnership are all options that desperately need to be worked out in a society where about 30 per cent of people still make a living from hunting, fishing and trapping. ..." Saganash cited economic development in Waswanipi, where construction of a sawmill two years ago created 75 jobs in a community of 1,000 people. [This is a joint venture partnership with Domtar Ltd. with the Crees owning a majority stake in the business.] "I think more and more we will be seeing that type of development initiative taking place in Cree communities. We have no choice"...Saganash said (Siblin 1999, A7).

In the context of the analysis presented in the previous pages of this article, there is a significant opportunity for Aboriginal people living in northern forest communities to nurture this new paradigm for forest livelihoods. What are its potential benefits? How can it be fostered?

In several critical aspects, there is significant potential to foster this paradigm. First, this potential relates to the "forestry frontier" in northern Canada. As has been noted, these lands are also the homelands of Indigenous peoples—where most of the people living on them are Aboriginal. There is an opportunity to "explore" and implement community-based forms of resource tenure and stewardship practice where Indigenous knowledge and customary resource management expertise is given "pride of place." It is within such models that customary resource management techniques and knowledge stand the best chance of being practiced, and are given the opportunity to adapt to new livelihood pursuits—including those that are "industrial" or "high tech."

The model of community-based resource tenure management for the forestry frontier in northern Canada provides an opportunity that transcends "politics of culture" and "politics of race." It emphasizes the "local" in resource management, and the benefits that local resource management and tenure can bring for maintaining diverse and abundant ecosystems as well as healthy communities within them.

The implication of the resource cycle theory in forestry points to the immense difficulty of restraining overexploitation in our contemporary economy: "...the removal of impediments to the free operation of markets is not enough—the market cannot accelerate natural regeneration, but it can accelerate depletion. Similarly, the establishment of secure property rights will not prevent overexploitation if the underlying market incentives favour rapid drawdown. Privatization is doubly perilous for sustainability, in that it is often used to justify resource giveaways (Dauvergne 1997). For biological resources with a slow reproduction rate...only state management, international agreements, and intense public scrutiny have had any success at slowing rates of exhaustion" (Clapp 1998, 139). The literature of community-based resource management suggests that even state management may not be sufficient to prevent resource exhaustion over the long term. However, it does point to the efficacy of community-based resource management to sustain natural resources over the long term (Berkes and Folke 1998). This efficacy is particularly notable in communities that have effective customary institutions of resource management. This is especially in contexts where many considerations (including the importance of a variety of resources for a variety of important social and economic purposes) beyond the "market signals" of the dominant economy will affect resource use (Chapeskie 1995).

Even in forest landscapes where Aboriginal communities live alongside settler communities, there is significant potential to promote community-based resource management. In the boreal forests of Canada, for example, tenure and management are typically focused on a very few dominant timber species. Such species are harvested for only a few uses (pulp and paper, lumber). Customary Indigenous forest management practice in these forests sometimes seems as if it was focused on every forest resource (from the creation of forages for ungulates to fruit harvested for domestic and commercial use) but timber! In the 20th century, for example, Frances Densmore, who originally went to study Ojibwe music in northern Minnesota and northwestern Ontario, got caught up with another fascination—Ojibwe (or Chippewa) plant use. Within a relatively short period of time, she catalogued an impressive

array of Ojibwe uses for more than 200 plants and trees (Densmore 1928). Within the forests of northern Canada, there is the potential to generate many economic opportunities from special forest products including NTFPs. In such cases, applying the concepts of pluralism and consensus-based decisionmaking to resource management between Aboriginal communities and other forest stakeholders offers considerable potential (Chapeskie 1995). This can be in the form of new business opportunities within which local forest livelihoods and forest resources can be sustained over the long term.

In the context of the foregoing, and even more for the future of our forests, it is important to remember that "resources are not; they become." Why would the larger public and private sectors be interested in pursuing a new paradigm of forest livelihoods with northern Indigenous communities of Canada? To begin with, if anything should be clear to anyone concerned with the future of our forests, it is that the only constant characterizing these forests will be change. From environmental factors to accelerating technological developments transforming the global economy, change is now a constant for forest communities and stakeholders. While the demand for forest resources continues to rise on a global scale, technological innovation in the form of mechanization continues to make more and more forestry workers redundant. Forest communities in northern Canada generally are in crisis. In the context set out in this paper, the future of Indigenous forest communities, which have historically been excluded from the larger forest economy, is even more fraught with danger. At the same time, significant opportunity also coexists within this crisis.

Aside from the potential of Indigenous knowledge and customary forest stewardship practice to contribute to the sustainable use of forest resources, Indigenous knowledge traditions have the potential to contribute significantly to a diverse "best end use" and "highest value use" forest economy. Indigenous traditional ecological knowledge (TEK) has the potential to serve as a "partnership resource" in fostering a diverse forest economy in northern Canada that places priority on community-based participation. For many years now, TEK has been used as a resource by outside interests for economic purposes. It has often been seen as "a gift for the taking."

Such an approach to Indigenous knowledge of forest resources and resource management practice does a disservice to the Indigenous peoples from whose knowledge traditions has been realized much "outside" commercial gain from forest resources. It is also seen by most Aboriginal people as fundamentally disrespectful. But in addition to this, it has the potential to foreclose on many other fruitful opportunities for successful economic collaboration and partnership to be achieved between Indigenous people and "outsiders."

There is, for example, an emerging popular interest in how the potential uses of birch bark are being pursued. The bark of the white birch is a "forest product" that has had numerous traditional uses among the Ojibwe people. It is these traditional uses that have in no small way inspired "outside" researchers to explore their broader application. Those who have the technological capacity to carry out this research would do well to consider that other equally significant potential opportunities might arise. This could happen through establishing strong and enduring collaborative partnerships with Ojibwe people to pursue the broader potential of these uses. In one discussion on the topic of the uses of birch bark that I had recently with Ojibwe people who are engaged in forest livelihood pursuits, I was presented with an array of other special forest product possibilities from other trees—uses that I had never come across before. They were intriguing to say the least. Do they have a broader application? Who knows. Certainly, however, the partnership approach to exploring them is worth serious consideration—not only for what "outsiders" can learn from Indigenous people, and vice versa, but how they might each contribute to the economic well-being of their respective societies.

SUMMARY

This paper has considered how a new paradigm of forest livelihoods might be built to foster the economic security and cultural well-being of Indigenous communities in the forest regions of northern Canada, and what this new paradigm might look like. This new paradigm is steeped in consensus-based decisionmaking and collaborative cross-cultural economic partnerships. To realize this paradigm constitutes a tremendous challenge. Not least of this challenge is the task of settler society in Canada to

let go of some of its most long-standing assumptions about Indigenous societies in this country.

I would like to state this challenge in practical terms: To focus on the ecological knowledge or even resource management practices of Indigenous peoples as "traditional" sets up what I have come to see as a problematic dualism between this knowledge and the knowledge of what are called "advanced" industrial societies. This dualism makes it too easy for "us" in "advanced industrial societies," especially those of us belonging to groups with vested interests in the northern forestscapes of Canada, to instrumentalize the "value" of "traditional" knowledge for our own purposes. Such a dualism leads to a view that appreciates the value in TEK solely in terms of our advanced industrial societies (e.g., it can be of value in state management of natural resources; it can provide pharmaceuticals for us). Such a dualism also tends to neglect the more profound significance and meaning of the economic, social, and cultural values of the societies out of which so-called TEK has arisen. Simply put, no matter how this dualist discourse of scientific, traditional, or Indigenous knowledge is presented, the implication is that some societies are more evolved than others. It even draws the conclusion that some societies are living in static, primitive, or fossilized states.

We must discard the ideology of the "traditional" Indigenous person, whether that person lives in the Canadian sub-Arctic or in Amazonia, as a "hunter-gatherer" practicing a way of life that "...involves subsisting primarily on wild plants and animals...[without the capacity] to regulate the growth and reproduction of the life forms on which people depend" (Plog *et al.* 1980, 210). Such assumptions can no longer serve our long-term ecological and economic interests. Rather, we must adopt a new paradigm that allows us to see how, for example, "[n]ative peoples' interactions **both past and present** with native plants, may offer some interesting yet novel [to non-Indigenous people], approaches to wildland management... [that] may prove effective safeguards against their rarity" (Anderson 1993, 173). This understanding can be applied to the whole range of resource management questions we face with respect to biodiversity conservation today. Equally important for Indigenous communities, it can foster collaborative strategies for economic security that are rooted in the deepest aspects of Indigenous culture.

This issue is crucially important for the economic well-being of Indigenous peoples in the northern forest regions of Canada. But, as I have noted above, it is also important in the context of the broader issue of biodiversity conservation. The issue of biodiversity conservation is generally considered to be one of the most important of our time. The present global ecological "extinction spasm" we are witnessing is viewed as threatening the very foundations of future human security (Wilson 1988). We have been told that, "...hope for the future is conditional on decisive political action now to begin managing environmental resources to ensure both sustainable human progress and human survival" (World Commission on Environment and Development 1987, 1).

In seeking guidance to a sustainable future, many in the "developed world" have turned their attention to the relationship between culture and conservation. Significant efforts are now being made to document and to understand the inextricable link between biological and cultural diversity (Wilcox and Duin 1995). A good number of these efforts are focused on the knowledge of Indigenous peoples of their lands and its potential value in biodiversity conservation efforts.

I believe that in the promotion of biodiversity conservation, for non-Indigenous people to understand and appreciate a deeper and more profound value of what some call traditional ecological knowledge (TEK) and what others call Indigenous knowledge (IK), it is necessary to move beyond focusing on the technical content of TEK or IK; that is, *what* Indigenous peoples know *about* the land. Rather, what is required is that we re-evaluate some of our most basic assumptions about the cultural contexts out of which TEK has arisen. We need to better appreciate *how* and *why* Indigenous peoples know what they know of their lands. We need to understand that while forest resources might be used for different purposes by Indigenous people in Canada today, Indigenous institutions and practices of customary resource stewardship have an enduring value for today and for tomorrow.

Taking up this task will also allow those of us who consider ourselves as being other than "Indigenous" or "traditional" to re-consider some of our most basic assumptions about our relationships with the "natural" others of our world. We need to understand the roots of the inadequacy of our discourse, as well as the inadequacy of the practice of resource management and conservation. By doing this, we can come to understand how, for example, the dualist idea of protecting some land from humans through conservation while allowing development on the rest of it may be ultimately futile. It is to concerns such as these that Indigenous knowledge has as much to offer as it does to fostering local Aboriginal economic security. Let us seize the present opportunity to address these concerns from our local forest communities through to the level of broad public policy and move toward meeting the challenge at hand.

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The First Nation Forestry Program in Ontario

Rick Greet[1]

"In partnership with First Nations" has been described as the motto of the First Nation Forestry Program (FNFP). Working in cooperation with the federal and provincial governments, forest industry companies, and other partners, the FNFP provides an opportunity for First Nations and First Nation businesses and organizations to promote forest-based economic development, with full consideration for the principles of sustainable forest management.

Jointly funded and administered by Natural Resources Canada (NRCan) and Indian and Northern Affairs Canada (INAC), the FNFP is a 5-year program that ends March 31, 2001. It is delivered by the Canadian Forest Service (CFS), a sector within NRCan. The intent of this national program is to help improve economic conditions in status First Nation communities by facilitating, levering, or being the catalyst for increased contributions from external sources, leading to self-reliance of business initiatives. The FNFP supports communities in developing better and more cooperative ventures from which viable and sustainable long-term jobs will be created.

The FNFP in Ontario is directed by a seven-member Ontario Management Committee (OMC), which consists of five members from First Nations, one member from INAC, and one member from CFS. To achieve the objectives of the FNFP, the OMC has placed priority on the following strategic issues:

- Encouraging broader understanding of traditional knowledge, culture, and values;
- Contributing towards self-sufficiency of business initiatives and community development; and
- Developing capacity and support for cooperative working and funding partnerships.

Projects must demonstrate a trend towards self-sufficiency, creation of economic benefits, and capacity development in a forest-based business.

To date, more than 60 individual First Nations or First Nation organizations have been assisted by the Ontario FNFP. In line with the intent of the program, the $2.7 million (Canadian) contribution from the FNFP over the past 3 years has helped facilitate the development of projects with a combined value of over $9.2 million. This means that for every $1 invested by the FNFP, an additional $2.40 has been contributed by First Nations and First Nation businesses and organizations, as well as by other government and private sector partners.

Businesses have been investigated, created, and enhanced that have helped facilitate economic and social development in communities across Ontario. Some of the worthwhile projects that have been supported include biomass heating studies for remote communities; partnership development and joint ventures in harvesting and value-added manufacturing; forestry business planning; education, training, and business development in forest firefighting; forest management services; non-timber forest products; and forest nursery and ecotourism operations, to name a few.

The OMC members are very pleased that the FNFP is an active partner in stimulating interest and investment in Aboriginal forestry business development. In a prepared statement, the OMC members have said, "there is still a significant amount of work to be done to ensure that the First Nations of Ontario establish a real presence in the forestry industry. The work being supported by the FNFP is playing an important role in the development of the First Nation forestry sector. This type of support needs to be continued in order to ensure the sustainability of First Nation forestry activities."

For further information, please visit the First Nations Forestry Program Web site at http://www.fnfp.gc.ca.

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Making a Black Ash Basket: From Log to Finished Product

A group of men drag a black ash log out of the woods. Only 1 or 2 of every 10 trees are good enough for basket making. To qualify, a tree must be at least 5 to 6 inches in diameter at breast height, have a straight 4- to 6-foot-long trunk that has no visible knots or defects, and have annual rings that are no thinner than a nickel.

Tools of black ash basketry.

The log is pounded with the blunt end of an axe to separate the annual rings for splints, the pliable wood strips that will form a basket. Here, Mark Bisonette is working his way down the log from the small end to the large end. He takes care not to strike too lightly or too hard because a too light blow will separate only two or three rings and a too hard blow will crush the splints.

Two women—one is the top basket weaver on the St. Regis Mohawk Reservation—get the splints ready to be woven into a basket. The splints are smoothed with a knife if they are thin enough, or they can be split once again by cutting halfway through them with a knife and then peeling them apart as if peeling the backing off of contact paper. The splints are then cut into different widths. When wet, a black ash splint is strong and flexible and can be bent into a right angle.

Les Benedict begins work on a basket. He uses a form to get just the right shape, a critical step in basket making.

Baskets come in many styles and sizes for many uses. The decorative, highly prized baskets in this photo are called fancy baskets. They are made from sweet grass and the most desirable wood of the black ash—the almost white sapwood. Black ash baskets hold their shape for years and are passed down from generation to generation.

A Leech Lake Reservation elder, with years of experience in her fingers, deftly weaves black ash splints into a corn-washing basket.

Black ash seeds surrounded by splints and sweet grass with a gauge—one of the tools of basketry—to the side and tiny pack baskets at the top.

NON-TIMBER FOREST PRODUCTS: BIOLOGY, ECOLOGY, AND RESOURCE MANAGEMENT

Intellectual and Ecological Traditional Knowledge: Can It Be Sustained Through Natural Products Development? Case Studies from Thailand, Tibet, Ghana, and Guatemala

Trish Flaster[1]

Sustainability, as defined by Charles Peters (1994), means having a greater abundance of mixed ages of keystone plant species growing than being harvested within a forest. In this presentation, I hope to demonstrate, through case studies, not only how sustainability is indeed ecologically what Dr. Peters said, but also how it is enriched and further sustained by the ecological and intellectual knowledge held by the cultures and their economies dependant upon the specific geographic region in which they reside. Furthermore, when the traditional ecological knowledge (TEK) and intellectual property rights (IPR) are sustained, the result can be mutually beneficial to people when applied to natural products microenterprises.

In this paper, I will describe four projects that have complemented sustainability with medicinal plant products from traditional sources. These preliminary projects are the creative results of responding to requests for alternative modes of income that benefit traditional peoples. The meetings and conversations that arose determined how relationships were structured, what knowledge could be shared and therefore included in the projects, and what results may be realized by these actions. Never was a project considered without the direct intervention by the traditional members of the team or without their agreement after clarity had been reached.

Even though TEK, knowledge held by traditional peoples about when to harvest and where to harvest useful plants, may be the most critical information to the success of a natural products enterprise, it must be woven into a program that acknowledges and is mutually beneficial to the IPR and the value systems of the traditional group.

IPR issues are also important because these benefits must be returned in a way that sustains the project and meets the needs of the community. This is an area that has stimulated great polarity as many "well-meaning outsiders" have thought they were assisting people while in reality they were blindly casting traditional wisdom away. However, it is also a difficult task for traditional people to determine what IPR is critical for them to protect because it is a foreign value system, resulting from a competitive market economy. A successful project daughters new smaller projects while promoting the current one. It protects the environmental resources, offers training, and imparts skills to community members. Skills may include plant collection and studies, collection of biological data about the products' traditional use, production, marketing, and sales.

Each international project is different because each cultural group has unique requests for how the project should be implemented, what materials are included in the project, and how benefits are to be shared. Each project also has a unique approach depending on the funding. Projects that may not have long-term funding need to take a different approach from projects that are secure in larger grants. When monies are not provided, the only way to succeed is to choose a path that rapidly creates revenue. The time required for training of personnel is limited so those already aware of marketing and business attitudes are initially contacted. Working with people in urban areas who already have production abilities and the understanding of American businesses is preferred. This is still ethnobotany because it is the direct interaction of plants and culture, but it is not the romantic definition assumed by most. Regardless of the approach, from the beginning, a clear understanding that shared profits

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are an essential part of any agreement is established with benefits supporting the sustaining of traditional knowledge and people.

THAILAND

In Thailand, after many discussions extended over a few years, we visited to confirm the project parameters. We chose to work with urban colleagues who wanted to make products from traditional medicines and support traditional knowledge. We visited a hospital to verify our formulas. The hospital offered allopathic medicine as well as traditional remedies. The patients could choose which medical system they preferred. We interviewed the pharmacist, toured the facilities, and saw the processing of the raw materials and the onsite making of the herbal pills dispensed from the pharmacy. We verified that the formula and dosage of a particular formula matched the one we intended to market in the U.S. In return for their help, we offered a donation for their building of a new processing facility. For the same project, we visited organic farmers to determine the quality and availability of raw materials as well as Thai massage schools where students were learning to make traditional herbal products. To complete our tour, we visited several suppliers and manufacturers with whom we hoped to partner in the future as well as university departments where biological and chemical assays could be performed on the new products. Finally, we met with colleagues who would act as liaisons to traditional healers we hoped to visit on a return trip. Even though it was an urban-based project, in each step we made sure that IPR and TEK were acknowledged and included. The result was two products based on traditional recipes and use, verified in the hospitals, with materials procured from quality sources and IPR rewarded to sustain training in traditional methodologies and current market systems as well as quality of production.

TIBET

The Tibetan project focused on ecological and cultural criteria. Unlike the case study in Thailand, the product was already active in the domestic market; before increased promotions, we were asked to audit the facility and set up research plots for a feasibility study of the sustainability of the raw materials. We made two visits before the field study. This gave us time to meet the members of the team, write up agreements, and scout out field sites and plants of focus.

Since the Tibetan homeland is predominately high altitude, concern for their raw materials through traditional sources was integral to the success of the project. We coordinated a field trip to one of the collecting areas of the Amchis or traditional healer. We visited his village and met with the local collectors and Amchis. While in the field, we observed and discussed the compromised availability of the raw materials, implemented study plots, and created awareness about the depletion of the medicinal plants. The plants were disappearing rapidly due to large numbers of Chinese emigrants in the region and their introduction of grazing animals other than yaks. The yak, a browser like the buffalo, does not consume all plants in its path. When we sought plants to collect and areas in which to set up study sites, we found degradation of the usual collecting sites. This led to the understanding that limits needed to be established and cultivated materials needed to be protected from browsing animals. It was at this point that the Amchis and collectors exchanged traditional ecological knowledge, and we surveyed areas to study and places where gardens could be established by the villagers. This was possible because the land is communal and available to all village members. Again the project began new alternative income projects, expanded knowledge of the plant population biology, and transferred technology while sustaining the land and culture.

The greatest exchange of technology was training the Amchis and collectors how to set up plots for harvest studies and plant identification classes. The sites were plotted with the assistance of the local people within their active collection areas. The sites were replicated a minimum of three times. Several plants were investigated this way, and the local people were given the role of overseeing the collection from the plots when the appropriate plant part was traditionally harvested. The plots were a unique endeavor: no other harvesting study has included the idea of testing the quality of the harvested materials used as medicines.

Some success of the project was clear as the training allowed for the continuation of the

project without our intervention by introducing the Tibetan Hospital to the local ecological institutional staff. They could collaborate to identify the plants and integrate the accumulated knowledge, the plant identity, and the conservation status of these plants into a plan for medicinal plant preservation in the area.

GHANA

In Ghana a pharmacologist with many years of experience in developing traditional medicine asked for involvement in our programs. He was able to offer a formula that he had used for a period of time based on traditional medicine. He worked in conjunction with the local university that collected and identified the botanicals as well as with the traditional health institutions to manufacture and validate his formulas. In trade he was given travel to natural products meetings where he could see how he might interact in the commerce of the natural products industry as well as assist us in training retail sales staff. This was critical for introducing new medicinals into the marketplace. The retailer had no idea how to promote this without sales support, and these conversations with the research and development staff showed us that this was the only way a product could be sold. As one of the long-term results of this relationship, the man has been able to establish a healers collective in Ghana that is currently approaching the government to secure the legality of selling and using traditional medicine in-country. With continued success, the revenues generated for this project will provide equipment that adds value in-country to the product.

GUATEMALA

The Mayan people in Guatemala have been persecuted for many years. They live in an area that is rich in diversity and they have the skills to maintain it. However, through various national laws, their culture, including their language, has been decimated. Only recently have many found ways to support the resurgence of their culture. They have initiated projects that have generated funds to purchase land and begin right livelihoods, jobs that are satisfying economically, environmentally sound, and pleasing to the employed in a social aspect. We began working with a women's cooperative, collaborating with a non-governmental organization (NGO), seeking someone to assist them in developing and improving their markets for their in-country products. They had identified the plants they wanted to focus on, and had procured land from the local government to protect supply. They wanted to gear the products for tourists so with advice from a foreigner passing through, they made aqueous alcohol extracts of their traditional teas. However, due to their lack of experience with this type of product, they did not have any data about whether it was safe to use or if the extracts were biologically active. This was the result of someone trying to assist by thinking they were creating streams of revenues, but having a total disregard for the TEK and IPR. What these folks needed was to validate their products for the domestic market. So we met with university people to set up IPR agreements and develop assays to assist them in gathering information and allowing for the legal sale of the product in their country.

Building a domestic trade in a product is the only way a sustainable business can advance. Because there is always a possibility that the international market will change or dissolve, validating a domestic market is critical for an economically sustainable project. Strengthening your partners' understanding and abilities will support your efforts towards quality and profits. With the adding of value in the source country, your whole team benefits.

The biggest obstacle in this program was trust. There had been so many forces telling the Mayan people what to do: the government from the past, and more recently, the NGOs. The issues of IPR have become so polarized that this group cannot determine who to trust and what IPR is critical to protect. I am at a loss as to how to resolve this and will continue to provide what these people request and offer self-determination activities for the group whether it results in my involvement or not.

What was critical in all these projects was the need to offer financial, ecological, and cultural stability. However, the information itself must come from the people within the country of origin. We have skills to help them reach their goals and ours only if we can integrate their knowledge into a mutually beneficial project. These are examples of some unique approaches to incorporate IPR and TEK into natural products microenterprises.

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Non-timber Forest Products and Aboriginal Traditional Knowledge

Robin J. Marles[1]

Abstract.—Ethnobotanical research was conducted in over 30 Aboriginal communities within Canada's boreal forest region. Specific methods for the research were developed that involved a high degree of participation by Aboriginal people in every stage of the project, with the result that well over 100 Aboriginal elders contributed information on the uses of more that 200 species of plants as foods, medicines, and materials for technology and handicrafts. The original field research was supplemented with an extensive literature review to identify potential non-timber forest products (NTFPs) based on traditional uses of plants. Important categories of NTFPs include functional foods, nutraceuticals, cosmeceuticals, herbal medicines, agrochemicals, and fine chemicals. This report details our research methods, highlights some examples of potential NTFPs from boreal plants identified in our research, and discusses concerns of Aboriginal people regarding sustainable development of NTFPs.

INTRODUCTION

The forest industry in Canada annually produces almost $70 billion in shipments of which slightly more than half are exported, mostly to the US. The major products of our forest industry have consisted of softwood lumber (28 percent), fine paper and paperboard (22 percent), wood pulp (17 percent), newsprint (17 percent), and waferboard (6 percent) (Natural Resources Canada 1999), but a significant area for future development lies in non-timber forest products (NTFPs). Diversification of the forest industry to include products other than wood and fiber can allow a greater level of sustainability by providing the same level of economic return with fewer trees harvested, and it can provide greater opportunities for employment because of the necessity for manual harvesting and value-added processing.

The sustainability aspect of NTFP development, as opposed to simply increasing the profit from a given cut-block of forest, is very important. Sustainability was generally not considered an issue in the past due to the perception that our forest was an almost endless expanse of trees. Indeed, half of Canada is covered by forests, which make up 10 percent of the entire world's forests. However, Canada harvests close to 1 million hectares (2.47 million acres, 0.4 percent of commercial forest area, 0.2 percent of total forest area) of forest per year (Natural Resources Canada 1999), which could be compared to Brazil's deforestation rate of 1.4 million hectares (0.4 percent of closed forests) per year (Brown *et al.* 1992). Most of the southern forested regions are already subject to forest tenures held by private companies for logging, and the northern half of the boreal forest region is labeled on our national forest tenure map as the "non-productive boreal forest" (Government of Canada 1991). This is rather ironic given that Aboriginal people have been living quite productively on that land for several thousand years. The federal and provincial Forest Services and forest industry are now looking for ways to diversify the forest industry, including the gathering of NTFPs.

The potential of NTFPs to help agriculture too is an area often overlooked. While we tend to think of agriculture in Canada as involving almost endless fields of wheat and canola, sustainability is a serious issue here too. Farm diversification is an essential strategy to reverse the high rate of farm bankruptcies, which have increased by over 1,000 percent since

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1979, especially on the prairies (Science Council of Canada 1992). Non-timber forest products can benefit agriculture through crop diversification, for example, the cultivation of ginseng, a forest species, under shade structures.

Canada's forests have long been important for the subsistence activities of Canada's Aboriginal peoples, including gathering fruit, vegetables, and beverage plants, medicinal plants, and materials for technology and rituals, plus hunting and snaring for meat and furs. Thus it is logical that one of the best sources of information on potentially useful native plants of our forests is the traditional knowledge of Aboriginal elders. Previous economic successes include the discovery from our eastern woodlands of the antibiotic sanguinarine from the traditional medicinal plant, bloodroot (*Sanguinaria canadensis* L., Papaveraceae), which is now available commercially in Viadent® mouthwash and toothpaste manufactured by Colgate Oral Pharmaceuticals, Inc. The prescription anticancer drugs etoposide and teniposide are semisynthetic derivatives of podophyllotoxin from the mayapple (*Podophyllum peltatum* L., Berberidaceae), another traditional medicinal forest herb (Robbers *et al.* 1996). Such precedents provide justification for the study of Aboriginal traditional plant use as a guide to potential new NTFPs.

TESTED METHODS FOR ETHNOBOTANICAL RESEARCH

Ethnobotanical research is a proven method for the discovery of potential non-timber forest products. Of the more than 120 pure drugs derived from plants in current commercial use, three-quarters were discovered through scientific investigations of traditional uses (Soejarto and Farnsworth 1989). However, it is important that this type of research be conducted with the full cooperation of Aboriginal communities. The well-tested approach in the following description will help to ensure that NTFP development becomes a truly sustainable venture for the benefit of all people.

Developing The Proposal

The proposal for ethnobotanical research was developed in consultation with a First Nations professional community worker to provide a plan that would likely be acceptable to Aboriginal councils and elders. The following steps are crucial in developing the proposal, getting it approved, and implementing it:

1. Have the proposal presented to the Band Council and elders in the languages of both the researchers and the community, e.g., in English and Cree or Dene, for informed consent, with work proceeding only after approval has been given.

2. Have the proposal reviewed and approved by the appropriate institutional Ethics Committee.

3. Create an Advisory Committee of elders to supervise the work, and set guidelines and limitations.

4. Hire, equip, and train young people from the community to assist in the research.

5. Report progress on a regular basis to the Band Council, which may terminate the project at any time.

6. Supplement the information gathered in the community with as much relevant information from the literature as possible, so that at least a foundation for the knowledge required for informed decisions on development proposals is available within a single report.

7. Ensure that copies of all research results, including reports, educational materials, and plant voucher specimens or facsimiles, will be given to the appropriate authorities within the community.

8. If economic development of a traditional knowledge-based product is a specific objective, prepare a mutually agreeable legal document regarding intellectual property rights and fair compensation.

Getting Permission to Conduct Research

Formal permission, such as a Band Council resolution, is required for any research on reservation land. An "informed consent" form prepared and presented by the Aboriginal researchers in the appropriate language is also an important tool to ensure that there will be no misunderstandings at any time regarding

permission to do the research. Most communities also want an agreement that they may preview results before publication, and if they deem it necessary, restrict the scope of what is published to protect intellectual property rights and confidentiality.

Conducting the Interviews

Bilingual interviewing, mostly by the First Nations or Métis trainees, was done in our research project to minimize misunderstandings and make the oral history recording more comfortable, since the elders could use their own language and talk to an interviewer who was already familiar with the language and customs. Since the interviewing was done by community members, the Councils were satisfied that elders would not feel duress and could easily set limits on the nature and extent of information provided.

No formal questionnaires or highly structured interviews were used in our research because previous experience showed that many elders are not comfortable with that rigid style of interaction. Traditional knowledge is not normally learned through a listing of separate facts, so interview techniques should mimic customary learning methods. For example, elders often share stories and experiences while on walks in the forest (field interviews), while examining traditional products such as foods or handicrafts and discussing the required methods and materials (artifact interviews), while re-enacting activities that used to be practiced long ago (simulation), and while getting young people to assist in traditional practices (participant observation technique). To ensure consistent and comparable documentation of the ethnobotanical information, each research team had data collection forms (fig. 1) that could gradually be completed as the information was gathered (semistructured interview technique). The work was documented in notebooks with these data entry forms and space for sketches or freestyle notes, with slides and video records. Interviews were also tape recorded to facilitate transcription. All this information has been incorporated into teaching materials as well as scientific publications.

DATE:	NUMBER:
LOCATION:	
PLANT LOCAL NAME:	
LANGUAGE/DIALECT:	
TRANSLATION:	
ENGLISH NAME:	
CONTRIBUTOR:	
USE NOTES:	
SCI. NAME:	
FAMILY:	
FLOWER/FRUIT CHAR.:	
HABITAT:	
HABIT:	HEIGHT:
SLOPE:	ASPECT:
ELEVATION:	SOIL:
COLLECTED BY:	DET. BY:

Figure 1.—*Ethnobotany field notebook data entry form.*

The Aboriginal trainees ensured that local traditions were respected, such as gifts of tobacco and cloth for elders who preferred to follow that custom rather than a strict wage scale, and ritual burying of tobacco before plant harvest to show proper respect for the Spirits. The work reinforced the trainees' own knowledge of their culture and respect for the depth of knowledge possessed by their elders. Teaming botany students with Aboriginal trainees resulted in a mutually beneficial experience. The trainees learned the basics of plant voucher specimen collection, plant identification, and proper documentation techniques. The botany students received training in the local language and through this work gained an appreciation for Aboriginal culture and practices.

Keeping a Proper Field Notebook

For each plant, notes were made on the presence and color of sap, juice, or latex; the color of flowers or fruit (that may change with drying); the height, growth form, or habit (e.g., erect, sprawling, trailing, climbing, shrubby, arborescent); branching pattern (e.g., opposite, alternate, whorled); and root system (e.g., tap

root, fibrous, bulbs, corms, tubers, rhizomes). Information was recorded on where each plant grows: region, exact location, latitude, longitude, and elevation from map and global positioning system (GPS); slope (in degrees); aspect (compass direction it faces); soil type or soil sample number (if needed for ecological studies); moisture regime of the soil; habitat and associated plants; disturbance if present; use by local inhabitants or animals if observed; date; time. "A picture is worth a thousand words," so photos or sketches were always taken to supplement the field notes. Using a small portable tape recorder helped us collect information quickly or under adverse conditions for later transcription into the field notebook.

Collecting Plant Voucher Specimens

The importance of properly collecting of specimens of the plants being studied cannot be stressed too much. A voucher specimen is a pressed, dried sample of the plant, mounted on high-quality white cardboard, and labeled with the plant's scientific and common names and a brief description of where, when, why, and by whom it was collected. Because common plant names vary from one location to another, and sometimes even from one person to another, they are unreliable as a basis for storing and collating information. Voucher specimens can be used to positively identify each plant and serve as a permanent record of the collection.

Multiple voucher specimens were collected during our research, one for each institution participating in the project to make this essential documentation readily available to other researchers. Plastic-laminated, life-size color photocopies of the voucher specimens were prepared for participating communities to use as teaching materials that would require no special storage and be durable for schools and forestry or agriculture extension offices.

Collection Materials

The bare minimum for collection materials should include a field press (as described below), knife, permanent marker, pencils, field notebook (as described above), and a plastic bag to keep things dry if it rains (garbage size and smaller). Other equipment that we found useful sometimes: GPS instrument if mapping of the resources is contemplated, pruning shears, trowel, hand lens, camera, map and/or aerial photographs to locate the sampling area, compass, whistle, insect repellent, flagging tape to mark transects or routes or plots, tape measure, high-visibility clothing (especially during hunting season!), tape recorder to make verbal notes (especially useful in bad weather when it is hard to write), folding shovel if a lot of deep roots must be collected, pole pruner for collecting tree branch samples, altimeter, clinometer, portable drier, string tags (especially useful to identify specimens by number so they do not get mixed up in the collection bag), nylon mesh bags for drying bulk specimens for later analysis, and plastic screw-capped bottles and ethanol if pickled specimens are required for chemical analysis or morphological studies of complex flower parts. Obviously, not all of these items were needed at any one time. Permits were obtained when required for collection in parks, and permission of the owner was obtained for collection on private or corporate land.

Plant Press Materials

Field press:	a corrugated cardboard box (bottom approximately 18" x 12" is best), cut so sides fold nicely over bottom, newspaper sheets cut to size, rope to close it.
Drying press:	two plywood or lattice boards (18" x 12"), two webbing belts or ropes with slip-knots, corrugated cardboard sheets, sponge (carpet underlay), blotter sheets, newspaper; plants will be sandwiched between newspaper, blotters, and then cardboard sheets.

What We Collected

For herbaceous plants we always collected at least part of the root system, stems, leaves, flowers, and/or fruit and seeds. For woody plants we collected a small stem and/or a piece of the bark (in addition to leaves, flowering and/or fruiting structures). Large fruit or succulent stems were split or cut into pieces for drying or placed in separate folded paper (e.g., cones) if too large and juicy to be pressed.

Note that some plants, such as willows, have separate sexes, both of which must be collected with flowers to identify them with certainty.

Specimens were always numbered consecutively, even if the same species was collected several times on different occasions. Each collection requires a separate number since related or otherwise similar species may be confused in the field. Only multiple specimens of the same plant collected at the same time and place shared a single collection number. Collections had different numbering schemes for different regions covered in this project because each student maintained his/her own consecutive numbering scheme, a fact that facilitated comparison of plants from different locations. The collection number was written on the pressing newspaper or on a tag firmly attached to a specimen that was to be pressed later, and the number and related information were recorded in the field notebook immediately. Using the pre-printed data form helped us keep consistent records.

Pressing Plants

All soil was cleaned from roots (mud was first rinsed off, then further brushed off when dry). Plant specimens were arranged on the newspaper carefully, so that they looked as natural as possible, without too many parts overlapping (which slows drying and looks ugly). Pruning was done if necessary. Tall plants were arranged by folding the stems like an upside-down V, or an N or M. At least one leaf was turned upside down so the under-surface could be seen after pressing. Room was left for a 3" x 5" label at the lower right-hand corner. Herbs were sandwiched between two blotters and then two cardboard sheets. For thicker specimens a sponge sheet in place of one of the blotters was used to press around the thick stem or root and still flatten the leaves. When the "sandwiches" of collected plants were ready to press, they were stacked and the stack was placed between the two plywood or lattice boards. The belts were tightened around the press by standing on the press as the ends of the belts were pulled. Further tightening was necessary later as the specimens dried and shrank.

Dry, sunny weather is best in terms of getting plants dried easily, but when that was not possible, we placed presses on racks suspended well above stoves, kerosene space heaters, or heat lamps. The faster the plants are dried, the better they will look, especially in terms of color and lack of mold, although care must be taken not to overheat the press. Plants were pressed as soon as possible after collection using a field press, which provides better specimens than if plants are collected in plastic garbage bags and pressed later.

Mounting Specimens

For permanent storage, each voucher specimen was placed on a sheet of archival quality white cardboard 12" x 18" and taped down with very thin strips of white fabric tape. Any loose parts such as conifer needles, seeds, or berries were placed in a small envelope and attached to the white cardboard in any free spot other than the lower right corner where the label was to be glued. The label (example provided in figure 2) was carefully typed and provided the plant's scientific name (*Genus specific-epithet* Author, Family), common names in English and other languages as required (e.g., Chipewyan, Cree, French), a brief summary of traditional uses, and a brief description of where, when, why, and by whom it was collected.

Storing Voucher Specimens

When the voucher specimens were submitted to each institution's herbarium, they were each assigned an accession number that serves for the indexing of the collections, e.g., on a computer database. The voucher specimens were then filed in folders with other specimens of the same species and then arranged in water and insect-proof herbarium cabinets in taxonomic order. To facilitate retrieval, the unique specimen label clearly identified it as a voucher specimen for the ethnobotany project, and it carried the collection number to connect the individual specimen to the data in the field notebook and subsequent publications.

Brandon University Herbarium
Boreal Ethnobotany Voucher

English: Fireweed
Cree: akapuskwah, athkapask
Dene: gó^{n}dhi'elé
French: bouquets rouges

Epilobium angustifolium L., Onagraceae

Food: young leaves, stems, flowers
Medicine: leaf tea for intestinal worms, poultice for wounds, boils, bruises
Tech: mat for food, stem fibre for thread

Coll: N. Spence #20, 22-Aug-95

Nelson House - Thompson highway mile 39

Figure 2.—*A sample herbarium label.*

Presenting the Results

In our reports the names of the elders contributing the information were substituted with a letter representing their cultural background (e.g., C = Cree, D = Dene: Chipewyan, or M = Métis) and a randomly assigned number for the individual. This was done to preserve confidentiality while still allowing quantitative ethnobotanical analysis of the results. For example, if identical uses are provided by several contributors from different communities or cultures, that indicates a more widely accepted use, which might take priority for followup investigations over a use reported only once. In publications detailing the results of the search, we provided a summary of the codes and anonymous biographical data (age, gender, community, and cultural affiliation).

A conscientious effort was made to produce readily accessible publications of ethnobotanical information that could be returned to the participating communities for their own use in addition to more technical peer-reviewed scientific publications that would have a much more limited audience. Examples from our research include Marles *et al.* 2000 and Spence-Tays *et al.* 1999.

RESULTS: BOREAL NON-TIMBER FOREST PRODUCTS

With the economic justification of diversification of the forestry and agricultural industries, we received funding to conduct extensive ethnobotanical field research across the central boreal forest region of the provinces of Alberta, Saskatchewan, Manitoba, Ontario, and the Labrador district of Newfoundland. A key aspect of this research is that it has involved First Nations communities in every stage, from planning to conducting field interviews, collecting and identifying plant specimens, to documenting and analyzing the results. The information to follow is based on interviews with over 100 Cree, Dene, Ojibwe, Innu, and Métis elders in more than 30 different communities across the north (see fig. 3), supplemented by an in-depth literature review. The following information is mainly summarized from Marles *et al.* (2000) except where otherwise indicated.

There has always been a rather limited demand for traditional handicrafts such as birch bark and sweet grass baskets, but we need to pay more attention to highly processed products, which provide greater employment opportunities within the community and have low bulk

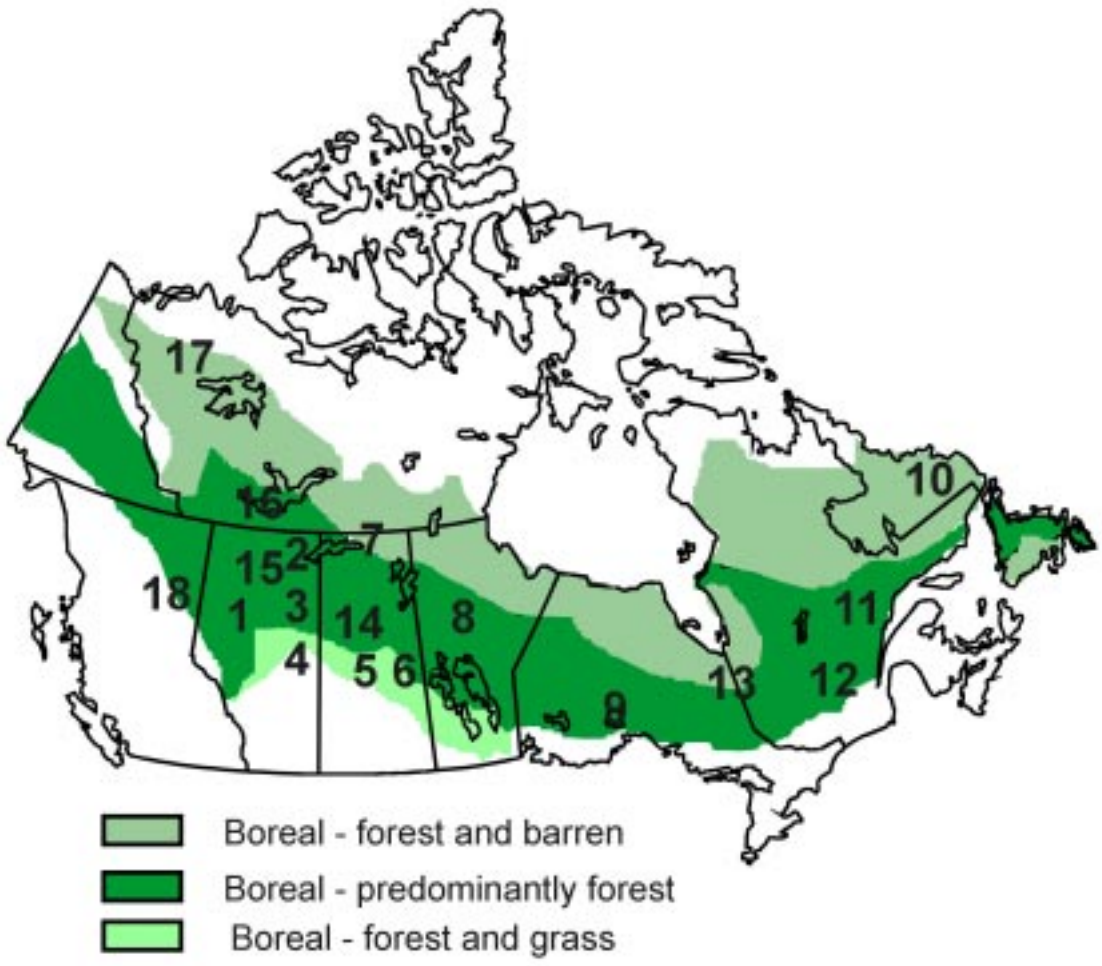

Figure 3.—*Recent ethnobotanical studies in Canada's boreal forest: #1-10: Research of Marles, colleagues and students (Abou-Zaid 1996; Clavelle 1997; Inkpen 1999; Marles et al. 2000); #11: Clément 1990; #12: Black 1980; #13: Berkes and Farkas 1978; #14: Leighton 1985; #15: Anderson 1980; Siegfried 1994; Wein* et al. *1991; Young* et al. *1989; #16: Lamont 1977; #17: Hara 1980; #18: Johnson-Gottesfeld 1988-98.*

and high value. This is important due to the isolation of many northern communities, which may depend on air and water transportation during the summer and ice roads over the frozen rivers and lakes during the winter, making the shipping of goods extremely expensive.

Some categories of plant-derived, value-added products include functional foods, nutraceuticals, cosmeceuticals, pharmaceuticals, agrochemicals, and fine chemicals. Estimates of the current North American market value for natural products vary from $5 billion to $250 billion, depending on whether natural products are defined narrowly as herbal medicines or more broadly as all functional foods, dietary supplements, medicines, and other products such as shampoos that have herbal constituents (Shambrock & Associates and Kelly Associates 1998). Even accepting the lower value, there are obviously tremendous market opportunities for boreal NTFPs that might fit into one or more of the above categories.

Functional Foods

The health benefits of fresh, unprocessed fruits and vegetables are well known. Aboriginal elders we interviewed made an explicit connection between the lack of consumption of "bush food" and the poor health of many young

members of their communities. Some northern plant products are already commercialized as healthful foods, such as wild rice (*Zizania aquatica* L., Poaceae) grains and pasta products. A "functional food," as defined by Health Canada (1997), is distinguished by the following characteristics: it is similar in appearance to conventional foods, it is consumed as part of a usual diet, it is demonstrated to have physiological benefits beyond basic nutritional functions, and/or it reduces the risk of chronic disease. One example of a "functional food" from a forest (bog) plant with a medicinal application is the cranberry (*Vaccinium macrocarpon* Ait., *V. oxycoccos* L., and *V. vitis-idaea* L., Ericaceae). Cranberry fruit and juice are known to treat or help prevent urinary tract infections due to the content of fructose, which inhibits adhesion of type 1 fimbriated *E. coli*, and particular proanthocyanidin-type condensed tannins that prevent adhesion of P-fimbriated *E. coli* bacteria to the urinary tract epithelium (Howell *et al.* 1998). These special tannins are restricted in their distribution to cranberries and blueberries (*Vaccinium myrtilloides* Michx., *V. uliginosum* L., *V. caespitosum* Michx., *V. corymbosum* L., *V. myrtillus* L., Ericaceae). Other potentially important examples from the northern forest include carotenoid-rich cloudberries (*Rubus chamaemorus* L., Rosaceae), commercialized in Newfoundland but not readily available in stores elsewhere; rhizomes and shoots of cattail (*Typha latifolia* L., Typhaceae), which have antioxidant flavonoids, low Glycemic Index carbohydrates, protein, fiber, and various vitamins and minerals; lamb's-quarter leaves (*Chenopodium album* L., Chenopodiaceae), a common weed rich in flavonoids, sesquiterpenes, and oxalic acid; and western wood lily (*Lilium philadephicum* L., Liliaceae), which has tuberous roots rich in low Glycemic Index glucomannans and health-promoting lignans and phenylpropanoids.

Nutraceuticals

A nutraceutical may be distinguished from a functional food as follows: it is produced from a food but sold in pills, powders, or other medicinal forms; it is demonstrated to have physiological benefits beyond basic nutritional functions; and/or it reduces the risk of chronic disease. Most traditional foods do not fit in this category, with the possible exception of mineral salts extracted from red samphire (*Salicornia rubra* A. Nels, Chenopodiaceae) by boiling and evaporation, and used by the Shoal Lake, Saskatchewan, Cree to season food. This crude salt provides trace minerals that act as enzyme cofactors critical for the maintenance of good health. Consumption of small amounts of chromium, manganese, and magnesium salts has been shown to be beneficial in the treatment of non-insulin dependent diabetes mellitus (Marles and Farnsworth 1995).

There are many classes of bioactive phytochemicals with known health benefits, including: mono-, di-, and triterpenoids; limonoids; phytosterols; carotenoids; flavonoids; phenylpropanoids; lignins; other polyphenols including: catechins, gallotannins, ellagitannins, and proanthocyanidins; allylic, aromatic, and isothiocyanate sulphur compounds; complex carbohydrates including fiber; lipids; and indoles. However, these nutraceutical compounds may be present in higher amounts in some wild edible plants, such as stinging nettle (*Urtica dioica* L., Urticaceae) than in cultivars such as iceberg lettuce that have been bred for mild flavor and pale color.

The inner bark (technically the inner active phloem, cambium, and outer active xylem layers) of aspen and balsam poplar (*Populus tremuloides* Michx. and *P. balsamifera* L., Salicaceae), birch (*Betula papyrifera* Marsh., *B. neoalaskana* Sarg., Betulaceae), white spruce (*Picea glauca* (Moench) Voss, Pinaceae), and pine (*Pinus banksiana* Lamb., Pinaceae), harvested in Canada's north as a starvation food or special treat in early spring, is a source of nutraceutical polyphenols already commercialized from the European maritime pine (*P. maritima* L.) as Pycnogenol®, a proanthocyanidin complex reputedly antioxidant and able to reduce blood capillary fragility.

Cosmeceuticals

Cosmeceuticals are compounds present in cosmetics that have a pharmaceutical effect, such as to improve skin texture, stimulate wound healing, control hair growth, regulate skin pigmentation, reduce inflammation, or reduce irritation, e.g., stinging, burning, and itching. Examples of plants with cosmeceutical potential include yarrow (*Achillea millefolium* L., Asteraceae), which contains anti-inflammatory sesquiterpenes, antimicrobial monoterpenes,

and hemostatic alkaloids; cow parsnip (*Heracleum maximum* Bartr., Apiaceae), which contains skin darkening furanocoumarins used commercially to treat psoriasis; and leaves of willowherb or fireweed (*Epilobium angustifolium* L., Onagraceae), the active constituent in a line of anti-inflammatory skin care products marketed by Fytochem Products, Inc. Willowherb has prostaglandin inhibitory activity due to its flavonoid glycoside (myricetin-3-*O*-β-*D*-glucuronide) content.

Traditional Herbal Medicines or Natural Health Products

More than 130 native or naturalized species of plants were identified in our study as having traditional medicinal uses. Health Canada (1995) defines, for registration purposes, a Traditional Herbal Medicine or Natural Health Product as a finished drug product intended for self-medication, for minor self-limiting ailments suitable for self-treatment, whose active ingredients are herbal only. There may be only limited scientific documentation, but these products must have a well-documented traditional use. Such registered herbal products are over-the-counter medicines with a Drug Identification Number and allowed therapeutic claims on the product label. Commercial examples include a bearberry leaf (*Arctostaphylos uva-ursi* (L.) Spreng., Ericaceae) diuretic produced by Nature's Way and the mouthwash and toothpaste with Canadian bloodroot (*Sanguinaria canadensis* L., Papaveraceae) mentioned previously. Some commercial European herbs, such as valerian (*Valeriana officinalis* L., Valerianaceae), could provide leads for similar Canadian wild herbs such as our northern valerian (*V. dioica* L.).

Medicinal plants are often used in combinations, but the elders have asked us to keep the formulas confidential to protect their intellectual property rights. We have their permission to describe and evaluate uses of certain individual plants to validate traditional knowledge. One example I can describe in some detail involves the rhizome of yellow pond lily (*Nuphar lutea* (L.) Sm., Nymphaeaceae). It is harvested from the bottom of ponds, cut into slices to be dried, then used both internally with other plants in a compound decoction and externally to treat diabetic ulcers. It is important to note that the treatment is not just herbal, but also involves smudging with burning herbs, prayers, and cleansing rituals involving the use of tobacco, charcoal, and red cloth. We cannot expect laboratory studies to perfectly describe the healing properties of the herbal medicines because the traditional healing rituals are an important psychological aspect of the healing.

North American rat root or calamus rhizome (*Acorus americanus* (Raf.) Raf., Acoraceae) decoction is widely used traditionally for colds, upset stomach, pain (rheumatism, head, etc.), and diabetes. There is scientific evidence to support its efficacy and superiority over the related species of Europe and Asia (*A. calamus* L.) (Bisset and Wichtl 1994), and thus it has a strong overseas market potential as well as demand among North American Aboriginal people.

Agrochemicals

Agrochemicals are used for the control of insects, weeds, or other pests. Naturally derived agrochemicals may be more "environmentally friendly" than current synthetic compounds due to biodegradability and novel mechanisms of action that defeat current pest resistance. A well-known example of an agrochemical from a northern plant is the insect hormone analogue juvabione from balsam fir (*Abies balsamea* (L.) Mill., Pinaceae). There is significant potential for the discovery of new insecticides from North American ethnobotanicals (Berenbaum 1989), such as yarrow, which contains insecticidal, insect repellent, and antifeedant monoterpenes and sesquiterpenes.

Fine Chemicals

Fine chemicals may be used as reagents, starting materials for synthesis, or in other industrial applications, such as terpenoids from pine (*Pinus banksiana* Lamb., Pinaceae) in turpentine. They may also include essential oils extracted for perfumery and aromatherapy, such as those from wild bergamot (*Monarda fistulosa* L., Lamiaceae) and Labrador tea (*Ledum groenlandicum* Oeder, Ericaceae).

DISCUSSION: SUSTAINABILITY OF NTFP PRODUCTION

Now that we have identified a significant number of potentially useful plants from the boreal forest, we must determine if they can be developed in a sustainable manner. There are various interpretations of "sustainable."

Ecological Sustainability

While clearcut logging is an efficient method of timber harvest, it is not likely to be ecologically sustainable if conducted on too large a scale or on unsuitable land such as steep slopes subject to erosion. Alternative strategies such as selective logging combined with the harvest of non-timber forest products could allow the same economic return per hectare with fewer trees cut, making the industry more sustainable. Conversely, some companies are sending in gatherers for the non-timber products and then clearcutting, which maximizes the dollars extracted per hectare but is less ecologically sustainable. Most native herbs, such as American ginseng (*Panax quinquefolius* L., Araliaceae), cannot be sustainably wildcrafted due to the quantities needed for commerce, and in many localities economic species have already become endangered or extirpated: American ginseng was officially up-listed to endangered status in Ontario and Quebec in 1999 (Committee on the Status of Endangered Wildlife in Canada 2000).

Biological productivity in the north tends to be low, although the long summer day compensates to some extent. Small-scale agriculture with ameliorative techniques such as raised beds or cold-frames can prove quite successful. Developing native species into new crops presents a unique set of agronomic challenges for cultivation, pest control, harvesting, and preparation for market, but for many of our economic native plants, selection of appropriate varieties and large-scale agricultural production will be the most viable option for a sustainable harvest. Our provincial Departments of Agriculture and the Crop Diversification Centres have numerous test plots of medicinal plants to evaluate cultivation, harvest, and pest control techniques under various conditions.

Economic Sustainability

Canada has a history as a major world supplier of raw materials, which we export and then buy back as finished products. This trend has carried over into medicinal plant crops, which are generally sold in bulk through brokers to American, Asian, and European markets. Much more effort must be made to develop value-added products, particularly if rural communities are to achieve the maximum benefit from new medicinal crops. Extraction and encapsulation processes are readily adapted to a cottage-industry scale. Target markets must be clearly identified and stringent quality controls established to ensure commercial viability. Health Canada (1996) has published a supplement to its Good Manufacturing Practice Guidelines specifically for herbal products.

Cultural Sustainability

Development should be consistent with local community needs and desires, not just demands of the global market. Among Aboriginal people of all ages participating in this study, there was no consensus on the desirability of economic development of plant products. Concern was expressed that pharmaceutical companies might profit from the development of medicines based on traditional remedies without any recognition or financial compensation for those providing the information, raising the issue of protection of intellectual property rights. When intellectual property rights are recognized, another question arises about the form (e.g., cash, funding for construction or scholarships, biological reserve land purchases) and quantity of fair compensation. In many cases the sacred nature of medicinal plants may be considered grounds for not developing them commercially. These issues must be dealt with fairly to ensure sustained involvement of the community in development projects. Direct involvement of community members in the research and development process empowers them to find the solutions they need. Involving Aboriginal youth in the research helps disseminate traditional knowledge, ensuring that these traditions will be sustained from one generation to the next. The preparation of educational materials from research results is another means to facilitate the transmission of traditional knowledge to new generations.

CONCLUSIONS

We believe the teamwork approach of Aboriginal researchers, community elders, scientists, foresters, agronomists, and marketers working together for the discovery and assessment of potential new plant products shows promise for sustainable boreal economic development. Many boreal plants have the potential to provide NTFPs, but issues of ecological, economic, and cultural sustainability must be adequately addressed.

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"Keeping it Living": Applications and Relevance of Traditional Plant Management in British Columbia to Sustainable Harvesting of Non-timber Forest Products

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Abstract.—There has been increasing concern about sustainability in harvesting and marketing of non-timber forest products in North America. This paper examines traditional approaches and practices for use of plant resources by Aboriginal peoples and discusses their applications in a contemporary context. Philosophies and attitudes of caring and respect are embodied in many traditional resource use systems, and these can become models for developing a responsible land ethic as an essential component of any program of sustainable land use. Aboriginal peoples have also developed and used a variety of practices and techniques in resource management that maintain the capacity for growth and regeneration of species being harvested, including re-planting and transplanting, pruning and coppicing, and burning. These also have relevance in current harvesting and production systems. Traditional systems of tenure, too, have enabled Aboriginal peoples to control access and monitor impacts of use. Traditional modes of knowledge transmission, including experimental, site-based learning, use of specialized names and vocabulary, stories, discourse, and ceremonial reinforcement of values of respect and careful use, are also potentially valuable and applicable to contemporary harvesting practices for NTFPs. In such applications, however, the rights and interests of Aboriginal peoples must be recognized and incorporated in any relevant NTFP use.

INTRODUCTION

Non-timber forest products (NTFPs) include many species and products harvested and used by Indigenous peoples. In British Columbia, for example, a wide range of traditional botanical foods, materials, and medicines have current or potential value in the NTFP industry (De Geus 1995, Mitchell 1998).

In all, over 500 plant and fungus species are known to have specific cultural applications among Aboriginal peoples of northwestern North America, and most of these are forest species (see Compton 1993; Kuhnlein and Turner 1991; Turner 1995, 1997b, 1998). Products from some of these species are already being marketed. For example, pine mushrooms (*Tricholoma magnivelare*) and chanterelles (*Cantharellus* spp.) are currently bringing wild mushroom pickers in B.C. (some of whom are Aboriginal) around $25-50 million Canadian each year, while exporters are earning $50-80 million (Hamilton 1998). In B.C. in 1997, the 200-300 commercial gatherers of medicinal plants collectively earned an estimated $2-3 million Canadian (Wills and Lipsey 1999), but most of this would have been for non-Aboriginal harvesters. Other locally marketed products include huckleberries, baskets and weaving materials, and specialty wood carvings (Turner and Cocksedge, in press).

Indigenous peoples have a number of concerns about commercialization of their traditional

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species, many of which have critical culturally defined values over and above their economic potential (Turner and Cocksedge, in press). These concerns range from issues of intellectual property rights and cultural appropriation (Brush and Stabinsky 1996, Department of Indian Affairs and Northern Development 1999, Greaves 1994) to fears that the resources that are precious to them will be inappropriately used and/or overexploited by outsiders who neither understand the cultural significance of these species nor know how to properly harvest or sustain them. To date, sparse attention has been paid to social and cultural aspects of the NTFP industry in general (for exceptions, see Liegel *et al.* 1998, Richards and Creasy 1996), yet we must understand these factors if we are to develop truly sustainable NTFP industries.

Traditionally, Indigenous peoples have had many culturally mediated ways for sustainably using their resources, embodied within worldviews and philsophies, and "played out" on the ground through various practical strategies. These strategies include habitat enhancement and diversification, through controlled burning and clearing, and careful selective, strategically timed harvesting, and increasing productivity through pruning, coppicing, tilling, and control of weeds and pests. Traditional tenure systems are an important element of sustainable resource use. Also relevant are effective methods and institutions for acquiring and disseminating such knowledge within Indigenous societies.

In this paper, I present information and examples of various views and aspects of traditional plant knowledge and use among British Columbia First Peoples, which need to be considered by all those practicing and promoting the harvesting and marketing of NTFPs in the province. Of particular relevance are the ideologies for looking after the land and its resources, and the understanding and incorporation of the techniques for sustainable harvesting that have been applied for many generations.

Since the harvesting of NTFP species can potentially provide alternatives to current economies focused solely on large-scale timber production—usually involving clearcutting and severe habitat disruption for both forest and aquatic systems, as well as for cultural systems—NTFP industries are seen by First Nations and others concerned about environmental integrity to be a desirable form of economic development. This traditional knowledge could form a basis for sustainable and respectful use of NTFPs in small-scale industry settings that would benefit many local communities, as long as it is used appropriately.

The information provided here is drawn from various literature sources (e.g., Deur and Turner, in press; Peacock and Turner 1999; Turner 1997a; Turner and Atleo 1998; Turner and Cocksedge, in press; Turner and Peacock, in press; Turner *et al.* 2000) and, most importantly, from knowledgeable Indigenous elders and plant specialists who understand cultural traditions relating to the natural world and have in some cases practiced the techniques described. These people are mentioned by name in the Acknowledgments section at the end of this paper.

It is important to emphasize that there is tremendous cultural diversity among and within B.C. First Nations. The knowledge and practices discussed here cannot be generalized without qualification; to do so would be disrespectful and inaccurate. However, there are common philosophical themes and practices known to many people from Indigenous communities that are geographically and linguistically diverse. It can be assumed that many of these beliefs and practices are widespread and longstanding, and that they will serve Aboriginal communities well into the future.

MANAGING AND SUSTAINING PLANT RESOURCES IN BRITISH COLUMBIA

"The Earth's Blanket": Philosophies of Caring for the Environment

Indigenous peoples' relationships with the environment share a common theme of kinship with and respect for all living things (Anderson 1996; Berkes 1993, 1999; Gadgil *et al.* 1993, Turner and Atleo 1998; Turner *et al.* 2000). This perspective is reflected in peoples' teachings and lifestyles in many ways, and it is manifested as a general cultural constraint against waste and overexploitation. One example is in the metaphor of "The Earth's

Blanket," as recorded for the Nlaka'pamux (Thompson) people by ethnographer James Teit: "*flowers, plants and grass especially the latter are the covering or blanket of the earth. If too much plucked or ruthlessly destroyed [the] earth [is] sorry and weeps[.] It rains or is angry & makes rain, fog & bad weather.*" (ca. 1900, cited from Turner *et al.* 1990:54). Other, similar expressions of the need for respecting resources are reflected in the teachings from a wide variety of sources. For example, Ahousaht Elder Roy Haiyupis explained:

> Respect is the very core of our traditions, culture and existence. It is very basic to all we encounter in life.... Respect for nature requires a healthy state of stewardship with a healthy attitude. It is wise to respect nature. Respect the Spiritual.... It is not human to waste food. It is inhuman to overexploit. "Protect and Conserve" are key values in respect of nature and natural food sources. Never harm or kill for sport. It is degrading to your honour.... It challenges your integrity and accountability. Nature has that shield or protective barrier [that], once broken, will hit back at you. (Roy Haiyupis, Nuu-Chah-Nulth, cited in Turner and Atleo 1998)

This type of respect and concern for Nature and its intrinsic values is essential in the development of an ethic for harvesting and use of non-timber forest products. It is like a safety net, overriding and enveloping any specific quantitative prescriptions for harvesting products from the wild. Such values need to be instilled in all of us, providing us with a major guiding principle in planning, decisionmaking, harvesting, and marketing activities, no matter what products are being considered.

Guarding the Meristem Bank: Practical Strategies for Sustaining and Promoting the Productivity of Perennial Plant Resources

John Zasada (Zasada 1992; pers. comm., 1999) has pointed out that, especially for the harvesting of perennials, the key to continued reproduction and propagation is to maintain a healthy meristem source for each species. Meristems, tissues comprised of cells capable of rapid growth and differentiation, are found in various parts of plants of all ages, including root and stem tips, nodes, and cambium tissues. It is these tissues that can give rise to new shoots and roots, both in normal times and in response to damage such as from pruning or cutting away of part of the plant. As long as plants maintain meristematic tissues and have the capacity to absorb sufficient nutrients and water, they can reproduce vegetatively and maintain individuals and populations even with a certain level of harvesting.

This process is captured well in the Kwak'wala word, ***q'waq'wala7owkw***, which translates as "Keeping it Living" (Chief Adam Dick, Kwaxistala, pers. comm., 1998). This term, according to Adam Dick, pertains to peoples' "gardening" practices for traditional root vegetables, such as in the areas of tidal flats at Kingcome River estuary and in many other locations along the coast. These areas were intensively cultivated and the root vegetables were harvested in tremendous quantities, yet the beds were maintained for many generations:

> It was all important. That ***texwsus*** [springbank clover; *Trifolium wormskioldii*], and the ***tliksam*** [silverweed; *Potentilla anserina* ssp. *pacifica*], and the ***q'weniy'*** [Nootka lupine; *Lupinus nootkatensis*], and the... ***xukwem*** [rice-root; *Fritillaria camschatcensis*]. See, when they go down the flats, they use little pegs. "This is my area." You got your own pegs, in the flats. And then you continue on that, digging the soft ground... so it will grow better every year. Well, I guess, fertilizing, cultivating, I guess that's... the word for it. Every family had pegs, owned their little plots in the flats. (Kwaxistala, Chief Adam Dick, Kwakwa'ka wakw, from Kingcome Inlet, 1996).

One of the secrets to maintaining these root gardens was to replant the propagules—portions of the underground parts in this case that contain active meristematic tissues and hence have the ability to regenerate. Adam Dick described this practice as follows: "... you don't pick those little ones that's going to grow the next season. You know, you just pick off the [pieces]." This was done with several different root vegetable species.

Perhaps the most detailed account of replanting propagules comes from Adam Dick's recollections of how, as a boy, he was instructed to remove the bottom part of the rice-root

[***xukwem***] bulb and put it back into the ground, specifically so it would grow into a new plant. They call this propagule "***GaGemp***" (literally "Grandfather"). "Yes, well, that was my job... to pick them off, the bottom of that [rice-root bulb]... it's... called the ***GaGemp***, then they told me to throw it back in the [ground].... It's on the bottom... that ***GaGemp***. It sits on there.... that was my job, to pull them off and throw it back in the [ground]... when ... I was with the old people" (Chief Adam Dick, pers. comm., 1997).

On southern Vancouver Island, there is also evidence that people re-planted the smaller bulbs of camas (*Camassia* spp.), selecting only the large ones to cook and eat. Some people also talked about planting the seed stalks in the upturned ground when the bulbs were being harvested in the summertime (Babcock 1967; Stern 1934:42-43; Suttles 1951a,b). Similar practices are noted in managing root vegetable resources in the interior of British Columbia, with yellow glacier lily (*Erythronium grandiflorum*) and other species such as rice-root (*Fritillaria lanceolata*), spring beauty (*Claytonia lanceolata*), and balsamroot (*Balsamorhiza sagittata*) (Loewen 1998; Peacock 1998; Secwepemc Elder Mary Thomas, pers. comm. 1997; Turner *et al.* 2000), as well as among other First Peoples, such as those of California (Anderson 1996b, 1998; Blackburn and Anderson 1993).

In addition to replanting propagules, people sometimes transplanted species from one site to another. Transplanting of culturally important plants, to make them more accessible, has been practiced on many occasions within the past century on the Northwest Coast of British Columbia. There are documented cases of people transplanting cattail (*Typha latifolia*) and American bulrush (*Scirpus americanus*) for basketry and mat-making materials, stinging nettle (*Urtica dioica*), cottonwood trees (*Populus balsamifera* ssp. *trichocarpa*), highbush cranberry (*Viburnum edule*), camas, wapato (*Sagittaria latifolia*), silverweed, and springbank clover (Turner and Peacock, in press). There is no way of knowing for sure whether species were transplanted through reproductive propagules in pre-European days, although it seems logical that people would have done this. Compelling evidence of this can be seen in the fact that some of these plants, particularly camas, were found outside of their "natural" range at contact and have since disappeared from these locations as Indigenous management ceased (D. Deur, pers. comm., 1999).

Pruning and coppicing of individual berry and hazelnut (*Corylus cornuta*) bushes was also practiced, both on the coast and in the interior: another means of "keeping it living," since this process took advantage of meristematic tissues at the bases and nodes of the stems of shrubs that allow them to regenerate easily. The breaking of the branches of berry bushes has been little documented, but like other practices, this may be in large part because people had not been asked about such practices. California First Peoples are known to coppice their basketry plants to produce better, longer, and straighter shoots (Anderson 1993). In the interior, too, Plateau peoples talk about increasing the productivity of their saskatoon bushes (*Amelanchier alnifolia*), chokecherries (*Prunus virginiana*), soapberries (*Shepherdia canadensis*), and huckleberries (*Vaccinium* spp.) by breaking the branches off during or following the harvest. On the coast, this seems to be a widely known but little publicized practice. Chief Adam Dick, as soon as he was asked, started to talk about it: "Especially that ***gwadems*** [red huckleberry, *Vaccinium parvifolium*], when they finished picking the ***gwadems***, you know, they pruned them. They chopped the tops off. Salmonberries [*Rubus spectabilis*] too. So, when the ***qwasem*** it's done, after you pick... after they get all ***tl'axwey'*** then we all break the tops off." ["Oh, and that makes them grow better?" NT] "Yes. My grandma tell me that if you let it grow this high [above your head], then it doesn't produce much berries. You know. But when you keep it down and, she says, the water, it's hard going up there, I guess, when it's too tall." He said the people also pruned the grayberry plants (*Ribes bracteosum*) and wild blueberries (*V. ovalifolium*). Nuu-Chah-Nulth people talk about breaking off the branches of red huckleberry, blueberry, and salal (*Gaultheria shallon*) (Craig 1998). This was said to make them produce more prolifically in the following years. Saanich Elder Elsie Claxton recalled "pruning" the branches of soapberries when picking the berries on San Juan Island, to increase their abundance (pers. comm., 1997).

Another harvesting technique was the intentional thinning of density-dependent species such as slough sedge (*Carex obnupta*) for basketry; this is said to aid the growth and

reproduction of the plants (Craig 1998). Similar thinning has been observed to enhance the growth of Indian hemp (*Apocynum cannabinum*), cattail and stinging nettle; all of these die back in the winter, and hence are not harmed by late-season harvesting.

Partial harvesting of tree bark for materials and medicines, and selective harvesting of branches and roots for basketry and other purposes were also part of the "keeping it living" philosophy. In using tree bark, such as Pacific yew (*Taxus brevifolia*) or cascara (*Rhamnus purshiana*), for medicine, people apply the traditional technique of harvesting a single strip from the trunk, or large branch, without girdling the tree, thus keeping it alive and allowing it to regenerate (Turner and Hebda 1992). Similarly, redcedar (*Thuja plicata*) and yellow-cedar (*Chamaecyparis nootkatensis*) bark for basketry was harvested in single or double straps from relatively young trees; generally no more than one-third of the circumference was removed, allowing the tree to continue to live and grow. The numerous "culturally modified trees" (CMTs) seen along the British Columbia coast, with evidence of bark removal dating back 100 years or more in some cases, bear testimony to the effectiveness of this practice in keeping the trees living, while still using parts of them (Stryd 1997, Turner 1996). Even, on occasion, planks were removed from standing trees without killing them (Garrick 1998, Stewart 1984, Stryd 1997). Sheets of birch bark (*Betula papyrifera*) and wild cherry bark (*Prunus emarginata*) for basketry were, and still are, harvested from living trees without damaging the inner bark or the growing cambium layer (Peacock and Turner 2000; Mary Thomas, pers. comm., 1997). Cedar, willow (*Salix* spp.) and other types of withes, spruce roots (*Picea* spp.) for basketry, and evergreen boughs for bedding were routinely cut selectively from living trees. Medicinal shrubs such as devilsclub (*Oplopanax horridus*) were also selectively harvested. At least recently, Aboriginal harvesters such as Arvid Charlie (pers. comm. to NT and T. Lantz, 1999) have started replanting lengths of devilsclub stem in the damp soil every time they remove part of the plant; the stems root easily and thus continue to regenerate.

In addition, burning is a widely practiced form of plant management and habitat manipulation that was used by B.C. First Peoples. By keeping the forest canopy at bay, removing woody fuel, and temporarily enhancing the nutrient composition of local soils, burning enhanced the growth of a number of culturally important plants. If undertaken carefully, fire did not damage the meristematic tissues at the base of most shrubs or in the root-crowns of wild strawberries (*Fragaria* spp.) or underground storage organs of root vegetable species such as camas, yellow glacier lily, or wild onions (*Allium cernuum*). This method was used especially for producing and enhancing camas in such places as southern Vancouver Island, but also for promoting berry production along the coast at Haida Gwaii, Bella Coola Valley, Clayoquot Sound, and numerous other places, as well as throughout the interior. Berry species promoted include trailing wild blackberry (*Rubus ursinus*), blackcap (*Rubus leucodermis*), red huckleberry, blueberry, wild strawberries, and salal. Burning was also said to enhance forage for deer and was also used to create clearings and to produce readily available firewood from snags (Johnson 1999, Turner 1999). The Kwakwaka'wakw quotation from Boas (1930:203), in "Prayer" to berries [type unspecified], is a classic example of apparent longstanding use of fire in berry management:

> I have come, Supernatural Ones, you, Long-Life-Makers, that I may take you, for that is the reason why you have come, brought by your creator, that you may come and satisfy me; you Supernatural Ones; *and this, that you do not blame me for what I do to you when I set fire to you the way it is done by my root (ancestor) who set fire to you in his manner when you get old on the ground that you may bear much fruit.* [emphasis added]. Look! I come now dressed with my large basket and my small basket that you may go into it, Healing-Women; you Supernatural Ones. I mean this, that you may not be evilly disposed towards me, friends. That you may only treat me well...."

Traditional Tenure Practices for Sustainable Resource Use

Another component of traditional ecological knowledge that is highly relevant to use of NTFPs is social control of resource use through land tenure systems and related cultural institutions. Ownership or proprietorship of plant resources is one obvious way to ensure that one might benefit from the long-term care

and enhancement of plant resources. Ownership makes investments of time and energy worthwhile; it can be both a cause and an effect of "adding value" to a place and its plant resources.

While all Indigenous peoples of B.C. have a strong sense of traditional territory, there is variation in the intensity, levels, and nature of ownership recognized. With the Nuu-Chah-Nulth and most central and northern coastal peoples, an individual chief or lineage had proprietorship over key, important plant resources. One social institution constructed around, and contributing to, sustainable resource use is ***hahuulhi*** of the Nuu-Chah-Nulth. Roy Haiyupis characterizes ***hahuulhi*** as follows:

> ***Hahoolthe*** [***hahuulhi***]... indicates... that the hereditary chiefs have the responsibility to take care of the forests, the land and the sea within his ***hahoolthe*** and a responsibility to take care of his ***mus chum*** or tribal members (Scientific Panel for Sustainable Forest Practices in Clayoquot Sound 1995).

Under this system, chiefs are given, along with their hereditary title to specific lands and resources, the responsibility for monitoring and sustaining them, and for sharing their resources with all members of their community. Thus, each stream, each beach, each root patch, each prime berry-picking area, was recognized as belonging to an individual and his (or her) family and was thus closely observed and maintained by them. "Owned" plant resources—roots, berries, redcedar stands, and individual crabapple trees (*Pyrus fusca*)—have been documented along the entire coast. In all, over 20 food species have been identified as having been "owned" by individuals or lineages in locations on the Northwest Coast (Turner and Jones 2000)

Ethnographer Edward Sapir (unpublished notes, 1913-14) provides a Nuu-Chah-Nulth example of ownership from the Somass River estuary at Port Alberni: "A place for roots or berries was called [***tlh'ayaqak***]. These patches for roots or berries had four cedar stakes marking the boundaries of the area, which were about one acre in extent. The stakes were six feet high.... These posts [***tl'ayaqiyaktlhama***] were changed about every 10 years to prevent rotting." (see also Arima *et al.* 1991: 190-191). A very similar pattern appears in other locations up and down the coast (Turner and Jones 2000).

Ownership of resources was a serious matter, especially those resources for which considerable effort was invested over many years. Pacific silverweed and wild clover root-digging patches were particularly prized; one elder explained that owners of silverweed "gardens" were very possessive of their holdings, as they "cultivated" the plants by placing the ends of the roots back in the ground so that they would grow the following year (Turner and Efrat 1982). Traditionally, digging on a chief's rhizome plot without permission would have been a grave offense (Turner *et al.* 1983). Yet, proprietorship of resources implied an obligation to monitor and care for them (Stanley Sam, cited in Bouchard and Kennedy 1990: 337). Many of the places where various resources were routinely looked after, or where prime populations were found, were named after their special status.

Even for the Central Coast Salish and for the interior peoples, whose social organization was generally more fluid, families or village units owned resources, and controls were in place over who could harvest from which areas, when the harvest could take place, and how much could be taken (Turner and Jones 2000).

Ownership and tenure are key considerations in the sustainable harvesting of NTFPs, and the practices of Indigenous peoples provide some good models. As noted, those in control of the resources were also accountable for their maintenance and for equitable sharing of their benefits. They also received considerable training, often from the time of early childhood (Chief Earl Maquinna George, pers. comm., 2000), in how to care for the land and resources under their stewardship. Elders and knowledgeable specialists were consulted about the timing and intensity of harvesting, and, if the productivity of a resource declined, the owners were responsible for reducing or stopping harvesting altogether until the resource recovered (Chief Adam Dick and Daisy Sewid-Smith, pers. comm., 1998; Turner and Jones 2000).

"Learning the Ropes" and Imparting the Knowledge

Traditional Ecological Knowledge embodies—as well as philosophies and practical strategies for sustainable living—ways of communicating knowledge, ideas, and information within families and communities, and from one generation to the next. The modes of transferring and communicating traditional ecological knowledge in Indigenous societies are fundamentally different from ways of passing on and learning knowledge and information in mainstream society. These traditional modes of communicating, teaching, and learning are potentially extremely valuable in learning about and practicing sustainable harvesting of NTFPs.

Traditionally, Indigenous children and youth actively participated alongside their parents and elders in harvesting and processing resources. During this time, they were continuously learning, from their own observations and from the teachings and instructions of the experts. They were taught not only the best techniques, but also the philosophies of respect and value of other lifeforms. As they participated in ceremonies like the First Fruits ceremony, and in the expressions of thanks and appreciation routinely addressed to the lifeforms they were harvesting and to the Creator who made them (Boas 1930), they learned to understand their relationships to the land and their environment and to care for and appreciate all the things that sustained them. Secwepemc Elder Mary Thomas (pers. comm., 1997) recalled how her mother, even when she was in her 90s, would always hold a handful of berries up before she ate them and say ***Kwukwschámcw, Kwukwschámcw, Kwukwschámcw***! ["Thank you, Thank you, Thank you!"]. Observing elders showing gratitude and respect for Nature is a highly effective way for young people to learn this approach.

When children were taught about peeling cedar bark, for example, they would be taught not only how to peel the strips and how not to girdle the tree, but also how to recognize the power and spirituality of the tree itself:

> Even when the young cedar-tree is quite smooth, they do not take all of the cedar-bark, for the people of the olden times said that if they should peel off all the cedar-bark... the young cedar would die, and then another cedar-tree near by would curse the bark-peeler so that he would also die. Therefore, the bark-peelers never take all of the bark off a young tree (Boas, 1921: 616-617; see also Boas, 1921: 619; Schlick 1994).

This kind of holistic teaching is extremely important and is also imparted in narratives that children and young people are told over and over again. Such stories as the Nuu-Chah-Nulth Yellow Cedar Sisters, and the Origin of Bunchberry [*Cornus canadensis*], the origin story of Daisy Sewid-Smith's family (Kwakwa̲ka̲'wakw), and the Nlaka'pamux story of Old One and the Creation of the Earth all impart ecological knowledge as well as cultural perspectives of resources as gifts for people to treasure and appreciate and never abuse (Sewid-Smith and Dick 1998, Turner 1997a, Turner and Atleo 1998, Turner *et al.* 2000).

Language and cognitive systems are integral to the process of knowledge transfer, and in the various languages there are not only names for the plants and plant products, but also terms and concepts for the processes involved in harvesting and preparing them, and in caring for them as well. Unfortunately, Aboriginal languages have been in serious decline, and with their loss comes the loss of much of the knowledge embodied within them. Even the names of places can reflect and perpetuate knowledge of plants and ecological systems (Turner *et al.* 2000). Additionally, day-to-day discourse in traditional languages is often associated with peoples' relationships to the land and its various lifeforms. The loss of languages is thus a major tragedy, yet the concepts are at least partially retained to the present day.

Major cultural institutions such as potlatches, feasts, first foods ceremonies, and systems of designated authority have been, and continue to be, vitally important in passing on traditional ecological knowledge and the philosophies that underlie resource use. For example, the Nuu-Chah-Nulth concept of ***hahuulhi***, discussed previously, leads to intimate knowledge of specific places by individuals. Those inheriting positions of proprietorship over lands are instructed, almost like apprentices, about these places and their resources and how to care for them, from the time they are very young. They are taught the philosophies associated with the use of the land, specific practical strategies, and obligations associated with its use, such as maintaining and caring for

salmon spawning beds and pools in a particular river (Scientific Panel for Sustainable Forest Practices in Clayoquot Sound 1995). Thus, there is continuity over generations of people knowledgeable about the same sites and localities. This is an important concept when considering sustainable resource use. Systems of stewardship and proprietorship over lands and resources comparable to ***hahuulhi*** were in place along the whole Northwest Coast. Short-term, broadly based land tenures, such as those operating in much of industrial forestry, usually lead to overexploitation, because there is no long-term understanding, monitoring, or commitment to the land and little specific knowledge over time of particular sites or populations.

CONCLUSIONS

Traditional approaches and practices for use of plant resources have much relevance to contemporary efforts to harvest NTFPs by Aboriginal and non-Aboriginal people alike. A responsible land ethic that includes respect for all lifeforms, and sanctions against waste or wanton destruction, is an essential component of any sustainable land use. Practices and techniques that maintain the capacity for growth and regeneration of species being harvested, including re-planting and transplanting, pruning and coppicing, and burning, are also essential, and Aboriginal people have traditionally used a variety of such practices.

Also important are locally developed and recognized area-based, long-term tenure systems in which responsibility and control over particular places or resources is held in trust by a particular individual or lineage and passed on from one generation to the next, along with the teachings about their use, management, and care. Finally, modes of communication and teaching about responsible resource use, including experiential, site-based "apprentice-style" learning, use of specialized names and vocabulary, stories, discourse, and ceremonial reinforcement of values of respect and careful use, are potentially valuable and applicable to contemporary harvesting practices for NTFPs.

There is every indication that a carefully and thoughtfully planned NTFP industry could be a sustainable and healthy one for the forest. The main task is to retain ecological integrity of an area, including species' capacity for regeneration at a rate equivalent to harvesting levels. For example, according to Juliet Craig's interviews with Ahousaht elders (1998), picking berries does not reduce the crop yield for the next year. In a similar vein, Richard Ross (1998) claims that harvesting of salal greens can be sustainable and can be undertaken annually, if the pruning is done correctly (1998). Some sites have been harvested since the 1950s and are still producing good quality shoots. However, higher intensity of salal harvesting, such as has occurred over the last 5 years in some places, can result in deterioration in salal quality and productivity, and this can lead to higher harvesting requirements and more pressure on the sites and populations. More research and monitoring are required for this and other NTFP species to determine sustainable levels of harvest and the extent to which the harvesting of salal greens impacts the productivity of the berries (W. Cocksedge, pers. comm., 2000).

As with traditional understandings, NTFP harvesting needs to be holistic in its approach. Impacts of harvesting NTFPs on other wild plants and animals in the ecosystem must be considered. Care must be taken in any large-scale berry harvesting program, for example, that the needs of birds, bears, and other wildlife are not compromised, and that some areas are left intact for these other users of forests. Aboriginal people are particularly conscious of such requirements and particularly appreciative of the interconnectedness of all things (Turner and Atleo 1998). Diversification—harvesting a variety of products over the course of several years rather than intensive harvesting of just one resource—is another lesson to be learned from Indigenous use. Flexibility and adaptability are important characteristics of Traditional Ecological Knowledge. Part of such a strategy in its contemporary form would be to combine educational opportunities, ecotourism, and other types of land use with the NTFP industry. In short, Indigenous traditional land and resource use is based on a long-term commitment to an area and its resources and detailed understanding of and continual monitoring of a resource base; these concepts are as essential today as they have been in the past for long-resident Indigenous and local peoples.

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Changing Resource Management Paradigms, Traditional Ecological Knowledge, and Non-timber Forest Products

Iain J. Davidson-Hunt[1] and Fikret Berkes[2]

Abstract.—We begin this paper by exploring the shift now occurring in the science that provides the theoretical basis for resource management practice. The concepts of traditional ecological knowledge and traditional management systems are presented next to provide the background for an examination of resilient landscapes that emerge through the work and play of humans. These examples of traditional ecological knowledge and traditional management systems suggest that it is important to focus on managing ecological processes, instead of products, and to use integrated ecosystem management. Traditional knowledge is often discussed by resource management agencies as a source of information to be incorporated into management practice; in this paper we go further and explore traditional knowledge as an arena of dialogue between resource managers and harvesters. To enter into this dialogue will require mutual respect among managers and users for each others' knowledge and practice. Such a dialogue could move forest management paradigms beyond our current view of "timber or parks" and toward one of truly integrated use.

INTRODUCTION

"Adopting sustainable development in forestry has meant broadening our overarching goal, *from sustained yields to healthy forest ecosystems*...Our goal is to maintain and enhance the long-term health of our forest ecosystems for the benefit of all living things, both nationally and globally, while *providing environmental, economic, social and cultural opportunities* for the benefit of present and future generations" (Canadian Council of Forest Ministers 1998a: ix-xii, emphasis added).

"We commit ourselves to apply our knowledge and expertise to fulfill our vision by, where applicable: Improving our understanding of forest ecological processes, and enhancing our capacity to manage forests in a way that will maintain the biological diversity, productivity and resilience of these ecosystems" (Canadian Council of Forest Ministers 1998b: 1).

"It seems obvious that the common procedure of incorporating TK [traditional knowledge] into environmental management is one that serves neither the interests of Aboriginal peoples nor the dominant culture. The full contributions of Aboriginal people and their knowledge to managing for sustainable use will not be realized if TK continues to be treated as just some other category of information to be inserted into, or merged with, western scientific knowledge to further the agenda of environmental managers. Rather, they will be realized when we begin to shift focus towards applying those management philosophies and systems that give TK its full meaning, merit, and efficacy" (Stevenson 1998).

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A shift is occurring in how Canadians think forests should be managed. As the Canadian Council of Forest Ministers (CCFM 1998a) noted, we are beginning to view our forests as ecosystems that provide timber, medicinal plants, foods, craft materials, and recreational opportunities. We are also beginning to realize that the long-term health of forest ecosystems and the well-being of people should be complementary, rather than opposing, goals. A healthy forest ecosystem is one that supports more than just logging activities. There may be people felling trees and others picking medicinal herbs or shooting the rapids in a canoe. It is also time to move beyond the idea that a healthy forest ecosystem is one in which there are no people. Healthy forest ecosystems are places where people live, work, and play, as well as visit.

The Canadian Council of Forest Ministers (1997, 1998a) have worked toward an ecosystem vision by outlining a set of criteria and indicators that provide forest management agencies with the tangible means to integrate economic, social, cultural, and ecological values in forest management. However, the chasm between the vision of a healthy forest ecosystem as a vibrant place of activity and its vision as a "silent cathedral" may not be traversed by such an approach. It will also require the ability of resource managers to imagine a healthy forest ecosystem as one that reconciles industrial landscapes with conservation landscapes.

It is not difficult to imagine that economic activity and conservation can overlap within the same landscape. This is a vision that many harvesters find acceptable as the manner in which the relationship between humans and the environment should be structured. Traditional ecological knowledge and traditional knowledge management systems start from the premise that there is no separation between the landscapes in which people live and play and those in which they work. As resource management paradigms shift toward integrated ecosystem management, it appears that there is a convergence between this new kind of resource management and traditional ecological knowledge, opening a new opportunity for dialogue and mutual learning.

This paper begins by exploring the shift occurring in the science that provides the theoretical basis for resource management practice. The concepts of traditional ecological knowledge and traditional management systems are presented next, to provide the background for an examination of resilient landscapes that emerge through the work and play of humans. These examples of traditional ecological knowledge and traditional management systems suggest that it is important to focus on managing ecological *processes*, instead of *products*, and to utilize integrated ecosystem management. Traditional knowledge is often discussed by resource management agencies as a source of information to be incorporated into management practice; in this paper we go further and explore traditional knowledge as an arena of dialogue between resource managers and harvesters. Such a dialogue will require mutual respect among managers and users for each others' knowledge and practice; it could move forest management paradigms beyond our current view of "timber or parks" and toward one of truly integrated use.

CHANGING RESOURCE MANAGEMENT PARADIGMS

Institutions and practices of science and traditional ecological knowledge are often presented as independent and bounded realms of knowledge that are free from any mutual influence. The evolving thinking on science and traditional ecological knowledge is that boundaries between knowledge systems are less rigid than previously thought, and the interchange between science and traditional knowledge more frequent (Agrawal 1995, Usher 2000). Both of us have made such observations in our work both in the Canadian North and internationally. We have noted, for example, the sophistication of Latin American Aboriginal people in the way they manage forest succession, and the use of diverse landscapes in forested mountain environments in the Western Himalaya (Berkes *et al.* 1998b). We learned from the knowledge of Cree fisherfolk to develop a healthy respect and interest in the linkages between the knowledge of harvesters and resource managers. Collaborative projects with the eastern James Bay Cree fishers through the 1970s and the 1980s provided new insights that influenced the way we do ecology.

Twenty-five years after he first started working with the Cree, Berkes reflected, "Somewhat to my surprise, I found myself comfortable with the Cree view of nature, even though, by virtue

of my Western education and scientific training, I was heavily influenced to resist it" (Berkes 1999: xiv). For the Cree, land was a portfolio of resources that sustained life, and landscape itself was full of life, spirit, and mystery. Such a "sacred ecology" was very different from the conventional positivist concept of cut-and-dried, predictable ecosystems consisting merely of lifeless, mechanical processes that could be "managed" by technicians.

The Cree helped Berkes realize that, "although ecology is a science, its greater and overriding wisdom is universal. That wisdom can be approached mathematically, experimentally, or it can be danced or told as myth. It is in Australian aborigines' 'dreamtime' and in Gary Snyder's poetry... The science of ecology did not discuss such views, but Siu, Leopold, McHarg, and later Bateson mentally prepared me to be receptive to a traditional ecology that did" (Berkes 1999: xv). At the same time, many other ecologists and scientists were widening their radius of intellectual search and coming to similar conclusions. Partly as a reflection of this, by the 1990s, there were major changes in the way ecosystems were viewed by ecologists.

The old ecology could be characterized as emerging from the mathematics of Newton, the philosophy of Descartes, and the scientific method of Bacon. The paradigm that emerged from such foundations was mechanistic and reductionistic. This framework led to the idea that an ecosystem was an entity that operated like a machine. Like any other machine, it could be disassembled and the parts identified; the whole machine could then be understood by revealing the mechanisms by which the parts interacted (Holling *et al.* 1998).

The use of these theoretical foundations and frameworks resulted in an ecosystem concept characterized by equilibrium, predictability, linear processes, and controllability. Resource management used this ecosystem view, together with similar models from economics, to suggest that resources could be broken down into discrete categories such as timber, water, and soil. Each discrete category, such as timber, could then be managed independently of the others, using maximum sustained yield and maximum economic yield models, and constructing supply-demand curves for each component of the ecosystem. The unstated assumption was that if each part could be managed for sustained yield, then the machine (forest) as a whole could be sustained. But, as many resource managers know, this is not a good assumption, and there are many resource management disaster stories to prove it (Gunderson *et al.* 1995).

The emerging scientific paradigm tells a very different story about ecosystems and resource management. If the old ecology can be characterized as a science of the parts, the new ecology can be thought of as the science of the integration of the parts (Holling *et al.* 1998). This new ecology suggests that ecosystems must be understood as integrated and holistic entities that are nested across scales. Ecosystems cannot be understood by breaking them into parts but must be understood as a functional and structural whole that exists due to the relationship among the parts. Ecosystems in this view are characterized by multiple equilibria; non-linear processes; surprises (perceived reality departing qualitatively from expectation, in the sense of Holling 1986); threshold effects; and system flips.

Following the emerging paradigm, the ecosystem cannot be broken down into discreet resource categories because of the linkages among ecosystem components. Uncertainty becomes a key property of resource management due to the unpredictable, non-linear, and uncontrollable nature of the systems being managed. Finally, there is a recognition that people, policies, and politics are as much a part of an ecosystem as are timber, fish, and wildlife. This new view of ecosystems has been moving into mainstream thinking, as evidenced, for example, by the Ecological Society of America guidelines for ecosystem management (ESA 1995) and the adoption of ecosystem integrity management objectives by Parks Canada.

These developments have led to a flux in resource management, as current practices are no longer supported by the current scientific thinking. The new resource management will "require policies and actions that not only satisfy social objectives but, at the same time, also achieve continually modified understanding of the evolving conditions and provide flexibility for adaptation to surprises. Science, policy, and management then become inextricably linked" (Holling *et al.* 1998: 347). It could also be said that science, policy, management, and people will need to be more closely linked in the new resource management models.

Also very significant, the new concept of a multiequilibrium, non-linear, unpredictable ecosystem appears to be reducing the distance between science and traditional ecological knowledge. There is a convergence between science and traditional knowledge, as science begins to perceive humans as part of a world that contains a large degree of uncertainty, complexity, and unpredictability. Resource management is beginning to realize the need "to utilise the self-organizing capabilities of natural ecosystems to design harmonious social and natural environments; that is, to try to integrate human production and consumption patterns, infrastructure and settlements with ecosystem processes..." (Berkes *et al.* 1995: 296).

TRADITIONAL ECOLOGICAL KNOWLEDGE

The use of the term traditional ecological knowledge or local knowledge is one way of recognizing that resource harvesters possess knowledge that they use to make decisions about their resource harvesting practices. Many resource harvesters depict their knowledge as based upon the practical adaptation of technique, technology, and institutions within a local environment. We have been using a working definition of traditional ecological knowledge as "a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and their environments" (Berkes 1999: 8).

Even though there is no clear delineation between traditional ecological knowledge and science (Agrawal 1995), the recognition of traditional knowledge as a legitimate kind of knowledge is significant. It shows that the distinction between traditional ecological knowledge and science is not the absence or presence of management systems but the existence of different concepts of management. Traditional ecological knowledge may best be considered as a knowledge-practice-belief complex. Traditional knowledge may be thought to consist of four mutually interrelated spheres that are nested in one another: local knowledge of plants and animals; land and resource management systems; social institutions; and world view. Local knowledge of land, animals, plants, and landscapes can include knowledge of taxonomies, spatial and temporal cycles, and behaviors. Land and resource management systems use such knowledge to develop appropriate practices, tools, and techniques for a local environment. Traditional resource management systems also require appropriate institutions that allow interdependent harvesters to coordinate activities, cooperate in tasks, devise rules for social restraint, and enforce those rules. Finally, the world view (ethics, religion, values) allows resource harvesters to weave their perceptions of the environment into a coherent system of knowledge and practice.

Is traditional ecological knowledge relevant to current resource management? The term "traditional" is considered by some to denote knowledge and practice that is old and unchanging. However, there is not necessarily a contradiction between the terms tradition and change; change is simply what is noted if tradition is sampled along a temporal spectrum. Tradition often changes by adaptive processes and incorporates trial-and-error learning. Tradition further implies that there is historical continuity in culture and in the system of knowledge. The term "tradition" has often been used by resource harvesters to emphasize that their knowledge has been generated out of accumulated practical experience. Often the term of choice of Aboriginal and other people close to the land, it refers to knowledge and practice generated out of the life experiences of generations of harvesters themselves.

TRADITIONAL ECOLOGICAL KNOWLEDGE IN PRACTICE—DISTURBANCE AND SUCCESSION

Traditional ecological knowledge has not only generated the proverbial "grist for the academic mill" but has also resulted in distinctive landscapes found across the world. We can, for example, learn about forest reclamation in grassland ecosystems from the Kayapo people of Brazil. As shown in figure 1, the Kayapo use crumbled termite and ant nests and mulch to initiate a process of forest succession that results in expanding forest islands in the grasslands (Posey 1985). The process begins by planting useful crops into the prepared mounds (*apete*) for up to 3 years. Sweet potatoes and yams may be harvested for up to 5 years, and papaya and bananas may last as

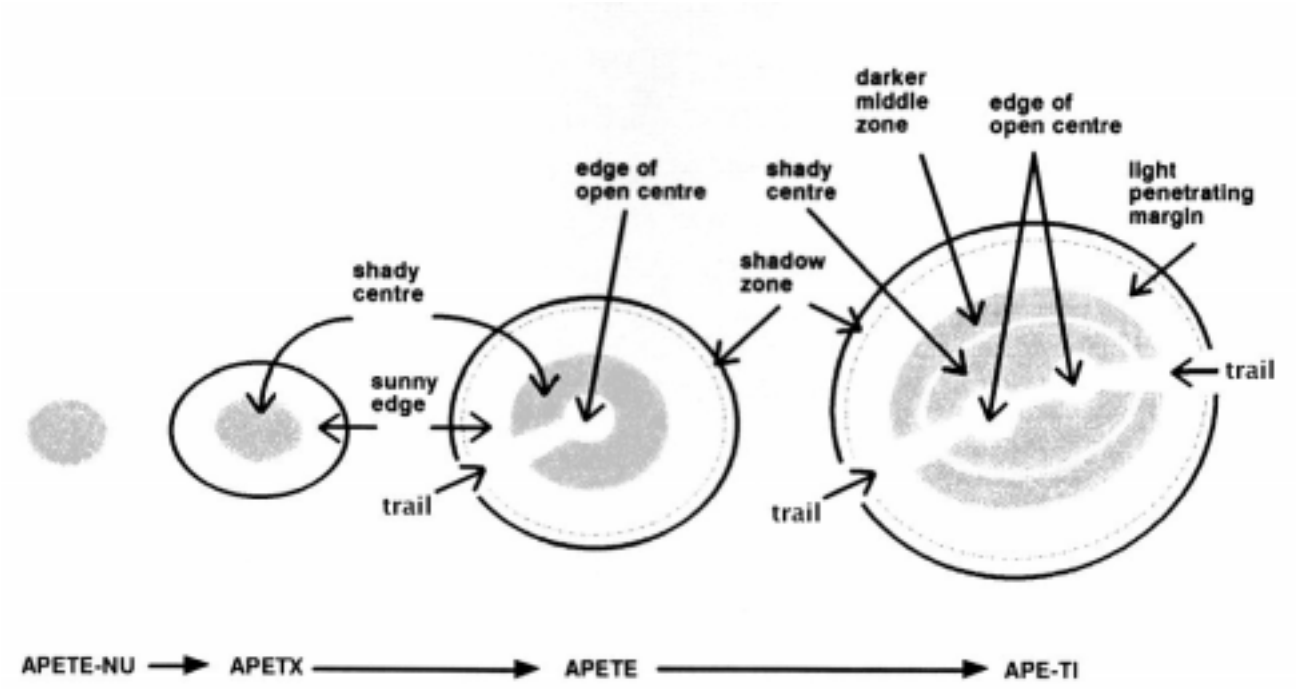

Figure 1.—*Enhancing biodiversity through the creation of forest islands,* apete, *by the Kayapo Indians of Brazil. Through a number of devices the behavior promotes patchiness and heterogeneity in the landscape in time and space.* Source*: adapted from Posey (1985).*

long as 7 to 10 years. Different fruit and nut trees are seeded or transplanted to the *apete* so that the resultant forest acts as a source of products for many years. The forest also continues to attract animals and birds who bring new seeds into the forest or disperse them to other areas of the grassland. The result of this management practice is a grassland landscape with interspersed forests. The knowledge of the relationship between disturbance and forest succession is one of the common traits of many forest management systems based upon traditional ecological knowledge.

Systems of forest management that use the ecological processes of disturbance and forest succession in an intentional manner often rely upon long fallow periods between intentional disturbances to allow for the conservation of ecological processes such as nutrient cycles and species recruitment. Useful plants are planted, transplanted, and harvested following the initial disturbance and for many years during the period of forest fallow. These useful plants can include food, medicines, and timber. If greater levels of production are required, then the forest management systems are often modified so that the fallow period may be shortened or bypassed altogether. Succession management systems grade into what might be termed agroforestry systems of management. An example is shown in figure 2, which depicts the *kebun-talun* management system of West Java, Indonesia. The *kebun-talun* system sequentially combines agricultural crops with tree crops by moving from a mixed garden of annual crops (*kebun*) to a mixture of annual crops and perennials (*kebun-campuran*) to a mixed forest of trees and understory plants (*telun*) (Christianty *et al.* 1986). This type of management practice leads to the classic patch mosaic or quilt landscape. However, the quilt has to be thought of not only as dispersed patches of *kebun, kebun-campuran,* and *talun* over space but also as each patch shifting over time. As the fallow period continues to decrease, the *kebun-campuran* system can move toward a different ecological arrangement called a homegarden.

The homegarden, such as the *pekarangan* in West Java, is an intensification of the *kebun-talun* in which the fallow period disappears altogether (Christianty *et al.* 1986). One way to think of this is to imagine one patch of the quilt where the *kebun-campuran-talun* cycle occurred. Instead of managing a variety of patches, each at a different temporal stage of

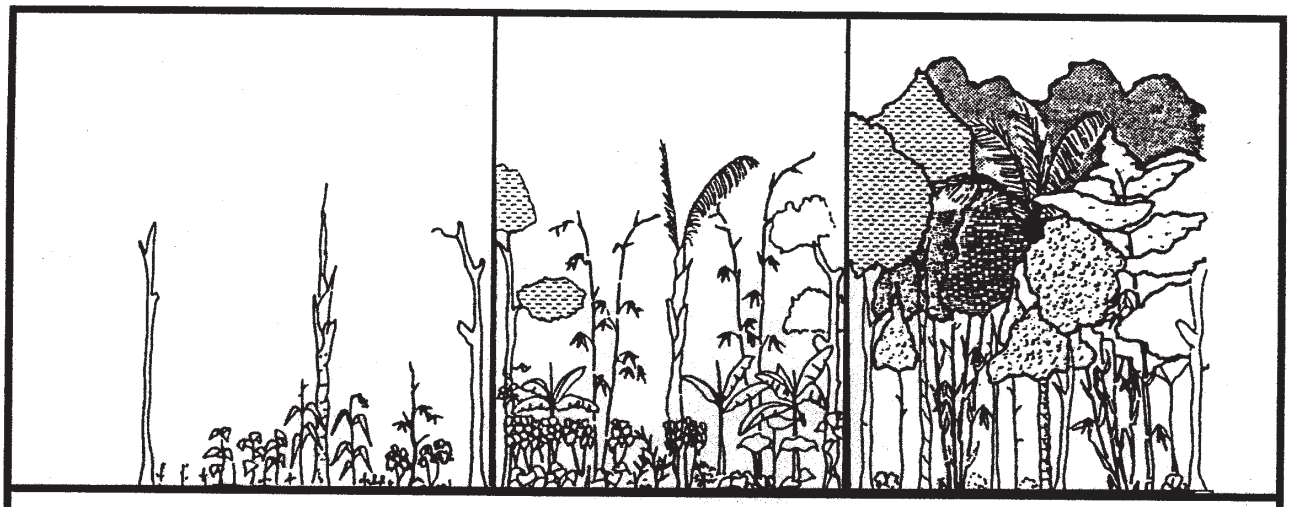

Figure 2.—*Successional stages of the* kebun-talun *system, West Java, Indonesia.* Source*: adapted from Christianty* et al. *(1986).*

the *kebun-talun* cycle, a person may build a house on the patch and begin to manage it as a *pekarangan*. The *pekarangan* combines the annual crop plants with perennial plants for market and home consumption. Species from each stage of the *kebun-talun* cycle may be brought into the *pekarangan* depending upon the market and home needs of the manager. As shown in figure 3, the diversity in the *pekarangan* is greater than in any one stage of the *kebun-talun* cycle. The loss of the temporal dimension of management is compensated for by the more intense management of vertical space within one patch.

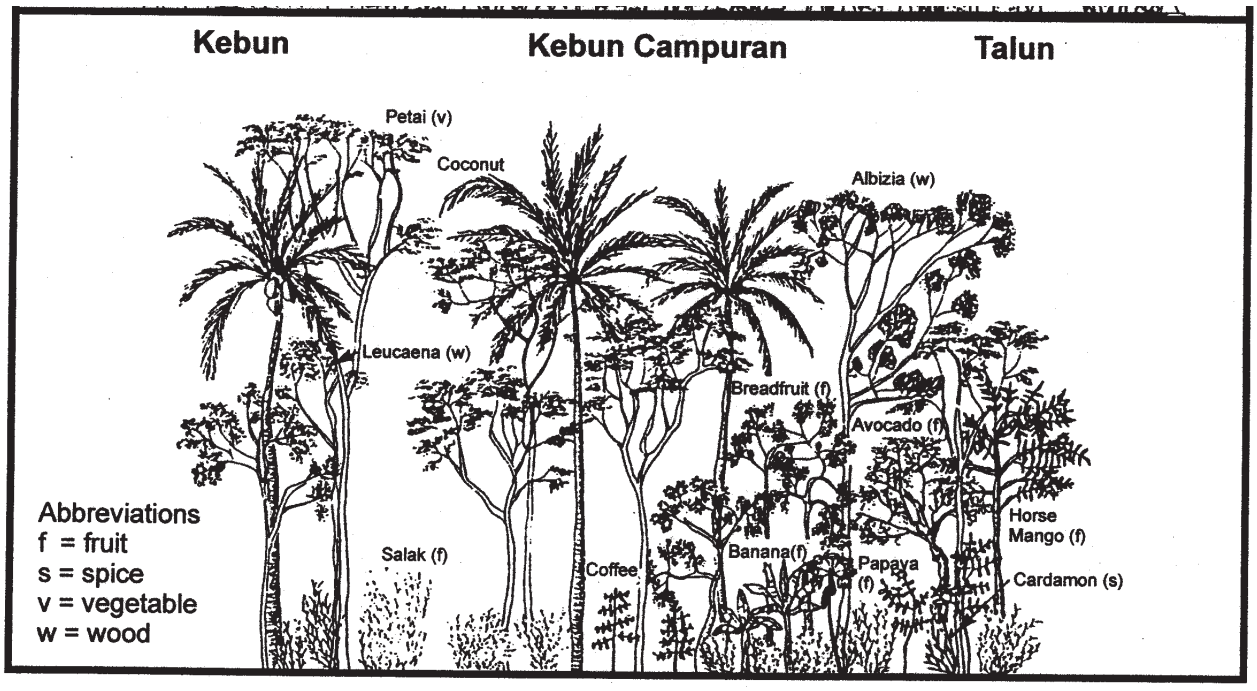

Figure 3.—*A representative homegarden (*pekarangan*), West Java, Indonesia.* Source*: adapted from Christianty* et al. *(1986).*

A similar agroforestry system is the *taungya* of Burma, shown in figure 4. In this system a patch of land is planted with both annual crops and perennial tree crops (Jordan 1986). In the early years, before the canopy of the trees closes, annual crops hold nutrients and prevent erosion. After the canopy closes, it is possible to plant understory crops, such as coffee or cacao, that take advantage of the space and diffuse light that filters through the canopy. The intensification of forest management thus uses disturbance to create intensively managed patches of forest but abandons the fallow period. In this management system, as in all others previously mentioned, a supplementary management objective is the creation of edge habitat to increase the abundance of forest animals and thus the chance of successfully hunting such animals. The outcome of the *taungya* management practices is a landscape that is less variable over time, but highly variable within a given patch of land, as the system takes advantage of vertical space instead of horizontal space (canopy, understory shrubs and herbs).

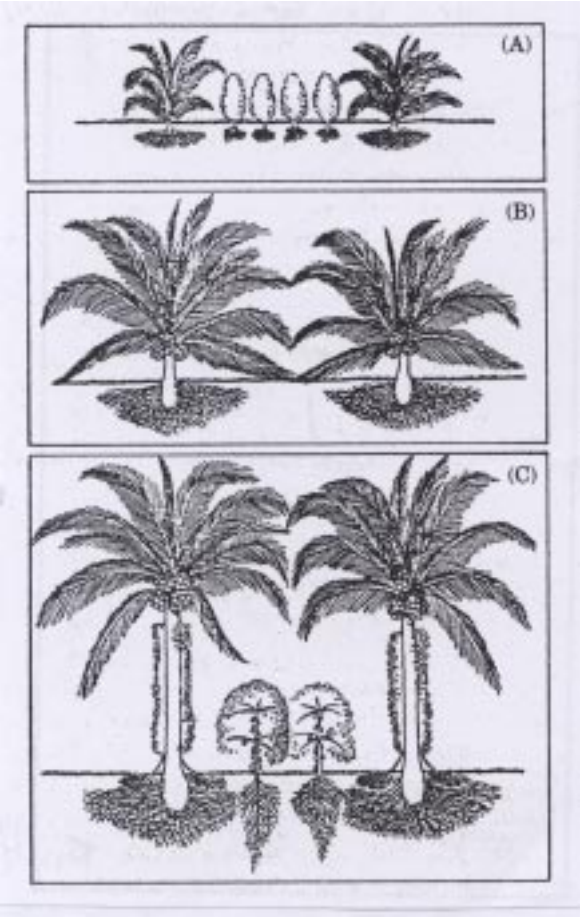

Figure 4.—*Idealized* taungya *system of cultivation using coconut palms as the dominant tree species. (A) Early stage—Coconut intercropped with annuals and short-term perennials. (B) Middle stage—Canopy cover does not allow understory layer. (C) Late stage—High canopy allows light penetration and production of understory crops such as coffee or cacao.* Source*: adapted from Jordan (1986).*

The previous four examples have demonstrated that forest management based on traditional knowledge can vary from low to high intensity. All of these systems are based upon the use of disturbance and succession as a management tool to produce for the market, home consumption, and aesthetic pleasures. These systems appear to reflect practices that can also be useful for temperate forest ecosystem management and for ecological rehabilitation. Robinson and Handel (2000) point out, "Ecological restoration can be likened to accelerated succession, in part because it aims to pass over the early phases of community development, when recovery can be delayed by the effects of past degradation... Following severe habitat damage, the reclamation phase closely resembles primary succession, in which most organisms colonize from external source populations. Indeed, a common goal of ecological restoration is to initiate natural populations as dispersing immigrants" (Robinson and Handel 2000: 174). The experimental work of Robinson and Handel (2000) demonstrates that habitat islands can act as sources of seeds that can be spread to surrounding land by dispersal agents. This is similar to the practice of forest management in Canada whereby islands of vegetation are left scattered throughout clearcuts to act as a seed source and habitat for dispersal agents. The recognition of the linkages between disturbance, dispersal agents, and succession appears to be an area in which the distance between traditional ecological knowledge and science is indeed shrinking and ripe for a process of mutual learning.

TRADITIONAL ECOLOGICAL KNOWLEDGE IN PRACTICE—ECOSYSTEM MANAGEMENT

One of the emerging approaches in forest management practice is ecosystem-based management (CCFM 1997, 1998a). Ecosystem-based management uses systems ecology theory, along with adaptive learning and practice. However, it is a management approach in which theory and practice are at the early stages of development and can thus benefit from insights provided by traditional ecological knowledge. Only recently has it come to the attention of ecologists that ecosystem-like concepts exist in the land wisdom of several Amerindian, Asia-Pacific, European, and African cultures (Berkes *et al*. 1998a).

One of the lessons from traditional knowledge regarding ecosystem-based forest management is that we need to move from a view that sees humans as external managers of forest ecosystems to one that considers humans to be integral components of forest ecosystems. This shift in perspective allows us to recognize the dependence of all human societies on the life-support functions of the ecosystem and the ways by which this may continue into the future (Berkes *et al.* 1998a). An ecosystem-based approach to forest management also needs to focus on spatially bounded units of land or water, consider everything within this unit to be interlinked, and recognize that units are nested and linked from smaller to larger scales.

Table 1 presents some of the applications of an ecosystem view as seen in traditional knowledge and management systems. Science-based resource management may never embrace all of the elements of such systems, such as their spiritual aspects. However, it is still possible that we can learn about ecosystem-based management from these long-standing examples of integrated resource management.

The *tambak* management system shown in figure 5 was used in Indonesia to establish mixed freshwater and seawater fish ponds in delta ecosystems and associated lagoons (Costa-Pierce 1988). The paddy rice fields were used to produce both rice and fish during the flooded period of rice production. The nutrient rich wastes of the paddy rice—fish production system were allowed to flow downstream into polyculture ponds (*tambak*) where shrimps, crabs, fish, vegetables, and tree crops could be produced. The wastes of this system then flowed into the flooded mangrove forests that enriched the coastal fisheries. The lesson of

Table 1.—*Examples of traditional applications of the ecosystem view*. Source*: Berkes (1999)*

System	Country/region	Reference
Watershed management of salmon rivers and associated hunting and gathering areas by tribal groups	Amerindians of the Pacific Northwest	Williams and Hunn (1982); Swezey and Heizer (1993)
Delta and lagoon management for fish culture (*tambak* in Java), and the integrated cultivation of rice and fish	South and Southeast Asia	Johannes *et al*. (1983)
Vanua (in Fiji), a named area of land and sea, seen as an integrated whole with its human occupants	Oceania, including Fiji, Solomon Islands, ancient Hawaii	Ruddle and Akimichi (1984); Baines (1989)
Family groups claiming individual watersheds (*iworu*) as their domain for hunting, fishing, gathering	The Ainu of northern Japan	Watanabe (1973); Ludwig (1994)
Integrated floodplain management (*dina*) in which resource areas are shared by social groups through reciprocal access arrangements	Mali, Africa	Moorehead (1989)

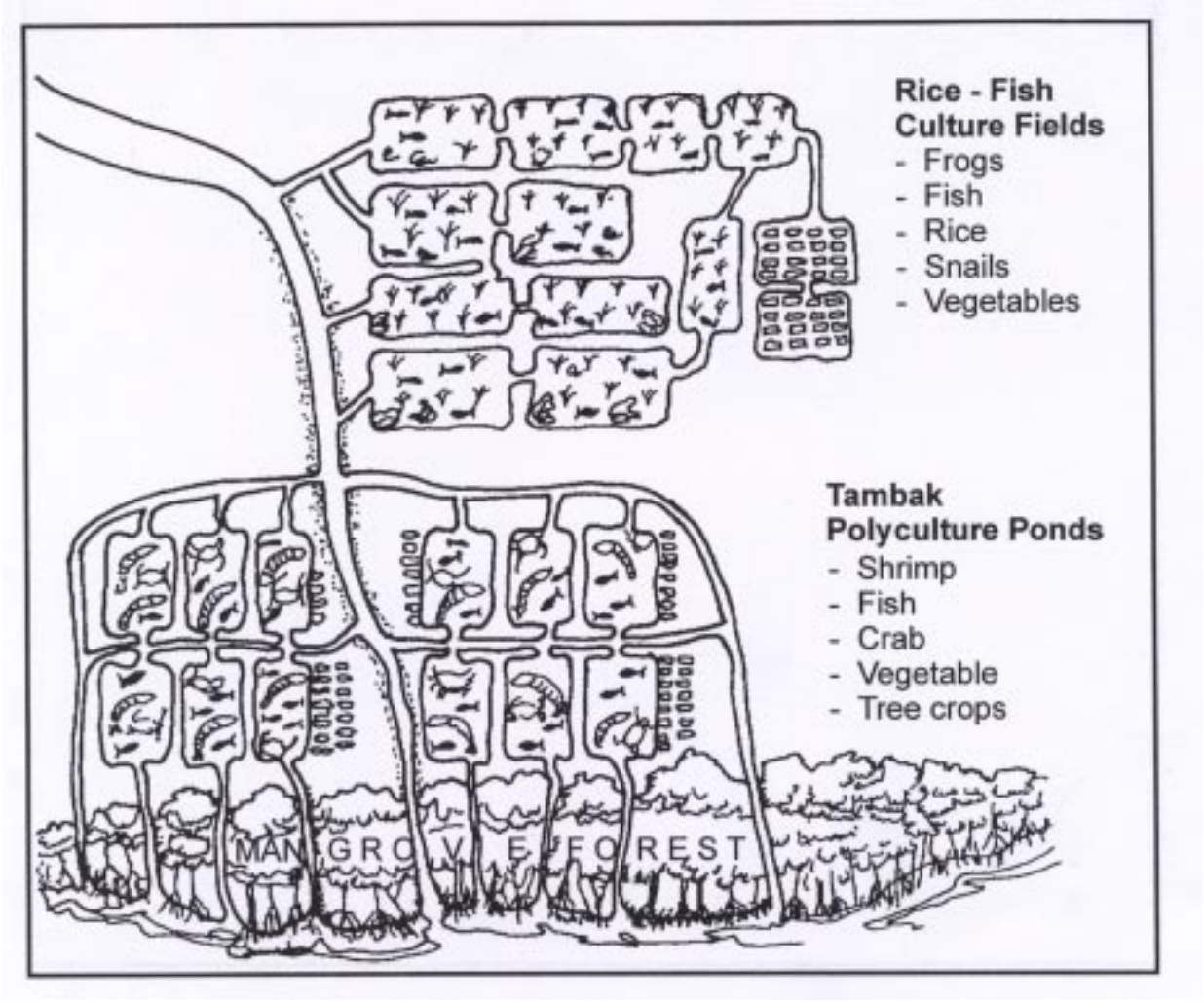

Figure 5.—*Traditional Indonesian coastal zone management.* Source*: adapted from Costa-Pierce (1988).*

this example is that by paying attention to ecosystem processes we can also generate ecosystem products. The linking of the paddy-pond-coastal lagoon to take advantage of nutrient wastes allowed the productivity of the entire system to increase by utilizing the outputs of one system as an input to the other.

Other examples of integrated watershed management can be found in the *vanua* system of Fiji and the *ahupua'a* of ancient Hawaii (table 1). The *ahupua'a* system of Hawaii, shown in figure 6, included entire valleys and stretched from the top of a mountain down to the coast and shallow waters. Each watershed was managed by a chieftanship, a social group under the authority of the king. The idealized version of this system shown in figure 6 included the following elements: forest zone (protected by taboo) at the top of the mountain for water catchment and erosion prevention; integrated farming zones in the uplands and coastal zone; coconut palms along the coastline to provide protection from storms and wind; and brackish water and seawater fish ponds.

The Hawaiian system no longer exists, but similar systems of watershed management can be found in other Asia-Pacific cultures, including Fiji and the Solomon Islands. The idea of managing a watershed as a unit historically appears in a number of different geographical areas, from the ancient Swiss and Turks to the peoples of the Far East (Berkes *et al.* 1998a). In our studies, we have found elements of watershed management in village resource areas in the Himalayas of northwest India in a temperate forest region. As shown in figure 7, each

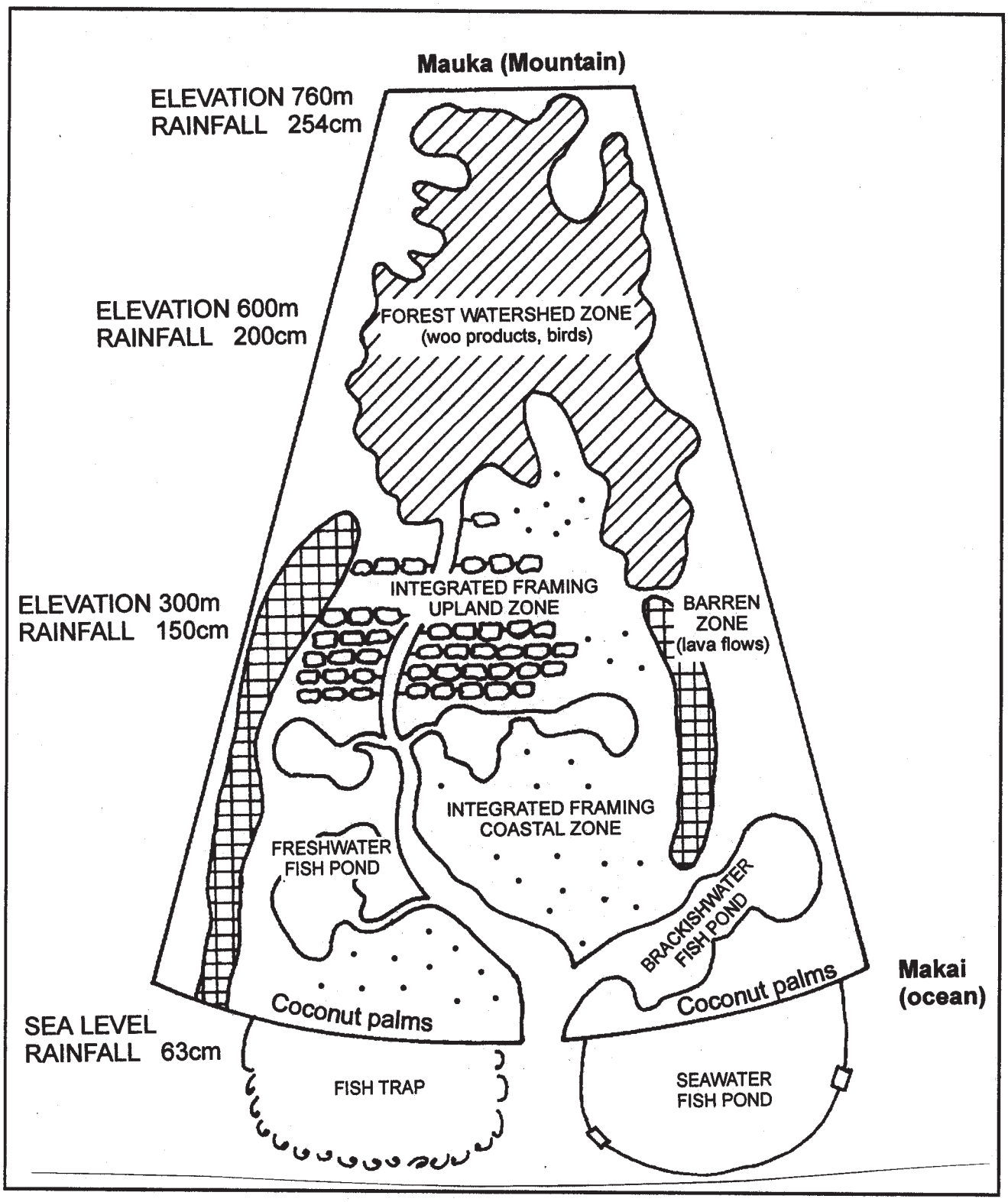

Figure 6.—*The* ahupua'a *system of ancient Hawaii.* Source*: adapted from Costa-Pierce (1987).*

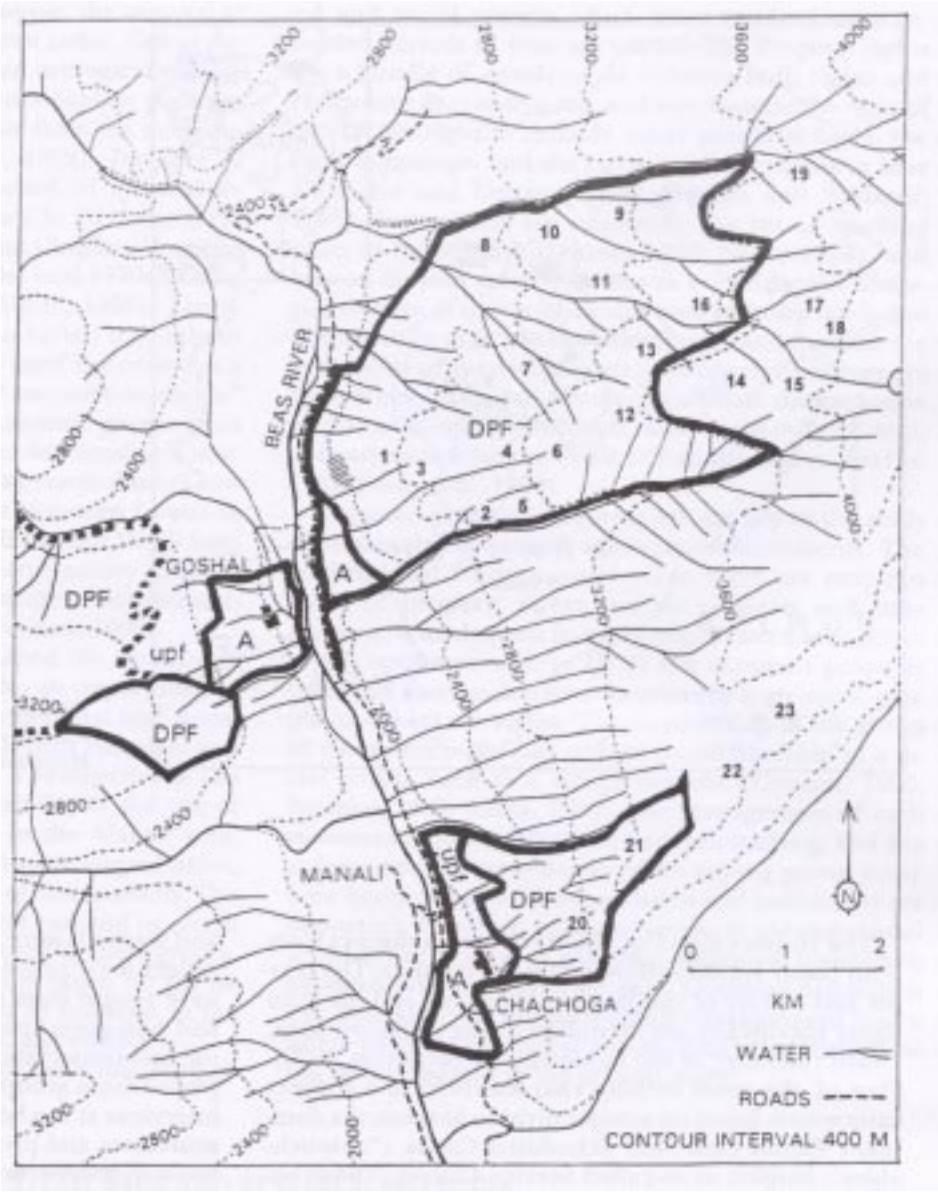

Figure 7.—*Management zones of two villages in the Himalayas of northwest India. Forest zone includes demarcated protected forest (DPF) and undemarcated protected forest (udf). Agricultural zones (A) are also shown.* Source*: Berkes* et al. *(1998b).*

village of the Beas watershed was granted a section of forest under the land settlement during the period of British rule. These units integrated alpine pastures, highland forests, forest meadows, upland agricultural land, and irrigated agricultural land on the valley floor. Both the forest and the agricultural area showed high biodiversity, in part because of the diversity of different social groups with different specializations (such as herding vs. agriculture), and in part because the dominant village agriculturalists used a variety of resources (e.g., different kinds of wood for different purposes) for their livelihoods (Berkes *et al.* 1998b).

One of the lessons from these examples of integrated watershed management is that it is possible to maintain both a productive and a diverse landscape through the integration of different types of land use. For modern resource managers, this will require devising management strategies that focus on ecosystem functions and process at the landscape scale, while paying attention to increasing the diversity of products that can flow from a

management unit. Such approaches have in fact been proposed for the sustainable management of tropical forest ecosystems (Lugo 1995).

It would be naive to suggest that the traditional management systems such as those mentioned above could be imported directly into the variety of ecological and social contexts that make up the boreal and cold temperate forest regions. What may be possible depends on the imagination and practice of the managers, workers, harvesters, and inhabitants of these regions. For example, by recognizing the value of both timber and non-timber forest products, we can increase the intensity and diversity of forest management, an idea consistent with some of the traditional systems discussed above, even though some of these examples may at first seem rather exotic. At this relatively early stage of ecosystem-based forest management in the boreal and cold temperate forest regions, it is through such explorations that we can begin to imagine what ecosystem-based forest management may look like "on the ground."

We can also learn from the principles developed by people who have investigated these systems. Janis Alcorn, for example, has derived seven principles from traditional knowledge and management systems. These principles can provide guidance as we address the challenge to focus on ecosystem processes while meeting the productive needs of society. She recommends that ecosystem-based management strategies (1) take advantage of native trees and native tree communities; (2) rely on native successional processes; (3) use natural environmental variation; (4) incorporate numerous crops and native species; (5) be flexible; (6) spread risks by retaining diversity; and (7) maintain reliable backup resources to meet needs should the regular livelihood sources fail (Alcorn 1990).

NON-TIMBER FOREST PRODUCTS AND CHANGING RESOURCE MANAGEMENT PARADIGMS

Traditional ecosystem knowledge and traditional management systems have often been placed in opposition to science-based management systems. However, with the advent of the changing views on ecosystems, there appears to be an increasing convergence between traditional ecological knowledge and some of the holistic science that pays attention to non-linear dynamics, complexity, uncertainty, and the location of human activities firmly within the ecological and social environment. We know something that we did not know 20 years ago: some traditional ecological knowledge is very good science, and some traditional management systems are very good management systems. For example, the practices of the Kayapo are currently reflected in the pages of the *Journal of Ecological Applications* (Robinson and Handel 2000), while the designs of ecosystem-based management appear strikingly similar to the landscapes created by Hawaiian and Himalayan systems of forested watershed management.

Many traditional knowledge practices are also consistent with scientific trends toward ecosystem-based management that focus on ecosystem processes, health, and resilience instead of maximum sustained yields of single species (Holling *et al.* 1998). It may not be possible to "manage" nature, but as Nancy Turner says, "you can keep it living" (Turner, this volume). "Keeping it living" in the boreal and cold temperate forests depends upon paying attention to ecological processes, such as disturbance and succession, and integrated resources management.

The study of non-timber forest products has run a parallel course to the study of traditional ecological knowledge and ecosystem-based forest management. Non-timber forest product studies of the past tended to focus more on production than on managing ecosystem integrity and process. However, the study of non-timber forest products provides an emerging arena of investigation in which ecology, traditional ecological knowledge, ecosystem-based forest management, and production can be brought together. Many non-timber forest products are linked to the ecological processes of disturbance and succession. Although timber is also linked to these processes, a focus on non-timber forest products provides the means by which we may be able to reverse the order of priority for forest management.

Ecosystem-based forest management means protecting the integrity, health, and resilience of ecosystems. It does not focus primarily on resources but rather on the sustainability of ecosystem processes necessary to provide these resources. Only then can we evaluate the products that emerge from these processes over

time and space. Timber, shrubs, herbs, mushrooms, animals, birds, and bacteria all have their own distributions in time and space relative to disturbance. For example, fireweed (*Epilobium angustifolium* L.) occurs in the early years following a disturbance, ginseng (*Panax quinquefolius* L.) is found under mature forest canopies, while highbush cranberry (*Viburnum trilobum* L.) often occurs along riverbanks disturbed periodically by spring flooding. Fireweed and ginseng have both been used as medicines while highbush cranberry is an edible berry. Ecosystem-based management requires that we consider ecological processes first and then link production to those processes—not the other way around.

A shift in priority from product to process opens up a whole new set of research questions. For instance, if we are interested in shortening the period between timber harvests, we need to consider both the ecological and social implications of such a management decision. In Indonesia the *pekarangan* reflects a similar decision to intensify forest management. One of the implications is that with intensification comes the need to recognize private property rights. However, we need to be aware that this is not the only possible alternative. If intensification is an option but not a requirement, then it may be possible to examine the ecological processes and the value of the products that flow from the ecological processes of a forest ecosystem.

What would such a multiple-species management system look like across the landscape and over time? What are the production/technological constraints for such a system of production? What is the distribution of products in space and time? What is the value of these products? What institutional changes would be required? A focus on non-timber forest products opens up a whole new set of questions that science and ecosystem-based forest management are only beginning to consider. These questions, however, have been considered within traditional ecological knowledge and traditional management systems.

The study of non-timber forest products opens up an area of research that can contribute to ecosystem-based forest management through a focus on ecosystems and traditional ecological knowledge. There is a potential for dialogue and mutual learning between scientists, resource managers, and traditional resource harvesters/managers through the establishment of cooperative research projects to answer research questions of mutual interest. However, this will require scientists and resource managers who are not just interested in mining information from traditional harvesters/managers but who are also willing to re-think the whole paradigm of resource management along with traditional harvesters/managers: scientists and resource managers who are able to envision the linkages between livelihoods and ecosystems, and able to imagine healthy forest ecosystems as vibrant places where people live, work, play, and visit. The linkages between ecosystem studies, traditional ecological knowledge, ecosystem-based forest management, livelihoods, and non-timber forest products provide a new direction for research and application that will lead us toward the vision of the Canadian Council of Forest Ministers to manage Canada's forests as ecosystems.

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Selected Non-Timber Forest Products with Medicinal Applications from Jilin Province in China

Yao Ge Huang[1], Branka Barl[2], and Gerald Ivanochko[3]

Abstract.—This paper provides a brief account of the distribution, production, and use of some non-timber forest products such as medicinal plants, medicinal and nutraceutical mushrooms, pharmaceutical insects, and "wild" vegetables in Jilin Province, China. All materials featured in this paper are used in Traditional Chinese Medicine (TCM) inside and outside of China. Given the similarities in environmental conditions between Saskatchewan and Jilin, the information provided herein may be used in assessing the potential of Saskatchewan wild plants for similar developments in the Canadian prairies.

Saskatchewan and the Province of Jilin, China, signed a twinning agreement on collaboration in agriculture research in 1984, which was extended in 1995 to include traditional medicine component. Saskatchewan Agriculture and Food and the University of Saskatchewan are attempting to evaluate production and harvesting potential of Saskatchewan native plants, as well as other herbs, for developments into economically viable crops in the province. The establishment of the Herb Research Program in 1994 was an important step in this process. Collaboration with experts from countries with a long tradition in herbal medicine, such as China, is considered invaluable in advancing herb research and industry development in Saskatchewan, particularly in the area of Traditional Chinese Medicine (TCM), which is being increasingly accepted in North America. In China, many of natural medicinal and nutraceutical materials could be classified as non-timber forest products, since they are either collected from forested areas or cultivated under conditions that closely simulate forest environment.

Jilin Province is located in the central part of Northeast China, has a territory of 187,400 square kilometers, and a population of 25 million (Department of Agriculture, Jilin Province 1997). Jilin is a major agricultural province and one of grain baskets of China. It is surrounded by mountains in the east, plains in the center, and grasslands in the west. It has a continental monsoon climate, four distinct seasons, and abundant rainfall. Jilin is one of the six major forest regions in China. It has 7.9 million hectares of forest plantations and is the third largest in the country (Jilin Province Leading Group of Foreign Capital Utilization Office, Foreign Investment Administration & Service Center 1997). It has the country's highest production of ginseng. Of 2,700 species of wild plants, 900 species are medicinal herbs and 80 species are medicinal and nutraceutical mushrooms. Most of them grow in the forested areas. For example, *Ganoderma lucidum* (Ling Zhi), *Gastrodia elata* (Tian Ma), *Astragali radix* (Huang Qi), and evening primrose are well known throughout the world, while *Hedgehog hydnum* (Hou Tou) is very popular in China.

It is well established that tradition of using herbal medicine goes back thousands of years in China. China is one of the largest medicinal herb material markets in the world, and forest area in Jilin Province is one of the most important production bases for medicinal herb material in China. For that reason, a unique

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college in the field of Traditional Chinese Medicinal herb materials, College of Chinese Medicinal Materials and National Institute of Local Products, have been established in the city of Changchun, Jilin Province.

Jilin has its own medicinal herb material distribution and selling system. The medicinal herb materials are mainly sold through the Chinese Medicinal Material Companies that are supplied by a network of smaller branches in several cities, counties, and towns throughout the Province. In some instances, the buyers of pharmaceutical factories buy medicinal materials directly from farmers and collectors. Many materials are also exported. Due to an increased demand for natural over synthetic pharmaceuticals in developed countries in recent years, the U.S.A., Germany, Japan, and Korea in particular have become large and lucrative international markets for medicinal herb materials from Jilin. The medicinal herb materials characterized as non-timber forest products (NTFPs) in China are listed in table 1. The following are the main NTFP products cultivated or collected in Jilin Province and sold worldwide.

Table 1.—*List of selected medicinal herb materials originating from China*[1]

Herb Powder Extract	Price (FOB China) $US/kg	Package
Siberian ginseng	13.5	25 kg/tub
Grape seed	165	5 kg/iron tin
Pine bark	190	5 kg/iron tin
Puerariae	33 - 40	25 kg/tub
Horsetail	14	25 kg/tub
Ginseng	80	25 kg/tub
Schisandra chinensis	18	25 kg/tub
Astragalus	17	25 kg/tub
Hawthorn	14	25 kg/tub
Polygonum multiflorum	24	25 kg/tub

[1] The prices provided by China Tiancheng Drugs & Bio-engineering Co., April, 1999.

MEDICINAL PLANTS

Ginseng (*Panax ginseng* and *Panax quinquefolium*)

Ginseng is the root, or root with rhizome, of two *Panax* species (*Araliaceae*) cultivated in Jilin Province: Oriental ginseng and North American ginseng. Oriental ginseng (Ren Shen) (*Panax ginseng* C. A. Meyer) is a native plant that has also been cultivated in China for more than 1,660 years (Huang *et al.* 1995a). The main active compounds in Oriental ginseng include ginsenosides Ro, Ra, Rb_1, Rb_2, Rc, Rd, Re, Rf, Rg_1, Rg_2, Rg_3, panaxynol, panaxdol, β-elemene, γ-elemene, and panaxans (Cui *et al.* 1996, Li and Huang 1994). The pharmacological properties of Oriental ginseng include: (1) acting on the central nervous system including excitation and inhibition processes; (2) exerting significant cardiotonic and hypertensive effects on acute circulatory failure after heavy blood loss; (3) decreasing the level of blood sugar; (4) promoting phagocytosis and enhancing lympocyte blastogenesis rate; (5) antiaging and improving memory (Kim 1996). Oriental ginseng is used to treat cardiovascular diseases, gastritis, hepatitis, diabetes, and neurasthenia and is particularly used during the recovery from major surgery. More recently, it has been used for treating gastric carcinoma, cervical cancer, uterine cancer, and leukemia.

Oriental ginseng is a perennial herbaceous plant. It likes a shady and cool environment, and sandy loam with rich organic matter. The optimal temperatures for the growing period range from 20 to 25°C and the optimal soil moisture content ranges from 40 to 60 percent. The yield of Oriental ginseng varies greatly, generally from 1 to 5 kg/m^2 (Yang 1993), depending on the cultivation situations. Oriental ginseng is usually processed as white ginseng (*Radix ginseng cruda*) (dried under the sun or in the oven), red ginseng (*Radix ginseng rubra*) (steamed and dried), sugar ginseng, ginseng powder, ginseng honey slice, ginseng extract powder, ginsenosides, ginseng cake, ginseng candy, ginseng soft drink, ginseng tea, ginseng liquor, and ginseng cigarettes (Jiangsu Medical College 1985). Jilin ginseng is very famous for its good quality and is sold inside

and outside of China. It is mainly exported to Southeast Asia, Japan, Europe, and North America. The price of Oriental ginseng ranges from $US 50 to 60/kg and Oriental ginseng extract powder is sold for $US 80/kg.

North American ginseng (Xi Yang Shen) (*Panax quinquefolium* L.) originated from North America and was introduced to Jilin Province from Canada in 1976 (Huang *et al.* 1995a). The germination of American ginseng seed is very difficult and slow (Huang *et al.* 1995a, 1995b). Under natural conditions, it takes 18 to 22 months for seeds to germinate upon harvest (Huang *et al.* 1996a, 1997b; Jo *et al.* 1998). Studies of the dormancy mechanism (Huang *et al.* 1995b, 1996a, 1997b, 1998) resulted in the identification of a germination-accelerating technology (Huang *et al.* 1995a, 1995b) that enabled seed to germinate within 7 to 8 months. The main active compounds in North American ginseng are ginsenosides Ro, Ra_0, Rb_1, Rc, Rd, Re, Rf, Rg_1, and Rg_2. However, the content of total ginsenosides is higher in North American ginseng than in Oriental ginseng, which is particularly true for Rb_1. The ginsenosides Rb_1 and Re constitute 50 percent of the total ginsenosides in North American ginseng (Li and Huang 1994). In China, North American ginseng is used for treating hypertension, coronary heart diseases, loss of blood, and pneumonia. North American ginseng is a perennial herbaceous plant that grows best in a shady and cool environment and in sandy loam with rich organic matter. The optimal temperatures for growing range from 18 to 24°C and optimal soil moisture ranges from 40 to 55 percent. The average yield of North American ginseng is 1 kg/m^2 (Yang 1993). It is processed as white ginseng (*Radix ginseng cruda*) (dried under the sun or in the oven), but not as red ginseng and sugar ginseng. Sometimes, it is processed as ginseng tea in China. It is mainly exported to Southeast Asia at a price of $US 85 to 145/kg.

Gastrodia (*Gastrodia elata*)

Gastrodia (Tian Ma) is the tuber of *Gastrodia elata* Bl. (*Orchidaceae*) grown in symbiosis with fungi *Armillaria mellea* (Vahl ex. Fr.) Quel. It has been cultivated in Jilin Province for many years. The cultivation efficiency of this medicinal plant has improved considerably since 1976 (Yang 1993). The main compounds in Gastrodia tuber are gastrodin, vanillyl alcohol, vanillin, and some alkaloids (Li and Huang 1994). The pharmacological activities of this plant include: (1) sedative, hypnotic, and antispasmodic effects; (2) increase in blood flow and decrease in peripheral resistance of blood vessels. It is used for infantile convulsion, tetanus, epilepsy, dizziness as well as migraine and arthralgia (neuralgic pain in joints). More recently, it has also been used for treating neurasthenia and hypertension. Gastrodia is a perennial herbaceous saprophyte. It grows well in cool environmental half-shady, half-sunny locations with high humidity, and humus loam rich in organic matter. The optimal soil temperatures range from 18 to 23°C and optimal soil moisture ranges from 30 to 40 percent. Wild Gastrodia can usually be found in a jungle-like environment at elevations from 1,000 to 2,500 m. The yield of Gastrodia tuber varies greatly depending on the cultivation conditions, generally from 0.3 to 1.8 kg/m^2 (Yang 1993). Prior to marketing, Gastrodia tubers are washed, peeled, boiled together with millet, and dried (Li 1991). The crude Gastrodia tubers are mainly exported to Southeast Asia and Japan at a price of $US 10/kg.

Radix Astragali (*Astragalus membranaceus*)

Radix astragali (Huang Qi) is the root of *Astragalus membranaceus* (Fisch.) Bunge var. *Monghplicus* (Bunge) Hsiao or *Astragalus membranaceus* (Fisch.) Bunge (*Leguminosae*). It is cultivated in Jilin Province. The main compounds in Radix astragli are astragaloside I, V, and VII, choline, betaine, kumatakenin, and polysaccharide (Jiangsu Medical College 1985). Its pharmacological activities include: (1) increasing the amount of leukocytes and polymorphocytes in peripheral blood and promoting lymphocyte-blastogensis; (2) healing skin ulcers; (3) acting as a cardiotonic; (4) dilating coronary artery and capillaries. It is used for treating loose stools, fatigue and bleeding, hysteroptosis or gastroptosis, common cold in debilitated patients, ruptured abscess, skin erosion, wound healing, and skin infection. More recently, it has been used for peptic ulcer and atrophic gastritis, edema, diabetes, partial body paralysis, asthma and for treating hepatoma, cervical cancer and lung cancer as well (Ou 1992).

Radix astragali is a perennial herbaceous plant. It grows in the wild on sunny and dry hillsides or under thin forest. The plant is generally adaptable to growing conditions and is relatively easy to cultivate. It grows well in sandy, well-drained, somewhat alkaline soil (Foster and Chongxi 1992). The yield of Radix astragali depends on growing conditions, and the range of yields is quite wide according to the cultivation situations, generally ranging from 0.2 to 0.8 kg/m^2 (Yang 1993). The processing of Radix astragali includes washing, drying, and slicing. It is mainly exported to Southeast Asia, Korea, and Japan in crude form at an average price of $US 6-7/kg. It is also sold as a powdered extract for $US 17/kg.

Herba Asari (*Asarum heterotropoides*)

Herba asari (Xi Xin) is the whole plant of *Asarum heterotropoides* Fr. Schmidt var. *mandshuricum* (Maxim) Kitag (*Aristolochiaceae*). It is cultivated mainly in Jilin Province. The main compounds in Herba asari include dl-demethyl coclaurine, safrole, methy leugenol, β-pinene, eucarvene, asarylketone, cineole, ι-asarinin (Li and Huang 1994). Its pharmacological actions include: (1) sedative, analgesis, antipyretic effects; (2) induces anesthetic effect on the sciatic neuroplexus of frogs and human lingual mucosa when used as an alcoholic infusion; (3) acts as a cardiotonic and vasodilator and can also relax smooth muscles, accelerate lipid metabolism, and raise blood sugar level (effect of Dl-demethyl coclaurine); (4) antimycotic (effect of safrole). It is used for treating common cold, headache, toothache, arthralgia, and cough. It can be used to wake a person from unconsciousness and to induce sneezing.

Herba asari is a perennial herbaceous plant. In the wild, it grows in rich loam soil or under thin forest canopy, and it likes lots of moisture. Typically, the yield of dry root is 0.8 to 1.2 kg/m^2 (Yang 1993). It is minimally processed, cleaned without washing, dried in the shade (Xu *et al.* 1997), and sold largely in China at a price of $US 10/kg. Powdered extract is sold for $US 17/kg.

Some of the other medicinal plants produced in Jilin Province include evening primrose (*Oenothera odorata* Jaeq.) (Yue Jian Cao), used for cardiovascular diseases; red-spotted stonecrop (*Rhodiola sachalinensis* A. Bor) (Gao Shan Hong Jing Tian), used for eliminating tiredness; bulaocal (*Boschniakia rossica* Fedtsch. et Flerov) (Cao Cong Rong), used for improving male sexual ability; and fructus schisandrea (*Schisandra chinenesis* (Turcz.) (Wu Wei Zi), used for insomnia and neurasthenia.

All plants mentioned above are used as medicinal materials in Traditional Chinese Medicine inside and outside of China.

MEDICINAL AND NUTRACEUTICAL MUSHROOMS

Ganoderma (*Ganoderma lucidum*)

Ganoderma (Ling Zhi) is the sporophore of *Ganoderma lucidum* (Leyss. ex Fr.) Karst. (*Polyporaceae*). Its medicinal uses have been recorded since the 11th century B.C. At the present time, it is cultivated in the manmade biofactory in Sulan County, Jilin Province. Its main constituents are organic germanium; polysaccharides BN_3C_1, BN_3C_2, BN_3C_3, and BN_3C_4; ganoderic acids A, B, C_1, C_2, D_1, D_2, E_1, E_2, F, G, H, I, J, T, U, W, X, Y, and Z; lucidenic acids A, B, C, D_1, D_2, E_1, E_2, and F; ganolucidic acids A, B, and C; acid protease, lysozyme, trehalose, and ergosterol (Li *et al.* 1996). Its pharmacological properties include: (1) acting as a sedative and analgesic; (2) increasing the tolerance of cold and anoxia in experimental mice; (3) exerting mild and prolonged hypotensive effect in rabbits; (4) protecting the liver in mice and decreasing the level of serum glutamic-pyruvic transaminase (SGPT); (5) decreasing blood sugar level; (6) acting as an antitussive and expectorant. The ganoderma is used for insomnia, amnesia, dullness, cough, and difficulty in breathing. Recently, it has also been used for hyperlipemia, hypertension, coronary heart diseases, arrhythmia, leukocytopenia, hepatitis, antiaging, and for some forms of cancers such as lung, esophagus, gastric, and nasopharyngeal carcinoma.

Ganoderma is a saprophytic fungus that thrives in an environment with high temperatures (24 to 30°C) and high relative humidity (85 to 90 percent). Wild ganoderma can be found beside tree stumps under the broadleaf tree forest. Cultivated ganoderma can produce 1 to 1.5 kg of dry product per 100 kg of media (Li 1996). Ganoderma can be processed into powder, extract, polysaccharides, health foods

and beverages, candy, liquor, makeup, shampoo, and so on (Huang 1992, Ou 1992). The crude ganoderma is mainly exported to Southeast Asia and Korea at a price of $US 4.5/kg.

Hedgehog Hydnum (*Hericium erinaceus*)

Hedgehog hydnum (Hou Tou) is the sporophore of *Hericium erinaceus* (Bull. ex Fr.) Pers. (*Hydnaceae*). This mushroom has been cultivated in the manmade biofactory in Duenhua County of Jilin Province since the 1960's (Jiang 1992). Hedgehog hydnum contains mainly polysaccharide and polypeptides (Li *et al.* 1996). The pharmacological activities of hedgehog include: (1) inhibiting synthesis of DNA and RNA in cancer cells; (2) inhibiting sarcoma$_{180}$ and Ehrilich-Ascites tumor *in vitro*. It is used for peptic ulcer, chronic gastritis, and more recently for the cancers of the esophagus, stomach, and intestines. Wild hedgehog hydnum can be found on walnut and oak trees. The optimal growing conditions for hedgehog hydnum are temperatures from 22 to 28 °C and relative humidity from 85 to 95 percent (Li *et al.* 1996). A single fresh hedgehog hydnum weighs from 60 to 100 g. It can be processed into candy, beverage, extract, liquor, and so on (Li *et al.* 1996). The crude hedgehog hydnum is mainly exported to Southeast Asia and Korea at a price of $US 15-17/kg.

Indian Bread (*Poria cocos*)

Indian bread (Fu Ling) is the dry sclerotium of the fungus *Poria cocos* (Schw.) Wolf (Polyporaceae). It has been cultivated in Jilin Province for many years. Its main compounds include several organic acids, pachymic acid, tumulosic acid, eburicoic acid, pinicolic acid, 3β-hydroxylahosta-7,9 (11), 24-trien-21-oic acid, and polysaccharides pachyman and pachymaran (Li and Huang 1994). The pharmacological activities of Indian bread include: (1) enhancing macrophage phagocytosis in mice (pachyman) and lymphocyte-blastogensis rate *in vitro*; (2) preventing gastric ulcer formation under stress in rats; (3) acting as diuretic and liver-protective. Indian bread is used for edema, dysuria, leucorrhagia, cough, jaundice, palpitation, insomnia, and chronic schizophrenia. Recently, it has also been used for treating many types of malignant tumors.

The fungus can be found on roots in pine forests at elevations of 700 to 1,000 m. It grows well in sandy loam at high temperatures (22 to 28 °C) and dry environment. The yields of fresh Indian bread range from 5 to 30 kg per cut pine root (Li *et al.* 1996). Indian bread can be processed into cake, pie, makeup, liquor mixed with ginseng, liquor mixed with Radix astragali, polysaccharides (Li 1985, Wei 1996). The crude Indian bread is mainly exported to Southeast Asia and Korea at a price of $US 4.5-6/kg.

Agaric (*Polyporus umbellatus*)

Agaric (Zhu Ling) is the dry sclerotium of *Polyporus umbellatus* (Pers.) Fries (*Polyporaceae*). Although it has a long history of use as a medicine in China—more than 2,500 years—it has not been cultivated yet. In Jilin Province, it is collected in forests at elevations 1,200 ~ 2,200 m. Agaric's main compounds are ergosterol, a-hydroxy-tetracosanoic acid, biotin, and polysaccharides (Li and Huang 1994). The phamacological activities include: (1) inhibiting sarcoma$_{180}$ and hepatic carcinoma in mice (polysaccharide); (2) enhancing macrophage phagocytosis and lymphocyte-blastogenesis rate; (3) acting as a diuretic. It is used for edema, dysuria, leukorrhea, jaundice, stranguria, urinary stone, and chronic hepatitis. Injections of agaric polysaccharides are used together with chemotherapy and radiotherapy for cancers of the lung, liver, and acute leukemia.

Agaric grows under the soil surface and prefers soil with high oganic matter. Under optimal growing conditions (soil temperatures of 12 to 20 °C and soil moisture of 30 to 50 percent), it yields 2 kg of fungus per 70 cm x 70 cm x 50 cm cell. Agaric is considered as one of the best anticancer fungi. It is mainly exported in sliced and dry form (Li *et al.* 1996) to Southeast Asia and Korea at a price of $US 4.5-7/kg.

Other medicinal and nutraceutical mushrooms produced in Jilin Province and used mainly as food and for anticancer activities include: padi straw mushroom [*Flammulia velutipes* (Curt. ex Fr.) Sing.] (Jin Zhen Gu), champignon [*Lentinus edodes* (Berk.) Sing.] (Xiang Gu), tremella (*Tremella fucidormis* Berk.) (Yin Er) (also used for cough), and Jew's ear [*Auricularia auricula* (L. ex Hook.)] (Hei Mu Er) (used as food and recommended for people working in mining, chemical, and textile industries (Li *et al.* 1996).

PHARMACEUTICAL INSECTS

Ground Beetle (*Eupolyphaga sinensis*)

Ground beetle (Tu Bie), presently reared in Jilin, refers to the whole body of dry female adult of *Eupolyphaga sinensis* Waller (Blattodea: Corydiidae). Beetles are killed with boiling water, and female insects are selected and dried for medicinal application (Zhu 1994). The main known compounds in ground beetle are naphthalene, volatile oil, alkaloid, fatty aldehyde, aroyl aldehyde, and camphor (Jiangsu Medical College 1985). The pharmacological activities include: (1) activity against L1210, P388, and SNU-1 cancer cells *in vitro*; (2) 126 percent increase in lifespan of S_{180} mice during 60-day *in vivo* tests with boiling water fraction (Huang *et al.* 1996b, Huang *et al.* 1997a). Ground beetle is used for trauma, fracture, anemia, hepatosplenomegaly, extrauterine pregnancy, chronic hepatitis, and pulmonary tuberculosis. More recently, it has been used for some cancers like nasopharyngeal carcinoma, melanoma, and uterine and ovarian cancer. The crude ground beetle is mainly exported to Southeast Asia and Korea for $US 7 to 8/kg.

Batryticated Silkworm (*Bombyx mori*)

Batryticated silkworm (Jiang Can), presently collected in the wild and reared in Jilin, is the larvae in the fourth and fifth stages of development of *Bombyx mori* L. (Lepidoptera: Bombycidae) parasitized by a fungus *Beaveria bassiana* (Bal.s) Vuill. Prior to use as a medicine, batryticated silkworm is dried by quick exposure to lime. Its main known compounds are chitinase, bassianins, beauvericin, corticoids, ecdysterone, and 3-hydroxykynurennine (Jiangsu Medical College 1985). Pharmacological activities of batryticated silkworm include: (1) sedative and hynotic effect in mice (at oral dose of 2.5 g/kg similar to hypodermic injection of phenobarbital at 50 mg/kg); (2) cytotoxic activity shown against L1210, P388, and SNU-1 cancer cell lines *in vitro* (Huang *et al.* 1996b); (3) increased lifespan of S_{180} mice at 80.2 percent during 60-day test *in vivo*. Batryticated silkworm is used for convulsion, epilepsy, tetanus, apoplexy, headache, ocular pain, sore throat, prurigo, urticaria, psoriasis, asthma, rheumatoid arthritis, diabetes, gastric cancer, and laryngocarcinoma. The crude batryticated silkworm is mainly exported to Southeast Asia and Korea for $US 7 to 8/kg.

Blister Beetle (*Mylabris calida*)

Blister beetle (Yuan Qing) refers to the dry adult of *Mylabris calida* Pallas (Coleoptera: Meloidae). In Jilin, blister beetle is not reared but collected in the wild. It is typically consumed as fried with rice. Cantharidin, its main active compound (Jiangsu Medical College 1985), has been shown to display strong cytotoxic activity against L1210, P388, and SNU-1 cancer cells *in vitro*; corresponding ED_{50} were 0.62, 1.05, and 0.58 mg/ml, respectively (Huang 1997a). Cantharidin also inhibits S_{180}, reticulothelioma and ascitic hepatocarcinoma in *in vivo* tests; it also inhibits synthesis of DNA, RNA, and protein. It is used for rabies, externally for carbuncle, scabies, leukoplakia of vulva, distortion of the face, and more recently, for gastric, liver, and esophageal cancer, lingering and chronic hepatitis, tuberculosis of bone and lymph node, and rheumatism. The crude blister beetle is exported mainly to Southeast Asia and Korea at a price of $US 4/kg.

Fuscous Ant (*Formica fusca*)

Fuscous ant (Ma Yi) refers to the dry adult of the worker ant of *Formica fusca* L. (Hymenoptera: Formicidae). It is artificially reared and/or collected in Jilin Province, then killed in steam (not fried or boiled) and dried (Wu 1994). The main compounds of Fuscous ants are aliphatic hydrocarbons, formic acid, farnesene, isoxanthopterin, 2-amino-6-hydroxypteridine, and biopterin (Wu 1994). Its pharmacological activities include: (1) anticancer activity against L1210, P388, and SNU-1 cancer cell lines *in vitro* (Huang *et al.* 1997a); (2) antiphlogistic activity; (3) antiaging in mice test; (4) recovering the immunity of old mice. Fuscous ant is used for rheumatoid arthritis, chronic hepatitis, sex functioning obstruction, postponing senescence, and diabetes. The crude fuscous ant is mainly sold in China at a price of $US 7/kg.

Other pharmaceutical insects collected in Jilin are tabanid (*Tabanus mandarinus* Schiner) (Mang Chong) for cervical cancer; dung beetle (*Catharsius molossus* L.) (Qiang Lang) for many kinds of cancers; cockroach (*Periplanete americana* L.) (Zhang Lang) for hepatoma, gastric carcinoma, and esophageal cancer; mole cricket (*Gryllotalpa africana* Pal. de Beauvois.) (Lou Gu) for edema.

The pharmaceutical insects mentioned above are approved for use as materials for both Traditional Chinese Medicine and health products in China.

WILD VEGETABLES

Brachen (*Pteridium aquilinum*)

Brachen (Jue Cai) refers to the tender leaves of *Pteridium aquilinum* (L.) Huhn var. (Desv.) Underw. ex Heller (Pteridaceae), a perennial herbaceous plant that grows in rich soil and sunny locations close to the forest. It is cultivated in Jilin Province. Every 100 g of fresh brachen contains 1.6 g protein, 0.4 g fat, 10 g carbohydrates, 1.3 g crude fiber, 1.68 mg carotene, and 35 mg of vitamin C. A gram of dry brachen contains 11.89 mg Ca, 2.18 µg P, 617.40 µg Fe, 16.58 µg Cu, 388.20 µg Zn, and 44.50 µg Mn (Dong 1997). It is used in dishes with beef or chicken, as a salad with green onions, and is used to treat jaundice and insomnia. It is washed for 1 minute in boiling water and for 7 - 8 hours in cold water prior to cooking, or dried after a 1 minute wash in boiling water. It is exported mainly to Japan and Korea for $US 2.5/kg.

Cinnamon Fern (*Osmunda cinnamomea*)

Cinnamon fern (Zi Qi) refers to the tender leaves of *Osmunda cinnamomea* L. var. *asiatica* Fernald., a perennial herbaceous plant that can be found in wet places under the forest. It is also cultivated in Jilin Province. Every 100 g of fresh cinnamon fern contains 1.97 mg carotene, 0.25 mg of vitamin B^2, and 69 mg of vitamin C. Each gram of dry plant contains 31.2 mg K, 1.9 mg Ca, 2.93 mg Mg, 7.11 mg P, 0.51 mg Na, 125 µg Fe, 81 µg Mn, 62 µg Zn and 18 µg Cu (Dong *et al.* 1997). It can be cooked with pork, snake, or fish spiced with ginger. It is used to treat cough, cold with fever, increased menstruation, rheumatism, intestinal cancer, gastric carcinoma, and hepatoma. Cinnamon fern needs to be washed, kept for 24 hours in cold water, and cooked or canned. Alternatively, it can be washed for 1 minute in boiling water and dried (Zhang 1997). It is exported mainly to Korea and Japan for $US 2.5/kg.

Balloonflower (*Platycodon grandiflorum*)

Balloonflower (Jie Geng) refers to the root of *Platycodon grandiflorum* (Jacq.) A. DC. (*Campanulaceae*), a perennial herbaceous plant cultivated in Jilin Province. It grows well at warm temperatures (20 °C) and relatively high moisture; dry product yield is 0.2 to 0.3 kg/m^2. Every 100 g of fresh balloonflower roots contains 14 g starch, 0.9 g protein, 3.19 g crude fiber, 10.00 mg of vitamin C, and 0.44 mg of vitamin B_2 (Dong 1997). It is used in cooking as sweet and sour balloonflower, balloonflower with hot pepper and pork, balloonflower with cucumber and carrot, and balloonflower with tremella to treat sore throat, cough, laryngocarcinoma, and lung and tonsil cancer. Processing involves washing, peeling, soaking in salt water for 24 hours, cooking, drying, or canning (Yang 1993). It is exported mainly to Korea and Japan for $US 5/kg.

Japanese Aralia (*Aralia elata*)

Japanese aralia (Song Mu) refers to the tender buds of *Aralia elata* (Miq.) Seem, a small arbor tree that grows well in sandy loam and is presently cultivated in Jilin Province. Every 100 g of fresh Japanese aralia contains 5.4 g protein, 0.2 g fat, 4.0 g carbohydrates, 1.6 g fiber, 20 mg Ca, 150 mg P, 1 mg Na, 590 µg K, 1,1 µg Fe, 32 µg Zn, 530IU of vitamin A, 19 mg of vitamin B_1, 0.26 mg of vitamin B_2, and 12 mg of vitamin C (Dong 1997). It is used in cooking with eggs and in sauteed Japanese aril. Japanese aralia buds are used to treat neurasthenia, rheumatoid arthritis, diabetes, nephritis, gastric carcinoma, intestinal cancer, gall bladder cancer, and lung cancer. Processing involves washing of buds for 1 minute in boiling water, followed by 1 to 2 hours in cold water, followed by cooking or canning (Dong 1997). It is exported mainly to Korea at a price of $US 0.5/kg of fresh product.

Other "wild" vegetables cultivated and/or collected in Jilin Province are dwarf yellow daylily (*Hemerocallis middendorffii* Trautv. et Mey.) (Huang Hua Cai), field sowthistle (*Sonchus brachyotus* DC.) (Qu Mai Ca), dandelion (*Taraxacum mongolicum* Hand Mazz.) (Pu Gong Ying), and shepherdspurse (*Capsella bursa-pastoris* (L.)) (Ji Ji Cai). They are quite popular in China and are often more expensive than cultivated vegetables in Chinese markets. Some are exported to Japan and South Korea every year.

Quite a few species of non-timber forest products are collected or cultivated in Jilin Province, China. Some of them have developed into a new industry already, while others still have great opportunities for growth ahead. We believe that the lessons we've learned about the non-timber forest products in Jilin Province may serve as good background information in planning and developing a viable non-timber forest industry in Saskatchewan.

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Ecological and Biological Considerations for Sustainable Management of Non-timber Forest Products in Northern Forests

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Abstract.—With a current output of over $241 million per year, non-timber forest products (NTFPs) contribute significantly to the welfare of rural and First Nations communities in Canada. Maple sap products, wild mushrooms, and wild fruits are the most important NTFPs for consumption both in Canada and abroad. However, because of increased access to international markets by entrepreneurs along with a growing international demand for NTFPs, it may be possible to double or triple Canada's NTFP harvest. As well, the development of this industry requires that biological research be conducted to better manage and locate the NTFP resources. To avoid depleting forest biodiversity, future research should also address the domestication of NTFPs.

INTRODUCTION

In recent years, non-timber forest products (NTFPs) have attracted the attention of politicians, entrepreneurs, economic development agencies, and First Nations agencies as a means to improve the quality of life in rural Canada (Brubaker 1999, Davidson-Hunt 1998, De Geus 1995, Higgins 1998, Mohammed 1999). NTFPs encompass a wide variety of products derived from forests, including conifer boughs, wild rice, wild blueberries, maple sap products, wild mushrooms, and wild medicinal herbs. In British Columbia 200 types of NTFPs are recognized and in Ontario 50 types are commercially used (Mohammed 1999), although we surmise that there may be as many as 500 NTFPs in Canada. In the Upper Peninsula of Michigan, Emery (1998) documented residents harvest of various plant parts from more than 132 tree, shrub, and herb species for commercial sale and personal use.

For this paper, we define NTFPs as non-timber products growing in forests and derived from plants or animals in their natural environment. However, we exclude animal products from this discussion because of wildlife regulations that control and/or prohibit the sale of wildlife or their products in many Canadian provinces. Applied broadly, our definition includes logging residues such as branches, stumps, or rotten logs that have been culled during timber harvesting operations. Although we exclude products such as wild ginseng and Christmas trees that have been domesticated for cultivation in agricultural settings, we recognize that they can become important income generators in rural communities.

Although many NTFPs can be harvested successfully in the short term, the long-term sustainability of the NTFP industry depends on a thorough understanding of NTFP biology and ecology for three reasons. First, it is essential to understand how NTFPs grow in order to promote their conservation through sustainable harvesting and cultural techniques. Second, gatherers and entrepreneurs need to understand the biology of NTFPs in order to optimize harvesting

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operations in both the short and long terms. And third, some NTFPs will eventually require domestication; to achieve this, a complete understanding of their genetics, biology, and ecology will be needed to grow a product that is as attractive as the naturally grown product. This understanding can be acquired through traditional knowledge gleaned from multiple generations of experience, through scientific research, or through a combination of these types of knowledge. The objective of this paper is twofold: First, we present an overview of the current NTFP industry in Canada. Second, we discuss the need to understand NTFP biology and ecology.

CANADA'S CURRENT NTFP HARVEST

We conducted an informal survey of the value of NTFP shipments by dealing with known entrepreneurs, local and regional economic development agencies, academics, consultants in the fields of NTFPs, and government agencies. In table 1, we report our findings for 1997 illustrating a total yearly value of approximately $241 million Canadian in NTFP shipments. NTFP outputs make up 0.4 percent of the $58.7 billion Canadian yearly output in forest products from Canada. However, NTFPs play a critical socioeconomic role at the regional levels because they contribute greatly to rural economies through seasonal employment and often allow families to increase their yearly income by $8,000-10,000. Hence we perceive NTFP harvesting as a means to reduce poverty and improve quality of life in rural Canada. At present, maple sap products and wild mushrooms make up the bulk of Canada's NTFP output for national consumption and international export (table 1). In contrast, wild berries, medicinal plants, and other NTFPs play a relatively unimportant economic role at the national level.

Table 1.—*Estimated non-timber forest products in Canada—value of annual shipments for 1997*

Product	Estimated value (in Canadian dollars)
Maple syrup	$120,000,000
Mushrooms	$100,000,000
Berries (*Vaccinium* spp., *Amelanchier* spp.)	$ 20,000,000
Medicinal plants	$ 1,000,000
Ornamentals	$ 500,000
Essential oils	$ 50,000
Total value of shipments	$241,550,000

It is difficult to determine the actual potential of NTFP outputs in Canada. In this discussion we estimate the yearly potential of NTFPs at $1 billion Canadian based on two approaches: 1) the current yield of NTFPs is assumed to be $1.00/ha of productive forest, so we estimate that this figure can easily be increased fourfold to fivefold; 2) there is a high demand for various types of NTFPs by international markets (Norvell 1995) and resource inventories suggest that NTFP harvesting industries could meet those demands (Duchesne 1995, Miron 1994). Our predicted output of NTFPs is comparable to the total value of timber product shipments from Manitoba, Newfoundland, and Saskatchewan for 1997 (table 2).

Table 2.—*Value of shipments from Canada's timber industry by Province for 1997*

Province	Value of shipments (in Canadian dollars)
Newfoundland	$ 603,000,000
Nova Scotia	$ 1,009,000,000
New Brunswick	$ 2,960,000,000
Quebec	$15,102,000,000
Ontario	$12,059,000,000
Manitoba	$ 702,000,000
Saskatchewan	$ 714,000,000
Alberta	$ 3,482,000,000
British Columbia	$22,039,000,000
Total Canada	$58,700,000,000

ECOLOGICAL SUSTAINABILITY AND NTFP HARVEST

The ecological sustainability of the NTFP harvest is a central issue to the long-term availability and management of NTFP on a broad scale. Undoubtedly, the impact of the evolution of harvesting operations from sub-sistence level use to commercial exploitation will create new pressures on individual species and ecosystems as well as conflicts with other forest users. Indeed, whereas traditional use of NTFPs by First Nations people was restricteded by technological limitations, the large-scale use of the NTFPs through modern means of extraction and transportation can have a great impact on individual species and ecosystem

productivity. A good example is the overexploitation of wild ginseng from eastern North American deciduous forests over the past 50 years.

ECOLOGICAL KNOWLEDGE AND NTFP PROFITABILITY

From a pragmatic perspective, it is critical to help harvesters of NTFPs acquire and use verified knowledge that helps them select the more profitable sites, harvest in an efficient and ecologically sound way, and handle the product so that value is mantained. To survive in the NTFP business, entrepreneurs must have this knowledge. A vast body of scientific literature and practical experience teaches NTFP harvesters that plants are not found uniformly through the forests. Their production and abundance varies with a wide range of environmental and internal plant factors such as soil conditions, climate, time of the growing season, history of disturbance, vegetation type, and plant age and condition. As well, it is important to recognize that within forest ecosystems not all NTFP sources are equally desirable. For example, the quality of birch bark varies among trees in a stand and between birch stands as does the pattern of annual ring width of black ash trees, an important factor in selection of trees for baskets (Collins 2000, McPhee 1989). Therefore, knowledge about the biology of NTFPs is critical to predict NTFP abundance and quality in order to profitably harvest and market NTFPs.

At this time, the most successful NTFP harvesting operations are supported by facilitating scientific knowledge. In western Canada, morel harvesters visit recent wildfire sites in search of black morels. Because black morel fruiting takes place early in the spring, harvesters start their harvesting operations in the south of the boreal forest and move northward as the morel season starts. In contrast, we have a poor understanding of the biology of many NTFPs, so it is difficult to predict their location and abundance in natural ecosystems. The future of the NTFP industry depends largely on entrepreneurs to gain the necessary knowledge to locate, harvest, handle, and transport NTFPs as efficiently as possible.

ECOLOGICAL KNOWLEDGE AND THE DOMESTICATION OF NTFPS

In the long run, there will be economic and ecological advantages to the domestication of some NTFPs. Domestication can take different forms depending on product, sites, and economic considerations. For example, blueberry producers in eastern Canada manage natural populations of plants while blueberry producers in Minnesota and elsewhere plant and cultivate desired varieties. Substantial revenues are currently derived from domesticated production of NTFPs in the northern forest. In Ontario, the Christmas tree industry and the ginseng harvest from agricultural lands yield combined revenues of over $55 million Canadian per year (Mohammed 1999). Reasons for domesticating these NTFPs included maximizing harvest, avoiding further depletion of natural stocks, stabilizing supplies, and increasing economic return. The intensive culture of ginseng in former tobacco fields of southern Ontario had the double advantage of providing tobacco farmers with an alternative crop when the tobacco demand fell and helping conserve wild ginseng. However, the success of the domestication of wild ginseng is largely due to our understanding of its ecological requirements for seed stratification, nutrient needs, and shading requirements. One caveat to the domestication of ginseng, and a factor that needs to be considered for other crops, is that field-grown ginseng is inferior to wild ginseng, because of the lower content of active ingredients in the former (Ma *et al.* 1995). Further research showed that ginseng grown under the canopy of a forest stand is of better quality (Beyfuss 1999). Other NTFPs, particularly wild mushrooms, could become domesticated if we understood their ecological requirements. For this we need to increase our understanding of NTFP biology and ecological requirements.

BIOLOGICAL FACTORS CONTROLLING GROWTH AND ABUNDANCE OF NTFPS

Understanding how plants grow and reproduce is central to the biology and ecology of NTFP production. Plant growth information needs for NTFP range from the physiology at the cell and whole plant scales of resolution to the interaction of plants with their environment at the

stand and landscape scales. For higher plants of temperate ecosystems, growth takes place in two areas. The apical or primary meristems of the shoot and root are responsible for growth in length and increase their area of occupancy. The activity in shoot apices also determines the differentiation of buds into reproductive and vegetative types; this determines the potential for fruit and seed production. The activity of the cambium, referred to as a secondary meristem, produces growth in diameter through formation of new xylem, phloem, and bark (Gartner 1995, Halle *et al.* 1978, Larson 1994, Lyndon 1998, Romberger 1963, Zimmerman and Brown 1971).

In branches and main stems of plants, apical meristems are located in buds that may be active or dormant for many years, becoming active when the plant is damaged or loses vigor. Collectively these primary buds and adventitious buds that form after the plant is disturbed are referred to as the bud bank (Harper 1977, Zasada *et al.* 1992). Their distribution and potential for development within the plant vary within and among species and with the resources available on the site (Gill 1995, Harper 1977). Their location and growth determine the architecture of the plant and distribution and display of the photosynthetic machinery (Gartner 1995, Halle *et al.* 1978). The lack of attention to the presence, location, and potential for growth of these primary meristems can result in excessive harvest of NTFPs like balsam fir boughs and clubmoss, leading to a stunting and decline in the growth potential of the plant and ultimately the loss of this resource. From an ecological perspective, it is important for harvesters to understand the relationship between harvesting intensity and long-term productivity related to growth potential and dynamics of apical meristems and the foliage, fruits, and seeds that develop from them. The interaction between physical, chemical, and biological environmental factors, genetics, and apical meristems determines the potential for fruit production and development of unique NTFPs. For example, burning blueberry plants stimulates the creation of new buds and substantially increases berry production. Whereas this fact was well-known to many Native American cultures of North America, it is now used to promote blueberry production. However, fire has been replaced by mechanical means: rotary blades are now used to prune the apical buds of blueberry plants.

Activity of the cambium in trees and other woody plants is responsible for the formation of the xylem, phloem, ray cells, and bark. Cambial activity and development of the cells and tissues derived from the cambium are very sensitive to environmental conditions (Larson 1994, Zimmerman and Brown 1971). This sensitivity is the basis for the potential that exists for managing the quantity and quality of some NTFPs. Wood characteristics and growth forms such as width of the annual ring (important in black ash basketry), development of burls (used in making wooden bowls and carvings), and wood patterns (important in development of diamond willow) are all directly determined by the inherent capacity of the cambium to interact with the physical and chemical environment of the air and soil and in some cases with other organisms, particularly insects and diseases. The bark from which we obtain important materials for various utilitarian and decorative purposes, such as birch bark baskets, is a direct product of both the cambium and the cork cambium, the latter derived from activity of the cambium and whose specific function is production of the bark layers.

The bark is the first line of plant defense against many insects and pathogens. Its anatomical structure provides a physical barrier, but perhaps more important the bark is the location of many secondary chemical compounds that provide effective chemical barriers against attack by various organisms (Bryant and Raffe 1995, Prance *et al.* 1993, Shain 1995). These chemicals, also called secondary metabolites, have been and continue to be important NTFPs. Up to 50,000 secondary plant molecules are generated from plants and many are located in the bark. They can be used for medicinal purposes, antifeedants, fungicides, essential oils, food additives, and other purposes. They include, for example, the resin of balsam fir trees, tannins in the bark of hemlock, betulin and papyriferic acid in birch bark, taxol in yew bark, and salicylic acid in willow bark to name but a few. The presence, and absolute and relative amounts of these compounds vary among and within the plant and with plant age and resources available for growth. There is little doubt that new compounds and more uses for those currently identified will be discovered as more research identifies and unlocks their potential.

The cambium produces the xylem or wood through which water and dissolved mineral and organic substances are transported in specialized cells, i.e., vessels and tracheids, from the roots to the leaves. Maple and birch sap, comprised of water and of dissolved sugars that were stored overwinter in the parenchyma cells within the wood and mineral elements, are transported in the xylem and removed from the xylem in the spring when trees are tapped. In addition, secondary metabolites accumulate within the ray cells in the wood of trees as they grow older. The tannins of oak wood are critical to the wine industry because they provide chemicals that affect the taste and quality of wine.

Understanding the biology of mushrooms, Canada's second most important NTFP, is equally critical. From an NTFP perspective, there are two types of fungi: those that feed on dead material, also known as saprophytic fungi, and fungi that form symbiotic associations with plants, generally called mycorrhizal fungi. For example, the mass-produced Agaricus, shiitake, and oyster mushrooms are saprophytic species that have been domesticated. In contrast, symbiotic fungi are difficult to cultivate. In nature, the roots of all trees are infected by fungi. With a few exceptions, these root-infecting fungi form symbiotic associations with trees—fungi exchange sugars for nutrients and water with the tree roots. Unfortunately, the most valuable wild mushroom species such as the chanterelles, the boletes, and the pine mushroom are symbiotic species and their domestication has not been achieved. However, cultivation of Lactaria species has recently been reported through the co-incubation of both fungi and a host plant under controlled conditions (Godbout and Fortin 1990).

DISTURBANCE AND MANAGEMENT OF NTFPS

It is important to understand the effects of all types of disturbance on NTFPs. NTFPs fall into four broad categories—materials for spiritual use, medicinal use, ornamental use, and technology (e.g., Marles *et al.* 2000, Turner 1998). Disturbance can be considered in several general classes for each of these categories. In our brief discussion, we list three classes, realizing that others may categorize NTFP disturbance differently.

1. Constant adjustment of forest ecosystems to the variation in climatic patterns and the various types of disturbance related to this variability. They occur at all scales of resolution and each has the potential to affect NTFP quantity and quality. Frosts and insects can affect individual buds and flowers; herbivory, disease, and wind affect parts of or entire plants; wind, fire, and insects affect entire stands and landscapes. The severe damage to sugar maple trees and forests and the effect on syrup production in the northeastern U.S., Ontario, and Quebec is one recent example of the impacts of more extreme forms of natural disturbance on NTFPs. These disturbances must be expected and bring a significant level of uncertainty to the availability of NTFPs at both temporal and spatial scales. Impacts of human activities on the physical and chemical variables considered under the general heading of "global" or "climate" change may add more uncertainty to NTFP availability.

   It is not surprising that the life cycles of many NTFPs are associated with natural forest disturbance. Small fruit-bearing species such as raspberry, mulberry, Saskatoon berry, and pin cherry are early colonizers after disturbance and they disappear as time since last disturbance increases. Many of these species survive in mature forest stands as seeds buried in the soil. The passage of fire activates the seeds and, without competition, these species thrive in open sunlight. However, as ecosystems mature and plant growth creates competition for light and nutrients, the seed-bearing species are displaced from ecosystems. Native cultures of North America were aware of the importance of fire disturbance for the production of small fruits. Succession in ecosystems brings other types of NTFPs as new species are introduced. For example, shade-tolerant species such as wild ginseng and *Lycopodium* develop best in the understory of older forests. Likewise, fungal species also undergo succession as forest stands age after disturbance. Early species after fire in jack pine ecosystems are often the commercial black morel (*Morchella conica*) for a very short period of time (Duchesne and Weber 1993). Black morels are then replaced by other species as the ecosystem matures.

An important aspect of climate and NTFP production is the annual variation in phenology and the effect on timing of collection and the quality of NTFP. Emery (1998), for example, has developed an annual calendar showing the "normal" times of collection/harvest of many products in the forests of northern Michigan. This analysis clearly shows how various species differ seasonally in their development and how gatherers who collect multiple species time their activities to plant development. For those gatherers who pick along a climatic gradient, e.g., mushroom harvesters who start in warm climates and progress to colder climates, an understanding of effects of temperature and other climate variables is a critical factor in planning.

2. Human disturbances not directed specifically at NTFPs. Forest harvesting, land development, mining, and other human activities that directly affect the land are common, and all have the potential to alter the availability of NTFPs. The effects may be of short duration or, in the case of conversion of forest land, NTFPs may be eliminated. Several points should be considered regarding the effect of these disturbances on NTFPs. First, where it is possible, gatherers of NTFPs should be directed to areas where disturbances are planned that will severely impact important NTFP species. For example, in areas where there is a balsam bough market, and a timber sale is planned that will severely damage a balsam fir understory, bough pickers should be allowed to harvest this material before it is destroyed. Second, many disturbances—forest harvesting is a primary example—result in an increase in production of NTFPs, such as fruits and berries. Where it is possible, these areas should be identified and gathering for personal and commercial use should be encouraged.

3. Human disturbances specifically related to NTFPs. These disturbances occur as a direct result of harvesting NTFPs or from efforts to manage the availability of NTFPs. Other papers in this proceedings describe some of the techniques used by Native Americans to manage the productivity of berries, roots, and other materials essential to their lives. These include the use of fire, harvest techniques, planting, and various levels of cultivation. Even today there are efforts to reduce annual periodicity of some NTFPs, increase production, and reduce natural variation not only by using similar approaches but also by using "modern" technology not available in the past. The other aspect of this category of disturbances is the effect of harvesting on the future availability of the target NTFP or another NTFP that may be available from the same plant. For example, the harvest of birch bark and birch sap may be possible during the life of an individual tree. What needs to be considered about the effects of the harvest of one on the availability and quality of the other? The same can be said of activities that affect entire stands such as burning or mechanical treatment to increase berry or fruit production. How do these treatments affect the potential availability of other NTFPs from the same land base?

CONCLUSIONS

Although NTFPs contribute less than 0.5 percent of Canada's forest output, they often represent a lifeline to rural economies. Because of sharp increases in the global demand for NTFPs, their exploitation is becoming more and more attractive for the economic development of rural communities. As Canadians become more aware of the NTFP potential, there is a need to augment our knowledge base to create a sustainable industry.

Two general types of knowledge are available about NTFPs. First, historic or traditional knowledge has been gleaned and "field tested" by countless generations of Native American and other harvesters and consumers of NTFPs. Often this information far exceeds the scientific knowledge available for a particular product (Richards 1997). The second type is scientific knowledge gained through the study of the natural history of plants and hypothesis testing using designed experiments.

Traditional knowledge and scientific knowledge both have important roles to play in the sustainable production of NTFPs. When traditional knowledge is not available, basic principles of plant reproduction and growth should provide a guide for developing practices for sustainable use of the NTFP resource. Scientific knowledge can also be used to explain the biological basis

for the success of well-tested traditional methods of NTFP harvest and utilization.

Disturbance is a key concept for understanding temporal and spatial variation in NTFP quantity and quality. Disturbance should be viewed as occurring at different scales of resolution ranging from the individual bud to landscapes. Natural disturbances are a normal part of forests and they create a significant level of uncertainty in both short- and long-term production and availability of NTFPs. To some extent, the effect of natural disturbance can be managed, but not yet to the degree that uncertainty can be greatly reduced or predicted. Human activities that occur generally in the forest affect the availability of NTFPs and create conflicts among products. There are many opportunities to coordinate major disturbance activities, such as forest harvesting, with NTFP gathering, but these are not fully recognized and taken advantage of at this time. The harvest of NTFPs can affect both the sustainability of the product being harvested and other products from the same plant. Management activities that target one particular NTFP will impact other resources.

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Lycopodium: Growth Form, Morphology, and Sustainability of a Non-timber Forest Product

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Abstract.—Several species of *Lycopodium* or clubmoss belong in the category of non-timber forest products and are often gathered for a variety of traditional uses. It is important to evaluate baseline information for these species, such as abundance and frequency of occurrence, before making any management decision. In addition, understanding the biology of the *Lycopodium* group as a whole, including growth form and morphology, may enable us to make better decisions about forest management practices used and harvesting quotas allowed for sustaining these species.

INTRODUCTION

Several *Lycopodium* or clubmoss species are extensively collected as non-timber forest products and are marketed to industries for production of seasonal and traditional decorations and for floral and horticulture uses. In addition, medicinal (Aboriginal and homeopathic), native folklore, and theatrical uses exist for various *Lycopodium* species (Johnson *et al.* 1995; Shakhashiri 1983; Ullman 1992, 1997). *Lycopodium* species are considered to be fern-allies. In temperate forests they are vascular, terrestrial, evergreen, perennial, rhizomatous, and clonal in nature. This group of species has been around a long time, with ancestors that date back to the Tertiary period (Lellinger 1985). Few studies have been done to determine how these species can be regenerated and how fast they recover after harvesting (Matula 1995, Primack 1973). Although some of the *Lycopodium* species are common in northern hardwood forests, the impacts of forest management practices on populations of these species are not well understood.

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SPECIES DESCRIPTIONS AND USES

Following is a brief description of each of the six *Lycopodium* species discussed in this paper. The descriptions are compiled from personal observations, as well as information referenced from the literature (Cody and Britton 1989; Flora of North America 1993; Johnson *et al.* 1995; Lellinger 1985; Meeker *et al.* 1993; Primack 1973; Turner *et al.* 1983; Ullman 1992, 1997).

Lycopodium species vary in growth form and morphology. The mature aerial stems of a plant photosynthesize. They may be either non-branching or treelike in form. When mature, the aerial stems often have cones (strobili) or sporangia that produce the spores necessary for sexual reproduction. Spores mature and are released in the late fall, even as late as November. In general, *Lycopodium* aerial stems reach maturity and begin to produce spores at from 4 to 6 years of age, depending on the species and local growing conditions. *Lycopodium* species have either aboveground or belowground running rhizomes or lateral branches. The rhizomes have the ability to produce adventitious roots and are used for photosynthate, water, and nutrient transport. The rhizomatous nature of these species may add to the photosynthesis capacity of the plant as a whole and may affect the plant's ability to get around vegetatively. A typical *Lycopodium* patch can have multiple-aged lateral branches or rhizomes, and each rhizome may have ramets that vary in age from 1 to 6 years. In general, the

bigger and more branching the patch, the older it is.

The aerial stems of *Lycopodium dendroideum* and *L. obscurum* are frequently harvested and used for decorative greens. Although commonly found in aspen-birch forests, these two species are also found in moist rich woods and along edges of bogs. The branching aerial stems resemble small pine trees: hence the common name of princess pine or ground pine. Only the individual mature aerial stems should be harvested, and this should be done after prime spore release in late fall. The spores of these two species are flammable when mature and have been used historically for theatrical and pyrotechnical purposes. In addition, the ground pines have belowground rhizomes running between 2 and 6 inches below the soil surface (Nauertz and Zasada, personal observations); consequently, a new aerial stem may not appear above the soil surface until sometime in the second year of growth.

Lycopodium complanatum, also known as ground cedar, is most commonly found in pine forest communities, typically grows in clumps, and can cover large areas. It has tree-like, branching aerial stems with adpressed and tightly packed microphylls or leaves that strongly resemble cedar boughs. When mature, the aerial stems host a "candelabra" of cones for spore production. This species of *Lycopodium* differs from the ground pines *L. dendroideum* and *L. obscurum*, in that it has aboveground running rhizomes growing through the litter layer on the forest floor. *Lycopodium complanatum* is also harvested for decorative greens and has some homeopathic and Aboriginal medicinal uses. Harvesting for greens is different for this plant in that the entire aboveground runner, or rhizome, is yanked from the surface of the soil; hence, the entire plant or section of a clone is harvested, rather than just the mature aerial stems as done for the ground pines. Optimal lateral extention or growth for each rhizome has been recorded to occur in year 1 (most recent year growing tip) to year 6, with maximum extension reaching 400 to 600 cm. Greatest aerial stem mass was recorded in years 3 to 6, with peak weights reaching 13 to 25 grams (Nauertz and Zasada, unpublished data).

Running clubmoss, Wolf's paw, or *Lycopodium clavatum* also has aboveground running rhizomes and is harvested for decorative greens in the same manner as the ground cedar. Traditional Aboriginal and homeopathic remedies are concocted from the dried plant parts of this species. *L. clavatum* has forking, non-branching aerial stems that typically bear one to two cones when mature. The aerial stems are often tightly packed along the aboveground running rhizomes. In Canada, Aboriginal peoples on Vancouver Island, located in British Columbia, believed the plant should be left alone. It is said that clubmoss should be left because it is "something that gets you confused in the woods" or "confused and uncertain about orientation" (Turner *et al.* 1983). Perhaps this belief stemmed from the random pattern of branching that is common for this species.

Lycopodium annotinum or stiff clubmoss is not traditionally gathered or harvested. Although considered evergreen, this species tends to dry out quickly and does not remain green and pliable, as do the other species harvested for decorative greens. *Lycopodium annotinum* has forking, non-branching aerial stems that produce a single strobilus, or cone, when mature. The stems are typically densely packed along aboveground running rhizomes.

Shining clubmoss or *Lycopodium lucidulum* is most common to northern mesic forests dominated by sugar maple, preferring the embedded acid, wet woods or rocky areas. Native Americans traditionally gathered it for use as padding for cradleboards. *L. lucidulum* does have some features that are unique to this group of clubmoss species. It has forking, non-branching aerial stems that, when mature at around 6 years of age, produce sporangia that contain spores in the leaf axils. In addition, gemmae or bulblets may be produced in the upper leaf axils. They mature usually in late summer or early fall, and when bumped will catapult off the aerial stem and, upon landing in proper growing media and conditions, have the potential for growing into a new, genetically identical plant. This is a means of vegetatively increasing plant frequency, but not genetic variation. *Lycopodium lucidulum* does not technically form rhizomes; instead the aerial stems tend to layer, and then branch and fork. Each fall the leaf litter from the overstory canopy falls, anchoring the layered aerial stems to the surface of the forest floor. Adventitious roots for water and nutrient uptake will form along the layered aerial stems.

LYCOPODIUM REPRODUCTIVE CHARACTERISTICS

Reproduction method, both sexual and asexual, may help explain the frequency and cover patterns of individual *Lycopodium* species. All ferns and fern-allies produce spores and experience an alternation in generations, which is a means of dividing, segregating, and re-combining chromosomes. This allows for genetic variability to occur and for evolution to proceed (Lellinger 1985). Spores vary in where they germinate within the soil surface layers and were found to germinate at deeper depths as well as on the soil surface (Cobb 1963, Freeberg 1962). The spores produced by fern-allies such as *Lycopodium* may remain viable for many years and could take up to 7 or more years to develop into a gametophyte (Cobb 1963). Gametophytes may remain alive from only a few weeks or months (Lellinger 1985) to as long as 10 or more years (Cobb 1963). A gametophyte bears the sexual mechanisms for reproduction and, given optimal conditions, may result in a new, genetically unique sporophyte or plant that would be recognized as *Lycopodium*. A complete life cycle from spore to gametophyte to sporophyte may take up to 20 years.

Spore development may potentially lead to a new patch and an increase in frequency. Rhizome growth and expansion will increase the overall area covered by an individual patch. For *Lycopodium*, as well as for other rhizomatous species, a major portion of the expansion of cover is created by the growth and branching of the lateral branches or rhizomes. Rhizomes are a plant's mechanism for getting around, exploring new territory, and foraging for new resources. At some point, if new resources are not discovered and exploited, that section of the plant will be cut off physiologically and another section of the plant will begin to grow and explore for new resources. In general, both methods of reproduction, sexual and asexual, help to explain *Lycopodium* distribution.

LYCOPODIUM DISTRIBUTION

The distribution of *Lycopodium* in northern forests tends to vary. These clumps or colonies are so well distributed throughout the forest that they have a certain amount of randomness in their distribution (Curtis 1959). A patch may be very dense and vast, or it may be thin and sparse. Patches of *Lycopodium* may be located near each other and occur frequently within an area, or there may be large areas where no *Lycopodium* occurs at all.

Lycopodium, especially ground pine, is often found in northern hardwood forests in Michigan's Upper Peninsula. Nauertz (1999) conducted a study in these forests to gain insight on the species biology and presence in managed and unmanaged forests. In addition, as part of a larger study (USDA, FS, NCRS, NC-4153-94-03), basal area was measured and recorded in all of these stands in 1995-1996. Four forest types were studied: (1) Unmanaged old-growth forest with trees as old as 250+ years that have not been disturbed by logging. Basal area was 23 - 47 m^2/ha. (2) Unmanaged second-growth forest that was clearcut in the 1910s and now remains unmanaged with trees that are primarily of second-growth origin. Basal area was 26 - 37 m^2/ha. (3) Managed uneven-aged forest that is of old-growth origin and is managed to have an all-age size distribution using selection cuts and group cuts. Basal area was 20 - 27 m^2/ha. (4) Managed even-aged forest that is also of second-growth origin and was clearcut around the turn of the century. Crop tree release and thinning have been performed at routine intervals to convert the even-aged stands to an uneven-aged distribution. Basal area was 21 - 30 m^2/ha.

Nauertz (1999) found that *Lycopodium* species occurred in 10 - 67 percent of the 130 plots sampled in the study. Two-thirds of the *Lycopodium* present was found in the managed even-aged and unmanaged old-growth stands used for this study. Highest *Lycopodium* frequency of occurrence and percent cover values existed in the unmanaged old-growth, managed even-aged, and unmanaged second-growth stands, respectively. *Lycopodium* percent cover under these three management regimes was not statistically different. *Lycopodium dendroideum*, *L. lucidulum*, and *L. annotinum* occurred most often across management regimes, with high and statistically similar cover values existing in the unmanaged old-growth, managed even-age, and unmanaged second-growth stands. *Lycopodium dendroideum* cover ($r^2 = 0.75$; $P < 0.01$), *L. annotinum* cover ($r^2 = 0.66$; $P < 0.01$), and *L. lucidulum* cover ($r^2 = 0.49$; $P < 0.01$) were correlated to total *Lycopodium* cover. Highest

Lycopodium frequency and percent cover occurred under the management regimes with the highest measured basal area.

FOREST MANAGEMENT AND *LYCOPODIUM*

The basic growth form or morphology of individual clonal species may offer different advantages under different environments. According to Doust (1981), most clonal species are categorized as having either a "guerilla" or a "phalanx" strategy. Species that have widely spaced individual aerial stems or ramets (guerilla strategy) explore a wide area, are successful in discovering and occupying gaps, are usually better competitors at low densities, and are more common in early successional habitats (Doust 1981). This strategy may be applied to the tree-like branching *Lycopodium* species such as *L. dendroideum*, *L. obscurum*, and *L. complanatum*. Species with densely packed individual aerial stems or ramets (phalanx strategy) expand slowly; form large clumps; are most successful in close, competitive environments; and predominate in late successional stages where competition is most severe (Doust 1981). This strategy, in turn, may be applied to the non-branching aerial stem species of *Lycopodium*, such as *L. annotinum*, *L. clavatum*, and *L. lucidulum*.

In Nauertz' (1999) study, *Lycopodium dendroideum* (ground pine) percent cover was highest and statistically similar in managed even-aged, unmanaged old-growth, and unmanaged second-growth forests. Mean percent cover of all *Lycopodium* species combined was greater in unmanaged forest than in managed forest; however, significant differences were noted, with the highest mean percent cover of *L. dendroideum* occurring in unmanaged forest. Mean percent cover of all *Lycopodium* species combined was significantly greater in second-growth forest than in old-growth forest; the highest *L. dendroideum* mean percent cover occurred in the second-growth forests. In addition, the highest *Lycopodium* frequency and percent cover occurred under the management regimes with the highest measured basal area. Considering these points, it is apparent from this study that a combination of disturbance and time following disturbance may be required to allow for adequate levels of *Lycopodium* frequency and cover to develop.

Another factor to consider is the evergreen nature of *Lycopodium* species. Regardless of the forest overstory management regime used, this evergreen characteristic should allow the clubmosses to take advantage of the spring and fall light windows that are known to exist in general and that have been recorded in these forest stands (Nauertz *et al.*, unpublished data). Temperatures near the forest floor respond to the increased light during these times and become warm enough to support biological processes relatively early and late in the growing season (Nauertz *et al.*, unpublished data). These "windows of opportunity" may be important times for photosynthate production and storage for the *Lycopodium* clone.

At various times during their life cycle, certain *Lycopodium* species may or may not turn out to be able to adapt to excessive changes in their environment. Much of their adaptive success will need to be attributed to the "individuality" of each species. In areas with dense *Lycopodium* populations, using forest management practices that consider the group as a whole will certainly add to their sustainability and overall success.

DISTURBANCE AND COMPACTION OF THE FOREST FLOOR

Soil surface disturbance is a side effect of logging operations in forest overstory management. On one hand, exposed mineral soil is a result of these operations and may provide good conditions for spore germination and gametophyte development and, if successful, a pathway for genetic variation. On the other hand, intensive soil disturbance reaching well below the soil surface and excessive soil compaction may both result when frequent entries are made into managed areas or when logging is done when soils are wet and more likely to compact. Consequently, intensive and excessive conditions may not offer the best habitat for survival of newly formed gametophytes or production of a new sporophyte. Considering the length of the life cyle for *Lycopodium* in general, fewer management entries and less excessive and intensive soil disturbance and compaction would be beneficial. Compact soils also make it difficult for species with belowground running rhizomes to expand vegetatively. Soil compaction will also alter the hydrology, often causing wetland-like conditions. Without optimal resources for success,

the *Lycopodium* clone may not be able to sustain itself or reproduce either sexually or vegetatively.

In forests of old-growth origin, the pit and mound topography is better defined and more variable than in the managed forests of second-growth origin. This variable topography offers a variety of microhabitats and resources of which *Lycopodium*, as well as other rhizomatous plants, may take advantage. In general, species with aboveground rhizomes such as *Lycopodium annotinum*, *L. clavatum*, and *L. complanatum*, as well as the layering species such as *L. lucidulum*, would have the advantage in wet, rocky areas with compact soil, whereas species with belowground rhizomes like the ground pines, *L. dendroideum* and *L. obscurum*, would have the advantage in areas where pit and mound topography exists, where the soil is well aerated and of low bulk density.

LYCOPODIUM HARVESTING GUIDELINES AND RECOMMENDATIONS

In the northern forests of Wisconsin, Michigan, and Minnesota, the ground pines are the most heavily harvested group of *Lycopodium* species. Typically you will need a permit if you plan to harvest ground pine on public land and only the mature aerial stems of the ground pine are considered to be valuable economically for decorative purposes (Wenger 1995). The most efficient and least destructive way to harvest ground pine is by clipping the mature aerial stem or tree-like portion of the plant near the base of the stem at ground level. It is less stressful for the plant if you cut it with a sharp instrument instead of ripping or tearing it away. Cutting lessens the impact the aerial stem harvest will have on the belowground rhizome, allowing it to remain stable in position within the soil below. Matula (1995) reported that disturbances such as harvesting of individual, mature aerial stems in such a way as not to disturb the underground rhizome may enhance the survival of the plant by increasing belowground rhizome branching. Taking only the mature or oldest aerial stems and leaving the younger immature stems will ensure future harvest opportunities. In addition, skipping a year or two between harvests will allow time without disturbance for possible spore germination and new plant development. A year or two between harvests within a ground pine patch will also ensure enough time for an increase in vegetative expansion and future harvest potential.

Lycopodium complanatum (ground cedar) and *L. clavatum* (running clubmoss) are two species with aboveground rhizomes that are often used when making wreaths. Harvest on public land is not allowed, but these two species are often gatherered on private land with the permission of the landowner. They are commonly harvested by grabbing an end of a rhizome and yanking it, pulling the aerial stems, rhizome, and roots all out of the forest floor litter layer. However, gathering an entire ground cedar or running clubmoss patch would prevent any surviving rhizomes from expanding vegetatively, and would consequently eliminate future harvest opportunities. Selective gathering from a dense patch is recommended, leaving plants or parts of the patch to branch and expand. In addition, some disturbance from the yanking of rhizomes during harvest exposes mineral soil and hence creates good conditions for spore germination.

Time of harvest of *Lycopodium* should also be considered for two reasons. First, *Lycopodium* species are evergreen perennials that process and store photosynthate primarily in the spring before leaf-out of the forest canopy. Since the greatest quantities of *Lycopodium* are used for traditional seasonal holiday decorations, it would not make sense to gather large quantities of them in the spring. Second, the *Lycopodium* do not produce spores until the fall, usually sometime between October and mid-November (Nauertz, personal observations), and it is important to consider whether the spores are mature and ready to be released or dispersed before the harvest. This timeline may vary slightly from year to year and can easily be tested by flicking the cone or strobili with a finger to see if the yellow dust-like spores escape.

In general, *Lycopodium* species are considered to be a rather slow growing group. A word of caution—it is not known how overharvesting will affect the growth rate of an individual plant, patch, or clone over time. Allowing a patch to recover for a few years after a harvest would ensure future harvest opportunities. Any abrupt and intensive alteration of growing conditions could make it difficult for any type

of existing ground vegetation to survive. When considering whether to gather any forest products, whether for timber or non-timber use, it is important to consider taking them in moderate quantities. The First Nation native tribal elders speak wise words: "Take what you need. Pay your respects. Leave the rest."

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Recommendations for Sustainable Development of Non-Timber Forest Products

Gina H. Mohammed[1]

Non-timber forest products—or NTFPs—are considered here to be botanical products havested or originating from forest-based species, but excluding primary timber products, industrial boards and composites, and paper products.

A recent study of non-timber forest products in Ontario, Canada, identified at least 50 types of NTFPs and hundreds of specific products used for food, health and personal care, materials and manufacturing, environmental purposes, landscape and gardening, and aesthetics (fig. 1). These products range from non-commercial goods used culturally and traditionally to commercial items that broaden the economic base of many regions.

However, commercial development of NTFPs can place substantial pressures on the viability of a resource, and other concerns about health and safety, and about social and economic factors are also important. Sustainability of the resource may be compromised through unrestricted harvest of products for lucrative commercial mass markets. Health risks are a reality when medicinal products, e.g., natural health products, are developed with little attention to natural toxicities in some plant species or in certain environments. Socioeconomic concerns often accompany large-scale product development that uses wildcrafted materials collected by poorly paid gatherers, or in which indigenous providers of strategic knowledge are prohibited from sharing product revenues. To succeed, commercial development must be designed to avoid such pitfalls, or the sustainability of the NTFP enterprise itself becomes endangered.

Sustainable commercial development is a shared responsibility. Governments, landowners, developers, and even product users each play a role. Government, in particular, can serve several key functions:

- ***awareness***—providing information on opportunities, ecology, risks, and funding programs
- ***facilitation***—coordinating partners, and research support
- ***stewardship***—providing incentives for responsible management, compliance monitoring, quality control, and habitat protection
- ***promotion***—increasing awareness of success stories, and expanding markets nationally and internationally
- ***research***—testing new products, enhancing resource productivity and quality
- ***conflict-resolution***—resolving multiple-use issues

OVERALL RECOMMENDATIONS

Several recommendations are offered here that may help to advance the NTFP sector in a sustainable fashion.

Recommendation #1
Emphasize Value-Added Products

Income levels for collectors of bulk NTFP materials are typically low, and the demand for the products can fluctuate widely. By concentrating on value-added products, which command a higher price, developers may be able to earn more with less plant biomass, and may be buffered more against sharp decreases in demand for bulk supplies. Also, there is less competition for bulk markets, which may already be adequately served by other jurisdictions with better established large-scale collection.

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Taken from Mohammed (1999).

Figure 1.—*Non-timber forest products in Ontario.*

Importantly, there may be less risk of overharvesting wild plant stocks using this approach.

Recommendation #2
Use Waste Materials for New Products

Materials such as emptied seed cones, pulp waste materials such as tall oil, and various byproducts of wood processing can be valuable sources of new products. Collection costs are low with this option because the material is already being harvested for other purposes.

Recommendation #3
Coordinate Collection of NTFPs with Timber Harvest and Tending Operations

Although forest lands can provide a wealth of products, in Ontario we have tended to emphasize timber and pulpwood. Fuller use of the forest's productive capacity through NTFP development could mean a greater flow of benefits to various users. For instance, collection of weed materials that would otherwise be burned or chemically controlled could provide biomass for other products. (Some biomass and debris should remain on site for ecological benefits such as maintenance of wildlife habitat and soil nutrient balance.) Collection of weeds and other products such as birch bark, boughs, etc., can be coordinated with normal forest operations to minimize interference with those activities and possibly assist in achieving some objectives.

Recommendation #4
Emphasize Rural and Community-Based NTFP Opportunities

Development of niche products with a local character can be a profitable venture for many communities. A good example is the range of manomin and wild berry products being created by the Wabigoon Lake First Nation in northwestern Ontario, where traditional knowledge is being applied to produce interesting new specialty foods. Such novel products may be more successful in a competitive marketplace.

Recommendation #5
Develop Methods for Cultivation of NTFP Species

Unrestricted harvesting of wild plants can severely compromise the viability of natural populations and eventually endanger important species. Instances of these occurrences are common in many jurisdictions. Further, some medicinals can vary too much in quality when taken from wild sources because of the considerable influence of environmental factors, genetic source, and site conditions on the quality and consistency of extracts. Damage to habitat is also a major concern. However, in many instances wild plants have been brought into cultivation successfully, using either agroforestry, farm forest, nursery, or even laboratory mass propagation methods. Chemically, it is now possible to synthesize a variety of chemicals that serve the pharmaceutical industry. Controlled production methods, wherever feasible, should be explored. This approach also avoids some issues around territorial rights to lands.

Recommendation #6
Increase Coordination Within Government and Between Government, Public, and Private Stakeholders

NTFP development needs to occur in an atmosphere that is conducive to innovation and free of unnecessary administrative controls. Entrepreneurs will benefit from access to ecological information, education programs, startup funding or tax incentives, market assistance, and research support. Government agencies can help to foster this climate. Development for commercial purposes also needs to occur in partnership with the private sector and with non-governmental groups such as First Nations peoples, who have been instrumental in stimulating ideas for NTFPs through the sharing of traditional knowledge.

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Richard David, Mohawk Black Ash Crafting, shows some of the tools and raw materials used in basket making. (Photo courtesy Bobbie Harrington)

One of the beautiful crafts on display at the conference: Dene beadwork on moosehide from the Dene Cultural Institute in Yellowknife, Northwest Territories, Canada. (Photo courtesy Bobbie Harrington)

Marlene Cameron, Cameron Birch Syrup & Confections, displays her company's syrup, marinade, and other products made from birch sap. (Photo courtesy Bobbie Harrington)

NON-TIMBER FOREST PRODUCTS: BUSINESS DEVELOPMENT, MARKETING, AND POLICY

The Minnesota Approach to Non-timber Forest Product Marketing: The Balsam Bough Industry and Other Examples

John Krantz[1]

THE WREATH INDUSTRY IN MINNESOTA

Minnesota is a leading state in the production of holiday wreaths. It is estimated that the companies producing wreaths in Minnesota have total sales exceeding $20 million and growing. Wreaths are sold in all states in the U.S., mainly by non-profit groups for fund-raising.

The boughs harvested from the balsam fir (*Abies balsamea*) are used in 98 percent of the wreaths manufactured. Balsam fir grows throughout the forested region of Minnesota and the northern portions of Wisconsin and Michigan. Balsam fir also grows throughout Canada including most of Quebec, Ontario, Manitoba, Saskatchewan, and Alberta.

The balsam bough harvesting season begins in Minnesota in late September or early October after two or more hard frosts have "set" the needles on the branches. Then, until early December, the boughs are made into decorative wreaths for homes throughout the U.S.

In 1996, Minnesota formed the "Balsam Bough Partnership," comprised of public landowners, such as state, USDA Forest Service, Bureau of Indian Affairs, and selected counties. In addition, the group includes most of the large wreath companies, bough buyers, and bough "pickers." This unusual group of public/private partners meets twice yearly to review seasonal needs and review compliance on legislation and permits, and it sponsors workshops and publications to ensure that boughs are harvested and transported within established guidelines.

Permits to harvest boughs are available from all public land management agencies. Permits vary in price. Reservation members obtain "free" permits and can harvest boughs on public lands within reservation boundaries. Bough pickers are required to post a "windshield" poster when harvesting.

The Balsam Bough Partnership published "how to" material for beginning pickers. As an example, boughs up to 36 inches in length are acceptable and fit the guidelines of sustainability. Harvesting guidelines call for clipping the ends of the branches, leaving shorter branchlets on the stem. A 5- to 6-year rotation is recommended.

Bough buyers are an integral part of the wreathmaking industry. The larger wreath companies within Minnesota, as well as several outstate companies, contract with bough buyers to handle the purchases for them. A good day's picking by a bough picker can yield up to 1,000 pounds. In 1999, bough buyers paid 14¢ to 17¢ per pound ($US) for the 12- to 36-inch boughs. The pickers usually bundle boughs in 25- to 35-pound bales—a weight that is reasonable to handle by pickers, buyers, truckers, and wreathmakers.

Several of the larger wreath companies manufacture wreaths, swags, and garlands at larger facilities throughout Minnesota. Wreathmaking begins in the summer when cones, collected from ponderosa pine in Idaho, Montana, and Washington, are shipped to Minnesota by the van load. It is not unusual for the bigger companies to use 8 to 10 million cones per year. The cones are painted using a tumbler system. The cones and vinyl coated berries and ribbons are all prepared in the summer so they are ready for decorating the wreaths during the busy October and November season.

Once, all wreaths were made by hand, but now most are made using a wreath machine that

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bends a wire hoop over the boughs. These machines, which have been in use for 10 to 12 years, have allowed the industry to expand rapidly.

Many wreaths are manufactured in homes by families living throughout northern Minnesota. The wreath companies contract with these families to produce a basic wreath; these wreaths are then brought to the manufacturing center where the cones, berries, and ribbons are added before shipping. As a home business, families can gross up to $20,000 ($US) for the season.

A number of small companies or families manufacture and sell wreaths and greens through their own marketing channels. Some specialize in fully decorated wreaths, some in large wreaths for specialty applications, and some in greenery as in decorated crosses and grave blankets.

HOW CAN FOLKS FROM CANADA CONTRIBUTE?

The wreath industry in Minnesota is limited by:

- production capacity
- labor
- availability of boughs

The larger wreath companies appear to have developed a larger market than they can supply. Therefore, Canadian folks are welcome to participate by:

- becoming bough buyers
- picking boughs
- as families, manufacturing basic wreaths in their homes

If anyone is interested in participating in the bough and wreath business, some Minnesota contacts are:

1. Evergreen Industries
   Joe Ahern
   4921 Babcock Trail
   Inver Grove Heights, MN 55007
   Phone: (651) 457-4441
   Fax: (651) 457-0676

2. Mickman Brothers, Inc.
   John and Chris Mickman
   14630 Highway 65
   Anoka, MN 55304
   Phone: (763) 434-4047
   Fax: (763) 434-4611

3. Nelson Nursery, Inc.
   Mike Lemke
   25834 Main Street
   Zimmerman, MN 55398
   Phone: (763) 856-2441
   Fax: (763) 856-2440

A dozen other companies in Minnesota would also be willing to consider a partnership with Canadian folks. Contact names are available from our DNR-Forestry office (see footnote 1).

OTHER NON-TRADITIONAL FOREST PRODUCTS

Birch Bark, Stems, and Twigs

The bark from standing dead trees is removed by first felling the tree, then scoring the entire length of the tree with a chainsaw, and then sectioning it into chunks. The bark from the dead tree can be peeled off fairly easily. Once off, the inside bark is scraped with a paint knife to remove any wood attached and then pressed flat. Markets include decorative flower pots, mosaics, furniture enhancements, decorative bird houses, and a multitude of other products.

Live bark is stripped by slicing vertically on a live tree. In early summer (around July 1), the bark will peel back virtually by itself and large sheets of bark can be removed. It is essential not to slice too deeply into the tree and damage the inner bark. Many products are made from live birch bark including containers of all types, novelty items, and other items.

The tops of birch can be used as decorative trees. Tops about 2-1/2 inches in diameter and 7 feet in length are shipped to companies that add plastic leaves and artificial branches and then pot the birch top as a look-alike tree for business and hotel lobbies. As many as five to seven tops can be harvested for decorative trees from one larger stem.

Birch twigs are often gathered and sold as material for hardwood wreaths. When green, the twigs bend easily and form a wreath that can be decorated for any occasion. Twigs from alder, red-osier dogwood, and tamarack are also gathered and manufactured into decorative wreaths.

Burls

Burls from spruce, birch, and black ash are highly sought after as a source of raw material for the home craft person. Sliced properly, the burl wood forms a highly decorative wood piece for many products including clocks, mirrors, knife handles, and turnings.

Artist Conks

These are shelf fungi that grow from dying or partially dead trees. After proper drying, they can be used by artists for wood burning, painting, or carving. These conks are best removed from the tree in the winter to prevent smudging, scars, or hand marks. Conks are sold by size; a clean 12- to 16-inch conk could be worth $15 to $20.

Cottonwood Bark

The thick bark found in western Canada has value as a raw material for carvers. Thick bark comes from large trees and the tree must be dead for the bark to be removed successfully. Bark 3 to 5 inches thick is desirable. A pickup load of this type of bark would be worth $300 to $400 ($US) on the wholesale market.

Walking Sticks and Decorative Wood

“Diamond” willow is found throughout central Canada and Alaska and the northern U.S. It is a unique tree used for furniture, lamps, walking sticks, and many other products. The diamonds form when a fungus attacks the branch stubs and a callus forms as the willow continues to grow around the wound. Decorative diamond willow products are most easily sold as finished products. However, there is a market for green unfinished pieces for folks who choose to finish the wood themselves.

Other walking stick woods desired by carvers include aspen, alder, birch, balsam, and cedar. The bark can be easily stripped from these woods when the sap is readily flowing in late May and June. Oftentimes the debarked stick is sold in the raw form to hobbyists who want to finish the stick themselves.

MARKETING THE NON-TRADITIONAL FOREST PRODUCT

There are many, many ways to locate markets for non-traditional products from the woods. Selling through consignment shops, roadside stands in tourist areas, flea markets, and craft shows, as well as advertising on the Internet, are but a few ways to market NTFPs.

The best way is to display your product at special interest group gatherings, such as this conference. Most people need to actually “see” the product before they decide to purchase it. The key is to present a quality product. Quality means more than price. Once you have established a quality product, you will always have a demand for your product.

Certifying the Harvest: Developments in NTFP Certification

Patrick Mallet[1]

I coordinate a Certification and Marketing program for Falls Brook Centre, an environmental organization based in New Brunswick. I first got interested in certification issues during my work with an international agroforestry network whose members wanted to highlight the ecological practices inherent in their production system. In my initial research, I found that a number of different certification programs operating worldwide were interested in incorporating agroforestry and non-timber forest products (NTFPs) into their systems but that each was operating in isolation. Our program is focused on increasing the collaboration between these systems, providing information and resources to producer groups interested in applying for certification, and creating market links for certified products. The ultimate aim of the program is to make certification more accessible for small producers of agroforest and non-timber forest products.

WHAT DOES IT MEAN TO GET CERTIFIED?

Certification is a market-based tool. It provides a means to differentiate your product in the marketplace and may also provide access to new markets. Certification conveys a message to the consumer about your product, usually having to do with the product itself or the process by which it was grown or harvested. The message behind a certified product is that it has been independently assessed to meet standard criteria. Those criteria emphasize different aspects of the product, depending on the type of certification you are dealing with. But certification of forest products is more than just satisfying criteria. It is also about sustainability. It is about making guarantees that your operation is not harming the environment, that it is fair to the workers, and that it is of benefit to the local community.

WHAT'S IN A LABEL?

As I mentioned, there are a large number of different certification programs, each with its own logo and criteria for measurement. What do they all mean? How is it possible to tell them apart? The first thing to look for in a certification system is independent verification. Anyone can claim that they are meeting criteria for sustainability, but third party assessment is a guarantee of this.

The next issue is whether the program is certifying an operating system or management practices. Operating system certifications assess whether there is a management plan in place, whether you are meeting the goals laid out in the plan, and whether there is a mechanism for constant improvement. Management practice certification, on the other hand, is more concerned with whether the production or harvest meets specific performance standards, thus providing a more objective measurement of sustainable practices. It is these latter systems that we are primarily concerned with.

The certification systems that are relevant to NTFPs include sustainable forestry, organic agriculture, and to a lesser extent, fairtrade. When we start to talk about agroforestry systems, many more certification programs also come into play, some of which are shade-grown, bird-friendly, and integrated pest management. These are less relevant for NTFPs.

CERTIFICATION SYSTEMS FOR NTFPS

In each of the three NTFP certification programs that I mentioned, there is an international coordinating body. The first of these, the Forest Stewardship Council (FSC), promotes

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well-managed forests through the application of criteria that address ecological, social, and economic issues. The FSC is a relatively recent certification program that resulted from concern over the fate of the world's forests, particularly in the tropics. It incorporates good coverage of many of the key issues and currently allows for the certification of NTFPs on a trial basis.

The International Federation of Organic Agriculture Movements (IFOAM) is the equivalent world body for organic agriculture. It grew out of a global farmers' movement and has become synonymous with the avoidance of chemicals in agriculture. IFOAM has criteria for wild-harvested products as well as specific criteria for some NTFPs like maple syrup and honey.

Fairtrade Labelling Organizations (FLO) International emphasizes the social components of production, ensuring the well-being of the producer. FLO developed out of the alternative trade movement, and it currently certifies a limited number of agroforestry products although its product range is increasing.

I am emphasizing these three international bodies because they have each set generic standards in their own field of expertise, they play a coordinating role for organizations working in their sector, and they each accredit or coordinate certification organizations who do the actual assessments of the producer.

MEETING THE CRITERIA

These certification systems share three main criteria components: ecological, socioeconomic, and institutional. Some of the issues associated with ecological criteria are environmental harvesting practices, conservation of biodiversity, use of chemicals, and waste management. Socioeconomic criteria address the well-being of the worker and the local community, Indigenous people's rights, and the overall viability of the operation. The institutional issues that are of relevance in certification are the legality of an operation, its management plan, and the monitoring of the implementation of that plan.

Most programs include all three types of criteria to a greater or lesser extent, but each places an emphasis on its own areas of priority. Even though each system has its own criteria, there are a significant number of areas of overlap. Some examples of this include IFOAM's recent definition of social standards and its initial movement towards organic forestry standards; FLO is currently developing more rigorous environmental standards to complement its social criteria; and members of FSC are trying to get accredited certifiers to focus more strongly on the social components required under this system. It seems that the ultimate goal, and the direction in which most systems are moving, is to develop certification programs that are more holistic and well-rounded—in other words, to move towards more sustainable production.

BREAKING NEW GROUND—RECENT DEVELOPMENTS

This is where the exciting work is happening! A lot of the recent progress has been made within the FSC, where most of the NTFP activity is focused. Currently, FSC-accredited certifiers are able to certify NTFPs if the products meet the basic Principles and Criteria of the FSC. The NTFP Working Group is looking to provide further guidance to certifiers in these NTFP assessments to ensure that the process for certification is standardized. Members of the Working Group have been undertaking field trials to test and revise generic standards for NTFPs. In the last year, assessments have taken place for chicle, Brazil nut, palm heart, and chestnut. One of these assessments, for chicle gum in Mexico, resulted in the first NTFP certification under FSC.

The other major area of work has been the collaboration between certification and accreditation systems. Organizations are looking at how they can work together better. This can happen at a variety of levels including the harmonization of standards, joint field assessments, and common promotion and marketing. The most promising work has taken place in the field assessments where certifiers from organic agriculture, forestry, and fairtrade have come together to identify where they overlap and can support each other. The joint inspections could lead to common inspector training workshops, joint questionnaires and reports, and even combining of assessment teams. These all result in reduced costs and time commitments for both producers and certifiers.

CHALLENGES FACING NTFP CERTIFICATION

Certification is not the answer for all situations; in fact, it has quite a limited applicability. This is especially the case for NTFPs where certification is relatively recent and has not undergone much testing in the field. Certification must be seen as only one tool among many to move towards more sustainable production systems. It is good to remember that the major costs of getting certified are usually not the costs of the certification process itself, but rather the costs of altering an operation to meet certification criteria.

Based on the information gathered during the recent FSC field trials, some of the key challenges to NTFP certification include the following:

- A lack of ecological knowledge about individual species including baseline data, sustainable harvesting levels, and resiliency of the species.
- Impact on small producers and subsistence users including definition of tenure and access rights, high fixed costs, and the impact of increased demand on subsistence use.
- Market demands including the quality of the product, limited market size, and uncompetitive prices versus alternatives.
- Inexperience in certification including lack of certifiers with NTFP experience, lack of standard policies, and difficulties integrating timber and non-timber products.

WHICH SYSTEM IS RIGHT FOR NTFPS?

While all certification programs are set up to deal with a wide variety of situations, each is geared to work better under specific circumstances. The key thing to remember when considering certification is that not pursuing certification may sometimes be the best option. Some further information will provide guidance on this issue.

Forestry certification under FSC has the most well-rounded criteria and is the most natural choice for NTFPs since we are talking about well-managed forests, but at the same time it is the most expensive and time consuming. In addition, it is difficult to apply this system to many NTFPs since they do not fit the traditional forest harvest structure that FSC was set up to deal with. FSC is probably most appropriate for large industrial NTFP operations. Organic agriculture certification provides a good alternative and may be the best option for food and medicinal products. It is not as comprehensive as FSC but is also less costly and has good consumer recognition. This currently means a better guarantee of price premiums for certified products and access to more local markets. Finally, fairtrade should also be considered although it is more of an option for southern producers. Advantages include its concern primarily that producers receive a fair deal and that the costs of certification are borne by the retailer and consumer rather than by the producer. However, the product scope for fairtrade does not yet cover many NTFPs, and it has limited application in northern countries.

REALITY CHECK—WHEN IS CERTIFICATION USEFUL?

The recent field trials and collaborative activities have identified a number of factors in determining when certification is applicable. Among the most common characteristics are when it is seen as an addition to timber certification or where there is a large-scale, organized operation in existence. Examples of this include maple syrup, Brazil nuts, rattan, and rubber. Certification is also useful where there is an international market or large national market. It is not often required to satisfy the needs of a local market. Organic certification is probably the best bet for small-scale operations, but it is still necessary to prove tenure rights, which is often difficult on crown land. From a market perspective, certification must be seen as part of an overall sales package.

While getting certified may have limited application in most cases, the real added value lies in the producer's ability to apply the principles of sustainable management inherent in certification criteria. These principles are valuable to all operations, whether or not the producer is seeking certification. In this way, certification can be used by all producers as a tool for better management. Criteria have been developed by experts in their fields and represent some of the best knowledge we have about sustainable production. Even the recent field tests of draft criteria have increased the knowledge available

on best management practices for a number of NTFPs. I would suggest that more test cases are needed to refine this knowledge for NTFPs and to make it more accessible.

BRINGING IT HOME—NTFP CERTIFICATION IN CANADA

Although a lot of work has been done on certification worldwide over the last few years, it is still a very new concept in Canada. Forest certification is only just beginning to be taken seriously in Canada. Market pressure from Europe is slowly forcing timber companies to change their management practices to meet certification requirements. Organic certification has been around much longer and is increasing its market share in Canada but is not yet in the mainstream for agriculture producers or those working with NTFPs. Certification is not yet an issue for NTFP producers and harvesters in Canada.

Through the FSC, three regional initiatives in Canada are each developing regional standards. These local standards will be used by certifiers when assessing operations in those regions. Only a few forests are currently certified to carry the FSC logo in Canada and no NTFPs are certified. Organic agriculture certification, on the other hand, has been operating in Canada for many years but is still only loosely regulated, with 47 different certification organizations in operation across the country. A national standard in organic agriculture recently came into effect that will help to standardize criteria between certifiers, although its application is still voluntary at this stage. In addition to concerns about variances between the certification programs themselves, producers also have to take into account national and provincial regulations. Each province has its own regulations and tenure system that producers are required to conform with.

FALLS BROOK CENTRE—CERTIFICATION AND MARKETING PROGRAM

The program that I am coordinating has been working with certifiers to address some of the constraints that I have talked about today. We are trying to make NTFP certification more accessible to producers. We are now beginning to focus more on developing information tools and resources for producer groups as well as on raising market awareness for certified products. We will be talking to producers about the types of information that they require and will be building a database of local market links for certified products. If you are interested in learning more about certification or working towards certification for your agroforestry and non-timber forest products, please feel free to contact me at <pmallet@netidea.com>.

The Industry of Wildcrafting, Gathering, and Harvesting of NTFPs: An Insider's Perspective[1]

Barb Letchworth[2]

THE INDUSTRY

The natural products industry has been undergoing a tremendous amount of change in the past few years. Large corporations including pharmaceutical companies, food and drug store chains, and even department stores have been adding medicinal herbs to their offerings. We can find anything from naturally raw bulk herbs, to standardized extracts, to time-released formulations. Everyone has seen some variation of the commercial that depicts a man standing in the middle of a parking lot looking very confused because he cannot remember where the car is parked. A package of ginkgo capsules is shown, and the man happily finds his car. This level of advertising has obviously helped the industry by encouraging potential consumers to try herbs as a possible long-term solution to health concerns. However, as demand has generally maintained an upward trend, it has ultimately been a roller-coaster ride. Supply and demand generally do not go hand in hand. Growers and wildcrafters can seldom react as quickly as the consumer, and may take a year or two to catch up. By this time, the consumer may have already gone on to something else. This can make it especially difficult for anyone in the initial stages of working with herbs and getting into the herb industry.

Because of the increased interest on the part of the consumer, and because of the perceived potential for profit in growing or harvesting herbs, new wildcrafters and growers are constantly trying their hand at harvesting, only to find that it is not as easy as it seems. Clearly, if it were that easy, many more growers and harvesters would already be involved with herbs. This leaves an opportunity for those who are truly interested in being successful in the herb industry—those creative people who can "invent" equipment and maintain a sensitivity to ethics and quality issues, and who have a drive to give customers what they require.

One issue that has continually frustrated anyone entering the NTFP market has been the absence of well-established general information sources similar to those available for true commodities, such as corn or soy beans. There is no single reliable report for price information, and most buyers who follow market trends closely do not publish price lists because price information is confidential, volatile, and quality-sensitive. The NTFP industry has yet to reach a level of sophistication necessary to develop a common base of information. As a result, growers and gatherers are left attempting to find more creative ways to learn about the market. Networking is one of the best ways to learn and begin to understand the variety of price and quality structures. Books and the Internet are helpful, but are only a first step. Prices vary significantly and most listings rarely clarify whether prices are for raw material or packaged products, or what level of quality is required for specific price points. This can potentially lead growers to undervalue an herb that is for sale.

For example, one grower was asked to quote the price for several different crops he was about to plant. He had quoted $3.00 per pound for each herb. As we started to discuss individual items, he began to see that for some herbs the price was too low for him to even break even, yet for other herbs the price was so high that he could not be competitive.

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[1] *Wildcrafting is the harvesting of wild plants in ways that will help increase a specific plant population and its health. The terms wildcrafters, gatherers, and harvesters are used interchangeably. For more information on ethical wildcrafting, contact the author.*

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The domestic market is, on its own, difficult to monitor, and factoring in overseas markets and competition complicates it further. Growers from other areas of the world are becoming increasingly competitive, and more countries are making certified organics more available. Part of the challenge has been to find ways of competing with countries where the cost of living is lower and where lifestyles are more spartan. Alternately, part of the opportunity is in finding ways of being better than the competition and adding value without adding significant cost of equipment and buildings. One major area of opportunity is still in providing herbs that are certified organic. Buyers are increasingly searching for herbs that are harvested in both ethical and sustainable manners. Organic certification is a very good way to address this important consumer concern. I will explain this more fully later when I address future niche opportunities.

The experience that my company, The Frontier Natural Products Cooperative, has developed in working with growers and gatherers has come from years of listening to our customers, growers, gatherers, herbalists, environmentalists, and scientists, in addition to those within the herb and world communities. To meet consumer concerns, we require ethical wildcrafting forms to be completed by gatherers, although we also rely on conversations and visits with growers and gatherers to determine authenticity. Our visits allow us to assess whether or not harvesters are truly concerned and understand ethical issues around harvesting, or whether the forms have simply become a process for marketing organic and ethically harvested products. Several forms and sets of guidelines exist and are available for gatherers. Some are more useful than others in helping train wildcrafters. The guidelines and questionnaires offered by United Plant Savers and by Rocky Mountain Herbalist Coalition are useful and have been utilized by many companies that purchase herbs from gatherers. Learning these guidelines and following them will help newcomers to the field in selling herbs.

Within the industry, another major key element is understanding that not all customers desire the same thing. Expectations for quality and supply vary among buyers. Recognizing that not all customers want the same level of quality, or be willing to pay for it, is very important.

If a potential customer has written specifications for a product, growers or gatherers can use them as a guide for harvesting. Any information that can be passed from the customer to the gatherer can be useful; the more you know about their needs, the easier it will be to supply them. For example, some companies are concerned about color variation within a specific lot or shipment. Obviously, there will be some color variation because each herb is an item from nature. But if a company requires that a root color range from light brown to beige, but part of the harvest is very dark brown, it could be subject to rejection. The grower or harvester may need to sort through and select color ranges to meet a customer's specific requirements.

Some companies test for constituent levels, oil content, color, flavor, aroma, dirt, wrong plant parts, salmonella, *E. coli*, and they may require botanical names (genus and species verification). Depending on the end use of herbs, some companies may not place importance on specific characteristics, while others may test for everything. This can be risky, and successful growers and gatherers maintain more than one customer so that if they cannot satisfy the requirements of one customer, they can sell the materials to another. If customers ask for lemon balm, or any other herb, it is important to know whether they require leaf only, leaf and flower only, flower only, or the entire herb. The amount of selection, cleaning, or selective harvesting that will need to be done must all be calculated into the cost of production and ultimately into the grower's selling price.

Other requirements can include representative preshipment samples for testing, different levels of cleanliness, i.e., dirt and debris. Some customers will want fresh herbs, others will need them dried to very specific levels of moisture content. Knowing as much as possible about what a customer requires will make a grower or gatherer more successful in making an initial sale and will further the relationship in becoming a trusted long-term supplier. There is, clearly, some responsibility on the part of the buyer to ensure that growers and gatherers obtain as much information as possible. If a buyer cannot provide specific information, serious problems may arise from misunderstandings of what is required. If there are no specifications, it would be wise to, at the very least, obtain this fact in writing.

GAINING THE EDGE

The importance of finding a niche cannot be underestimated. Working closely with a buyer might help a gatherer focus in a specific direction, yet does not provide flexibility within an area of potential opportunity.

With herbs that are wildcrafted, there is increasing concern voiced by consumers and native peoples that areas are being overharvested. One area of potential, then, is to respond to this concern through certified organic ethically wildcrafted herbs. There are several advantages of organic certification of wildcrafted herbs. Buyers are assured of ethical wildcrafting practices as outlined by the certifying organization. In this vein, wildcrafters are registered and required to know and follow guidelines provided. As well, gatherers are eligible for the premiums that exist for certified organic herbs. This provides for a good and sustainable option in that many wildcrafters hold a vested interest in future harvests. Many harvesters have a natural understanding of our environmental situation including deforestation, urban sprawl, mining, and uneducated overharvesting. Without some measures that control harvesting, it will become more difficult to maintain biodiversity and sustainability within harvesting practices, with the possible outcome of forcing more cultivation into monoculture production, as opposed to harvesting within an ecosystem.

Several organic certification agencies are very concerned about these issues and have programs in place for working with wildcrafters. They will require that there is someone they can contact who is in control of the land, whether it is crown land, government land, or even timber mill land. Additionally, there must be maps of the area available for verification. The group, agency, or company in control of the land then needs to provide written confirmation that there has been no industrial contamination in the area of harvest and needs to submit a list of harvesters and information about their harvesting practices.

Seemingly, organic certifying agencies require a good deal of information and demand a substantial amount of control over harvesting. Yet, if we look at a harvesting situation from another point of view, the land has already been under some level of control with maps, owners, or land managers. Organic certification is not an attempt to specifically add more controls. Rather, it is a method of ensuring future harvests while gaining the opportunity for gatherers to take advantage of the premium for organic certification. There are also broader benefits built into the certification process, as gatherers can assist with plant population counts, observe reactions of populations to harvesting practices, and contribute to the definition of optimal sustainable population levels. Making connections with groups who are already studying plant populations and practices can also be beneficial on a much larger scale. It can assist continental and global efforts already under way with groups such as United Plant Savers. Even though there is considerable domestication and cultivation of traditional plants, more and more information is being distributed about the benefits of the natural environment. The benefits of the permaculture[3] environment and companion planting have brought new awareness to how planting, population maintenance, and harvesting should be handled.

Ethical wildcrafting is another possible way of gaining an edge in the marketplace. Various groups in the States have been working on setting up ethical wildcrafting programs, and some have had good results. As the program develops, it will begin to offer classes in wildcrafting, ethics, and marketing. A registry of gatherers who have completed the program can be easily developed and provided to buyers. Ethical wildcrafting would be a much less structured option than organic certification and could provide a whole new way of protecting specific areas of the environment. Clearly, the ideas presented here could be perceived as a form of encroachment on freedom of gatherers and a move towards increased controls over harvesters. And, yes, it can be viewed in this way. Yet, we need to consider the destruction experienced within some areas that have not

[3] *Permaculture is a system of growing crops in balance with the environment. Unlike monoculture and companion planting, permaculture is the ultimate method of sustainability in which the cultivated environment most closely resembles the natural environment. Several species are planted in the same environment to complement, nourish, and protect one another as seen in nature.*

been protected in any way. The processes suggested here are, in fact, milder and may ultimately impact the harvesting process less than an extreme situation that could either shut harvesting down altogether, or through not sharing Mother Earth's gifts, lose them to those who would take without respect.

MARKETING IDEAS FOR SUCCESS

The marketing of wildcrafted herbs is ultimately not very different from the marketing of cultivated herbs, and it is still extremely important to understand as much as possible about the herb industry. If gatherers or growers are considering becoming involved in wildcrafting, they should plan on a great deal of hard work to succeed. This applies regardless of whether work is in the field, the forest, or the marketplace. As a result, anything that can be done to make the work easier and faster should be experimented with. If a tool, building, or vehicle can be converted, or a piece of equipment adapted, it may make a difficult job both easier and faster. The opportunities are as endless as the imagination itself.

It is also wise to focus on quality. As a rule, the better the quality, the higher the price. Building a reputation for providing high quality herbs will make the selling part of the work much easier, although understanding the customers' quality requirements is paramount. It is helpful to build contacts with government departments of agriculture and university extension services that may offer ideas and ways to improve your focus. Establishing contacts on the Internet, visiting web sites, and making connections via e-mail can also help build relationships with specific buyers.

In terms of understanding market trends, local health food stores can be a way of finding out which products are popular, which have been steady sellers, and which products are marginal in sales. This will help in the selection process of what to grow or wildcraft. It is important to remember, however, that very rarely does the shelf price reflect in any way the price that the grower or wildcrafter can expect. Shelf costs reflect quality, processing, testing, advertisement, and other variables that make up the cost of an item on the shelf. It is also useful to check current herbal magazines and periodicals for discovering market information: who is advertising, and which herbs are the current focus within the industry. Attending regional, national, and international trade shows will also help in establishing more connections. Many companies have representatives at such shows, and it gives the grower or wildcrafter the opportunity to learn about the various companies interested in buying raw materials. It is also a very useful arena in which to gain valuable information about the future directions of the industry as a whole. While seminars and conferences are not always exciting, a wealth of information can be gained from the speakers and from other attendees at such events. Most speakers are interested in sharing more information than simply was presented, and it is good to plan to meet either during the conference or afterward via phone, fax, or e-mail.

It is also important to learn some of the more technical aspects of herbs through tests such as high pressure liquid chromatography (HPLC). The technical intricacies are not as important as simply knowing how such a test can affect your sale. Other things to be aware of include tests such as the steamed volatile oil test (SVO), thin line chromatography (TLC), and quality control (QC), certified organics, ethical harvesting techniques, permaculture, and companion planting. Visibility is also important, and you can have your name or company's name listed in catalogs, organic directories, with university extension agents, with forestry service departments, in wildcrafting registries, or any other listing that will help get your name in front of buyers. Many of these publications are free or have a minimal charge, and buyers consider them to be very precious publications and find many suppliers in this way. As a general rule, working directly with end-using companies, and staying away from "middlemen" as much as possible will more likely lead to a higher price for your products. However, this is not to say that all middle connections are bad. In fact, in some cases, they are very useful, especially if you have very small quantities. Middle people can group several small quantities of like quality into a larger lot for sale, and they may have already developed the necessary connections, allowing a grower to make a sale more quickly. Given that each situation differs, it is necessary to weigh the pros and cons of working with or without such a middle connection. It is also wise to develop more than one outlet for your herbs. If nothing else, it is good to have a backup in case you cannot meet the

quality requirements dictated by the primary customers, or alternately, if your customer cannot purchase all you harvested.

Learning how other countries are growing and wild harvesting herbs is also a useful activity. Additionally, keeping in touch with the weather channels to know drought areas in other regions of competition and staying abreast with world political situations all help you understand your market better. Knowing the impact of weather, or politics, or earthquakes, or other conditions can give you a bit of an edge when it comes to selling a product. Customers themselves can also be a good source of market information. The closer the growers' relationship is with their customers, the better source of information both can be.

Another useful activity is to find out what herbs are "at risk" and whether there are areas where such herbs can be cultivated. It is also possible to work with companies that will be logging, mining, or developing an area with the result of destroying plant populations. You may be able to work out an arrangement entitling you to harvest the plants before they are destroyed. These can then be transplanted, sold as seedlings or rootlets for others to cultivate, or planted elsewhere. But finally, and perhaps most importantly, learn as much as you can about your customer. The more trust you can develop with each other, the easier it will be to work through hurdles that will most certainly arise. Trust and loyalty go hand in hand when developing a long-term relationship between supplier and buyer.

Using Aspen for Artist Stretcher Frames: Adding Value Through Quality Service, Direct Marketing, and Careful Material Selection

Chris Polson[1]

Abstract.—Aspen wood, when carefully selected and kiln dried, makes excellent stock for artist stretcher frames. Direct marketing techniques including the Internet and word of mouth give access to national markets, providing a more diverse and stable customer base for operations from a rural area. High-quality service, as shown by product performance and rapid order fulfillment, yields high returns.

There is a clear need in the art supply market for high-quality, heavy-duty canvas stretchers suitable for large canvas paintings. We created **Twin Brooks Stretchers™** to fill this need. Our stretchers are made from aspen wood sawn and dried at our facility in Lincolnville, Maine, and assembled at our own custom shop. Aspen wood, when properly dried and selected, is stable, strong, and makes excellent stock for stretcher bars. We use a mechanical corner fastening system called a Tite Joint Fastener, which we believe to be a rugged, cost-effective improvement over traditional wedges.

ASPEN WOOD

Technical Advantages

Aspen sapwood is firm and white with uniform consistency and density through the cross section. The color of heartwood varies from white to cream to light grayish brown. Aspen is free from sap and associated staining problems. Properly dried to 6 percent moisture content and selected for straightness and structural integrity, aspen is a strong, lightweight, stable wood.

Benefits for Stretcher Use

Aspen wood is well suited to the job of taking and holding staples or tacks to fasten canvas. Aspen's strength and stability stand up to the task of holding a taut canvas as it dries after gesso application or other canvas preparation. Aspen wood does not tend to splinter.

Silviculture of Aspen

Bigtooth aspen (*Populus grandidentata*) and trembling aspen (*Populus tremuloides*) grow predominately in northern regions of the world. Aspen is a pioneer tree species with several adaptations that enable it to colonize newly disturbed sites such as burned or harvested areas. When the main tree stem is removed, hormonal control over latent buds on the root system stops and heavy root sprouting occurs, often in the same growing season. The intact root system provides abundant nutrition and water to the rapidly growing shoots, which soon dominate growing space. Aspen tends to grow in expanding groups from this habit of root sprouting. Aspen produces large quantities of lightweight seed early in the spring, which can get a headstart on bare soil over heavy seeded or later seed-bearing species. These seedlings grow rapidly compared to other tree species.

The abundant young aspen shoots that arise from both of these forms of regeneration ensure a rapid recolonization of harvested sites. This,

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in turn, helps harvested land remain productive. Vigorously growing young shoots produce a great deal of oxygen and consume a lot of carbon dioxide, both desirable traits with a global warming trend upon us. These young shoots also provide ideal food and cover for wildlife such as ruffed grouse, woodcock, white-tailed deer, and snowshoe hare.

Source of Raw Materials

We buy aspen logs that grow in the state of Maine. These logs come from a variety of harvesting sites including selective harvests, patch cuttings, and clearcuts. Loggers in Maine are required to operate under strict Occupational Safety and Health Administration standards and perform in accordance with the Maine environmental laws as well as the progressive Maine Forest Practices Act of 1989.

When possible, we use logs cut from our own lands and lands here in Lincolnville. Other sources may include cuttings where the smaller parts of the aspen stem are utilized for pulp and paper production.

Value-Added Benefits

We saw our own logs on a small efficient bandsaw and dry the lumber in a state-of-the-art kiln that produces consistent high-quality drying. By manufacturing stretchers at our facility, we are able to get more value from the same raw material. This, in turn, allows us to offer high prices for logs, which benefits landowners, loggers, and their suppliers.

MARKETING

Marketing from rural areas presents challenges and opportunities. Drop-in traffic tends to be low, and shipping expenses tend to be high. Quality of life issues such as short work commutes, low traffic congestion, and proximity to natural environments are definite benefits of operating a business from a rural area.

Direct marketing techniques have helped us establish a diverse, stable customer base. Using low-cost Internet Web page advertising and communications as well as personal phone service with a toll-free telephone number, we are able to maintain a national market presence. Personal phone service for developing relationships for customized products is a must. Word of mouth business continues to be vital to our success. Products that get “used up” and need to be reordered have been the mainstay of the business.

SERVICE

Having a dependable high-quality product and backing it up with services such as prompt order fulfillment and a satisfaction guarantee contribute significantly to the success of this business. Providing options for customizing our product such as fractional sizing of stretcher frames and various levels of custom canvas preparation gives customers a wide range of choices to fit their particular needs.

SUMMARY

Non-timber forest product marketing from rural areas can be a viable business opportunity. Product choices that favor success include items that get used up and need to be reordered as well as items that can be customized to meet a variety of customer needs. Direct marketing techniques are critical to developing a diverse and stable customer base. The Internet is a fantastic tool for direct marketing and customer communications.

ACKNOWLEDGMENT

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Establishing an Alaskan Birch Syrup Industry: Birch Syrup—It's the *Un*-maple!™

Marlene Cameron[1]

Abstract.—Ten years ago a small group of Alaskans began commercial production of birch syrup from the sap of the paper birch, *Betula papyrifera*, and established an industry that is expanding in response to demand and has the potential to make a significant contribution to Alaska's economy. There are still many problems to be solved; research and development have taken a backseat to production in efforts to keep up with the overwhelming response to birch syrup and related products. However, as the industry matures and as the Alaska Birch Syrupmakers Association becomes more effective, solutions to these problems will follow.

BEGINNINGS OF THE ALASKAN BIRCH SYRUP INDUSTRY

In the spring of 1989, nearly 20 years after hearing an Alaskan sourdough tale about making syrup from birch trees the same way maple syrup is made, I finally tried tapping six birch trees. It took all day to boil down a pan of sap to syrup in the oven of an old propane kitchen stove in the backyard. The result looked—and tasted—like Alaska crude oil. But it was syrup! It seemed to me that this had real business possibilities. Having, however, absolutely no business sense, my mantra for success was this: "If the tourists will buy moose nugget earrings, they'll buy anything!" Thus began a business under the worst possible conditions.

The next year we "went commercial." That is, we managed to sell our birch syrup to an Anchorage gift shop, known for helping new Alaskan artisans and crafters. The syrup was bottled in plastic, pre-printed maple syrup containers with paper labels glued over the maple text. Since we knew our first year's syrup was too dark and nasty-tasting, we didn't cook this year's as long. Consequently, the syrup was thin, and one bottle fermented on the store shelf. Selling that syrup to the first gift shop I approached, though, was a heady experience, and I was sure I was on my way to fame and fortune.

Through the Small Business Development Center, I learned about the Alaska Science & Technology Foundation (ASTF) and submitted a hastily written pre-proposal for a grant. It was a surprise to learn the pre-proposal was accepted, and I was invited to submit a full proposal. Knowing nothing about grant proposals—or making birch syrup, for that matter—I started work on a proposal for a 3-year grant impressively titled "Research and Development of a Birch Sap Products Industry in Alaska." As an English teacher, I figured at least I could write a good story.

To "legitimize" my proposal, I began database searches through the University of Alaska and surprised myself by turning up a significant amount of scholarly research and publications about birch sap and syrup. Most of the studies had been done in the Ukraine, where both juice and alcoholic beverages were made with the sap, and in Finland, where the University of Turku funded studies of birch syrup as an alternative sugar source. More searching discovered historical and traditional stories about birch sap and syrup, and one book, published in London at the end of the 17th

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century, even had a recipe for birch wine, "now so frequently made...and that so highly, vinous and spirituous, that it hath past for a sort of foreign Wine (Westmacot 1695)." Isolated studies of birch syrup were made in Canada at the end of World War II and again some years later, and one study was done in Fairbanks, Alaska, and published in 1982. Canada and the U.S., however, were not interested at the time in pursuing birch syrup as a commercial enterprise.

At the end of 1990, the final proposal was submitted to ASTF, complete with all the required bells and whistles and estimates and projections and justifications; I called it my work of science fiction. I admit to a rather cavalier attitude about the whole project—there was no chance my insignificant little proposal would be awarded a grant alongside really important issues related to Alaskan fisheries and human bone growth and innovative computer software. So when I was advised at the end of February 1991 that we had been awarded the 3-year grant as proposed (minus the trip to Japan I had thrown in), I was more shocked than anything else. It certainly was a wakeup call; things got serious.

As I look back now on the development of the birch syrup industry, I marvel that the Board of Directors of ASTF truly had more vision than I had. The support, guidance, and encouragement I received throughout the grant period, and still receive, has been vital to the continued growth of the industry. We set out to determine if processing birch syrup could become a viable Alaska industry. If it isn't a million-dollar industry yet, it certainly is viable and it certainly has potential as a leader in Alaska's non-timber forest products sector.

PRODUCING BIRCH SYRUP

The *Un*-maple™—Similarities and Differences

The basic process to make birch syrup is the same as maple—evaporate most of the water from tree sap to concentrate the sugar to syrup density of about 67˚ on the Brix scale. There end the similarities.

The differences are considerable. The main sugars in birch sap are the simple sugars fructose and glucose, whereas the main sugar in maple sap is the complex sugar sucrose. Moreover, the average sugar content of birch sap is 1˚ Brix and that of maple ranges from 2 to 4˚ Brix. Acids present in birch sap are malic, phosphoric, succinic, and citric. Inorganics present include significant amounts of potassium, calcium, manganese, and thiamin. Because of the differences in chemical components between birch and maple, the resulting color and flavor of birch syrup also differ from maple. Fructose caramelizes (and burns) faster than sucrose; that, coupled with the fact that the low sugar content requires more processing, results in a syrup generally darker than maple. The flavor, too, is different; it's a complex flavor, reminiscent of many other things, but it ultimately is distinctive and unique.

Other major differences affect collection rather than processing. Tappable birch trees are smaller in diameter than maple, so generally only one tap per tree is made. In addition, the lifespan of the birch is shorter than the maple, and the birch is susceptible to heart rot early in life. Lack of strong root and trunk pressure, along with the vagaries of Alaskan weather and geography, makes pipeline or tubing (as used in large maple operations) an inefficient means of collecting sap.

Problems

Some of the problems involved in collecting and processing birch sap in Alaska are inherent. The low sugar content already mentioned means that it takes at least 100 gallons of sap to make 1 gallon of syrup. In addition, the sap season is much shorter for birch than for maple. In south-central Alaska, the sap run lasts an average of 19-20 days. In the interior (Fairbanks), the season has been as short as 10 days. By the time the roots thaw enough for the sap to begin flowing, the temperature both day and night is well above freezing, unlike the gradual freeze and thaw experienced by maple trees. If the temperature climbs into the 50's and 60's before the sap run is over, the sap can spoil before it ever reaches the sugarhouse.

Another problem Alaskan birch syrup producers faced in the beginning was a lack of experience; none of the producers had been involved in the maple industry. In addition, there were no instructions or guidelines to follow, other than scholarly research from other countries

and “down home” suggestions from maple producers (who had never tried making birch syrup). It seemed logical, then, to begin with maple technology. That system worked—we made syrup—but it became apparent very soon that adaptations needed to be made if we wanted a high quality product. For example, we discovered that metal spouts, buckets, and tanks used in the maple industry were inappropriate for the acidic birch sap—an expensive discovery after large initial purchases.

Other problems—the toughest hurdles of all—have been financial. We did not simply create a business, we created an industry. To do so requires costly marketing, advertising, and product sampling to educate both retail and wholesale customers. In addition, it wasn’t clear just what niche market would be appropriate for birch syrup, so a lot of time and money were spent discovering what did not work. The cost of producing 1 gallon of birch syrup can be four to five times higher than the cost of producing 1 gallon of maple syrup; thus marketing is not simply a matter of introducing a new pancake syrup. Not only is the cost of producing birch syrup higher than maple, but the costs for equipment, supplies, transportation, packaging, and shipping are higher as well. Alaska is 2,000 miles from the rest of the United States; manufacturing is and has always been a difficult and expensive undertaking because almost everything required (except the natural resources) must be brought into the state. The most pervasive financial problem and the most difficult to overcome, however, is the fact that every birch syrup producer has started business undercapitalized. Perhaps as more used equipment becomes available in the state, more appropriate and efficient processing methods are discovered, and traditional financial institutions recognize the industry as a worthwhile investment, startup costs will come down and the new-business breakeven point will come sooner.

ALASKA BIRCH SYRUPMAKERS ASSOCIATION

In 1992, the Alaska Birch Sugarmakers Association (ABSA) was formed in an effort to create a certain amount of cohesiveness and validity for the industry. Initially members met once a year during the Alaska State Fair to share ideas and talk about problems. The only official agenda for several years was an association booth at the fair and election of officers. Finally, with some grant money from the ASTF, I sent a sample of birch syrup to a food lab in Oregon for nutritional testing, which allowed syrup producers to take a more professional approach to advertising and sales of birch syrup.

For several years, we moved our portable sugarhouse to the fair for the association’s use. Originally we had the 2x6 evaporator still set up in it, and during the fair we boiled water with a little syrup in it for demonstrations. Logistics proved difficult and expensive—setting up fuel and water tanks, paying fuel costs for 2 weeks, and tending the evaporator while trying to talk with customers became more problematic each year. Also, as more syrup producers came on line, there wasn’t enough space to have the evaporator and sell product too, so the evaporator had to go. Finally, in 1998, ABSA built its own building at the fair. Now the association is looking to enlarge the building to accommodate the increased number of syrup producers and products and perhaps add a miniature demonstration evaporator.

This year marks a turning point for ABSA. Member birch syrup producers are finally moving to accomplish significant advances for the industry. We all agreed that we needed to get away from maple terminology and rename our association; we can’t make sugar with birch. So it is now the Alaska Birch Syrupmakers Association. The association is now working on determining set quality standards of processing for ABSA certification. An ABSA certification will indicate to buyers that the product is made in accordance with strict processing standards. Much more detailed (and controversial among syrup producers) will be a Best Practices manual that is produced by ABSA, covering all aspects of the birch syrup operations—harvesting, transporting, processing, packaging, and forest stewardship. A committee has been appointed to develop a survey for ABSA members and a basic outline for the manual. Most important from an industry standpoint, however, is a proposal to the U.S. Food and Drug Administration for inclusion in the FDA Code of Federal Regulations, which will define birch syrup for all U.S. producers. Once birch syrup is included in the Code, the industry will be officially recognized by the government and have “authority” behind it when needed.

GROWTH OF THE BIRCH SYRUP INDUSTRY

Commercial Syrup Producers

In 1990, three birch syrup producers began business in Alaska, unknown to one another and in three widely separated locations—Wasilla, Trapper Creek, and Fairbanks. Three years later another operation started in southeast Alaska, and since then one new producer has come on line almost every 2 years. There are now seven commercial birch syrup producers in the state—an impressive accomplishment for an industry only 10 years old and one in which startup costs are high and profits low.

Sap Collectors

Quite by accident an unanticipated secondary industry evolved and has now become firmly established within the birch syrup industry. A year after we began commercial production, a few local people wanted to know if they could tap trees and give us the sap to boil. From those eight people in 1992, who brought in a total of 3,000 gallons of sap, to the hundreds of collectors this past season who brought in 40,000 gallons of sap, we've come a long way in a short time. As a matter of fact, our business now depends entirely on purchasing sap from collectors throughout the Matanuska-Susitna Valley. Collectors come in all shapes and sizes—families, retired folks, individuals, children, school classes, church groups, social service agencies, people who work, and people who don't work. Tapping trees gets people out of the house after the long Alaskan winter, it's easy and it's fun to watch the sap collect, the season doesn't last long enough to get boring, and the money can add up considerably. Our largest sap collector last season is a retired woman who made over $2,000 in 20 days.

Marketing

Birch syrup producers have a variety of marketing strategies. In general, birch syrup is targeted toward the high-end users: local tourist-oriented gift shops, tour companies (i.e., Princess Lines), gourmet shops, and fine restaurants. Other marketing outlets include Internet sales, mail order, gift shops outside Alaska, bulk sales to Asia and Europe, natural food stores, espresso shops, and a local ice cream manufacturer. In addition, our business has a retail outlet store attached to the kitchen and shop. The two newest syrup producers aren't even concerned with retail or wholesale marketing; they sell their syrup in bulk to the other producers who need more to fill the ever-increasing demand.

Value-Added Products

While it's possible to make a profit with birch syrup, you'd better have another income handy if you want to eat and live in a house! To work toward a full-time, self-supporting business, several of the birch syrup producers developed value-added products. Our business was the first to create new product lines with birch syrup as a base. We now have several birch candies, marinade, salad dressing, popcorn, reindeer jerky, coated nuts, and flavored birch syrups. Two other birch syrup producers are now making candy, one has a birch syrup/honey blend, and the other has a birch caramel ice cream topping. Rather than birch syrup-based products, two of the other producers are using their evaporating equipment year-round to make Alaskan berry syrups—fireweed, rosehip, blueberry, and raspberry. This extends the use of their equipment, making it more cost effective.

FUTURE OF THE ALASKAN BIRCH SYRUP INDUSTRY

Most of the Alaskan birch syrup producers are experiencing a growing demand for birch syrup and for the value-added birch products. Even though the price of birch syrup can be 4-5 times higher than maple, it has a different niche, and as it becomes better known it is more in demand. While some Alaskan producers would like birch syrup to remain a unique, Alaskan-only product, there is enough growing interest in it to warrant operations in other areas with large stands of birch.

It's obvious that more syrup is needed. But establishing larger operations is not the answer as it is in the maple industry; making birch syrup is expensive, labor intensive for a short period, and has a low return of syrup from sap. As I see it now, there is a point of marked diminishing return beyond which the cost of equipment and tapping a vast number of trees by the producer simply cannot justify the product. The solution is to establish more

small producers who sell to larger producers who can more effectively market the syrup.

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North American Networking Activities on Non-wood Forest Products by the Food and Agriculture Organization of the United Nations

Paul Vantomme[1]

Abstract.—FAO, the Food and Agriculture Organization of the United Nations, is the largest autonomous agency within the United Nations system dealing with agriculture, fisheries, forestry, and related disciplines. FAO provides a neutral forum for policy dialogue, a source of information and knowledge, technical assistance, and advice to 180 member countries. Technical information and global networking on non-wood forest products (NWFPs) are provided mainly by the Forestry Department. The NWFP Programme, intended to be a "Centre of excellence in information sharing," is implemented through the following main elements: information gathering, analysis, and dissemination; appraisal of the socioeconomic contributions of NWFPs to development; and improved networking. FAO and NWFP related activities of interest to the North American region are mainly channeled through The Committee on Forestry (COFO), The North American Forest Commission (NAFC), and the NWFP task group of the North American Forest Products Study Group (FPSG). URL addresses are provided for further reading.

WHAT FAO IS AND WHAT IT DOES

FAO, the Food and Agriculture Organization of the United Nations, was founded in October 1945 with a mandate to raise levels of nutrition and to improve agricultural productivity. It is the largest autonomous agency within the United Nations system with 180 member nations and more than 4,300 staff, including specialists in agriculture, fisheries, forestry, and related disciplines. FAO has headquarters in Rome, Italy, a comprehensive regional structure with regional offices[2], and a physical presence/representation in more than 100 countries.

The primary roles of FAO are to serve as:

- a neutral forum for policy dialogue (including international governmental meetings, for example, on agricultural trade, on natural resource management issues, etc.),
- a source of information and knowledge (technical information on products, methodologies, and statistical data on production and trade in agriculture),
- a provider of technical assistance (field projects to develop/introduce new products or technologies, to assist governments in institutional capacity building, etc.),
- a provider of advice to governments.

More information on FAO, its mission, and contacts can be downloaded from http://www.fao.org.

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HOW FAO DEALS WITH NON-WOOD FOREST PRODUCTS (NWFP)

The term "non-wood forest products" (NWFP) and similar terms like "minor," "secondary," or "non-timber" forest products (NTFP) have emerged as umbrella expressions for the vast array of both animal and plant resources other than wood (or timber, in the case of "non-timber") derived from forests or forest tree species. The term NWFP is used by FAO to refer to all plant and animal products derived from forests and other wooded lands.

Technical information on products gathered in forests or from forest species falls under the responsibility of FAO's Forestry Department, through its NWFP Programme. However, other programmes may also be involved with NWFPs, such as the Community Forestry, Marketing, and Extension programmes. More information on the activities of the Forestry Department in general and on the above programmes in particular can be downloaded from the FAO Web site at: http://www.fao.org/forestry.

For those NWFP products that are partly domesticated and that can also be cultivated by farmers, technical documentation may be complemented with information provided by FAO's Agriculture Department, and particularly by the programme on the development of underutilized plants of the Industrial Crops Group at http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGP/AGPC/doc/industr/Indcrop.htm.

On NWFPs used for food and on food products in general, information and quality control aspects are provided by the Nutrition Division, at: http://www.fao.org/WAICENT/FAOINFO/ECONOMIC/ESN/NUTRI.HTM.

It is important that NWFPs, when promoted and traded as food products, comply with the internationally agreed upon food quality requirements as described in the 'Codex Alimentarius.' This code on food has become the seminal global reference point for consumers, food producers and processors, national food control agencies, and the international food trade. The code has had an enormous impact on the thinking of food producers and processors as well as on the awareness of consumers. Its influence extends to every continent, and its contribution to the protection of public health and fair practices in the food trade is immeasurable: http://www.fao.org/WAICENT/FAOINFO/ECONOMIC/ESN/codex/default.htm.

ACTIVITIES OF FAO'S NON-WOOD FOREST PRODUCTS PROGRAMME

The aim of the Non-Wood Forest Products Programme is to be a "Centre of excellence in information sharing" for improved use of NWFPs. Wise use of NWFPs is seen as a contribution to sustainable forest management and to the conservation of the biological diversity of forest resources, and simultaneously as a way to improve income and food security for rural people. The programme's URL is: http://www.fao.org/forestry/FOP/FOPW/NWFP/nwfp-e.stm.

NWFPs may represent the major actual or potential source of income from forests with low timber production potential, such as degraded/logged-over forests or those in arid and semi-arid zones. With a few exceptions, however, it is unlikely that in production forests NWFP income can compete with financial returns from timber harvesting. NWFPs are likely simply to supplement the returns from timber rather than replace it as a source of revenue. Increased production of NWFPs in forests that are unsuitable for timber production, however, will enhance the value of these forests, and thus at least theoretically provide a form of economic protection against conversion to other land uses. Care must be taken, however, that commercialization does not result in overharvesting of NWFPs, since this can have its own negative environmental consequences. Management of forests for NWFPs in addition to timber is more likely to benefit the local economy and to provide goods and a source of income for forest-dwellers.

The NWFP Programme is composed of the following main elements: (a) information gathering, analysis, and dissemination; (b) appraisal of the socioeconomic contributions of NWFP to development; and (c) improved networking.

(a) Information Gathering, Analysis, and Dissemination

Specific categories of NWFPs and important topics for their development are highlighted in the FAO *Non-Wood Forest Products Series*. Twelve volumes have been published to date including the following titles: *Flavours and Fragrances of Plant Origin; Natural Colourants and Dyestuffs; Edible Nuts; Non-Wood Forest Products for Rural Income and Sustainable Forestry; Trade Restrictions Affecting International Trade in Non-Wood Forest Products; Domestication and Commercialization of NWFP Through Agroforestry Systems, Tropical Palms, NWFP from Conifers;* and *Medicinal Plants for Forest Conservation and Health Care*. These and many other publications on NWFPs can be viewed online at: http://www.fao.org/forestry/FOP/FOPW/NWFP/pubser-e.stm.

The FAO *NWFP Series* is open for contributions and joint development of new titles with any interested agency, as long as they deal with topics of global relevance within the overall scope of the NWFP Programme of FAO. Several issues in this series have already been jointly compiled with governmental and/or non-governmental agencies, and potential topics for new titles to be developed include the following working titles: The contribution of NWFP to food security, Gender and NWFP, Sustainable harvesting of NWFP, Extension of NWFP, and Certification of NWFP.

(b) Appraisal of the Socioeconomic Contributions of NWFP to Development

Comprehensive statistical data and other descriptive information on the production and trade of NWFPs are essential for an accurate appraisal of their true socioeconomic contribution to sustainable development. This, in turn, will contribute to the elaboration (and acceptance by policymakers and senior decisionmakers) of appropriate policies leading to more equitable access to non-wood forest resources and to a fair distribution of benefits obtained from them.

Although FAO, as well as many other agencies, has already assembled a wealth of information on the socioeconomic role of many NWFPs, the available information base on NWFPs is very dispersed, still insufficient, not aggregated at a national level, and far from being comprehensive or global in scope.

The objective of this programme element is to gather, validate, and disseminate statistics and other descriptive information on the production and trade of NWFPs at the national level for all countries. As a first step in this direction, and within the framework of an "EU-FAO Partnership Programme to Support Data Collection and Analysis for Sustainable Forest Management in the African, Caribbean and Pacific Regions," country reviews are being prepared that describe the production and trade of major NWFPs. Similar exercises are ongoing to cover countries of other regions, i.e., in Latin America, the Near East, and Asia. The results will be posted on the FAO Forestry Department Web site at: http://www.fao.org/forestry/FON/FONS/outlook/Africa/acppro-e.stm as they become available. Data are obtained and validated through partnerships with the relevant national agencies in the countries.

(c) Improved Networking

In the past years, an impressive network of contacts with organizations (governmental and non-governmental) and individuals working in the field of NWFPs has been developed by the NWFP Programme of the Forest Products Division of FAO. To improve networking, an annual news bulletin, *Non-Wood News*, compiled from voluntary contributions of relevant information about ongoing activities dealing with NWFPs, links more than 2,200 individuals and organizations worldwide. The newsletter is available at: http://www.fao.org/forestry/FOP/FOPW/NWFP/newsle-e.stm. Printed copies are available free of charge upon request.

A comprehensive database is presently under construction, the aim of which is to gather and collate reliable information about all partners involved with the development of NWFPs and about the kind of activities with which they are concerned. A first draft of this interactive database can be consulted at: http://www.fao.org/forestry/FOP/FOPW/NWFP/nwfpdb-e.stm; it incorporates an option to download a

questionnaire (available in English, French, or Spanish) for those who wish to be included in the directory.

Although FAO is an intergovernmental organization and, as such, its main line of communication is with member governments, this is not its only source of information. Inputs from a broad range of interest groups, including the private sector, universities, forest industries, and non-governmental organizations, representing environmental and developmental interests, are warmly welcomed. There is a need to ensure that dialogue takes place between interested parties and that duplication of efforts is avoided so that skills and resources are most efficiently used. To further increase awareness about NWFPs and to strengthen collaboration and partnerships at the national, regional, and global levels, FAO's NWFP Programme has co-organized several international expert consultations on NWFP worldwide, including:

Global expert consultations:

Social, Economic and Cultural Dimensions of NWFP. Bangkok, Thailand, 1994.

Inter-regional Expert Consultation on NWFP. Yogyakarta, Indonesia, 1995.

Regional expert consultations:

Asia and Pacific Region. Bangkok, Thailand, 1991.

Anglophone African Countries. Arusha, Tanzania, 1993.

Latin America and Caribbean Countries. Santiago, Chile, 1994.

Medicinal Culinary and Aromatic Plants in the Near East. Cairo, Egypt, 1997, and followup meeting in Beirut, Lebanon, 1999.

NWFP in Boreal and Cold Temperate Forests. Joensuu, Finland, 1998 (in collaboration with EFI/ECE and Ministry of Forestry, Finland).

Expert Consultation on NWFP in the Congo Basin. Cameroon, 1998 (in collaboration with CARPE, USDA Forest Service).

Reports of these meetings can be viewed at the NWFP Web page, under "Publications."

FAO AND NWFP RELATED ACTIVITIES IN THE NORTH AMERICAN REGION

The Committee on Forestry (COFO)

Dialogue at the international level is an essential complement to the efforts of individual countries to develop appropriate forest policies, institutions, and practices. FAO supports a number of statutory bodies specifically designed to provide neutral fora for discussion in the field of forestry. Foremost among these is the Committee on Forestry (COFO). Heads of forest services and other senior government officials meet at FAO headquarters every 2 years to identify emerging policy and technical issues, to seek solutions, and to advise FAO and others on appropriate action. Other international organizations and, increasingly, non-governmental groups participate in COFO. Six regional forestry commissions complement the work of COFO and cover the regions of Asia-Pacific, Africa, Europe, Latin America and the Caribbean, Near East, and North America. These commissions normally meet between COFO sessions and provide a forum for member countries to discuss both technical and policy issues at the regional level. Information on COFO, and their reports, can be downloaded from: http://www.fao.org/forestry/FO/STATBOD/statb-e.stm.

The North American Forest Commission (NAFC)

Established in 1959, the North American Forest Commission provides a policy and technical forum for Canada, Mexico, and the United States to discuss and address forest issues on a North American basis. Drawing on regional experiences, it also provides advice to the FAO's forestry program. The mandate of NAFC, as with other FAO forestry commissions, is to advise on the formulation of forest policy and to review and coordinate its implementation at the regional level; to exchange information and, generally through special subsidiary bodies, advise on suitable practices and action with regard to technical problems; and to make appropriate recommendations to FAO. In this regard, NAFC supports research and sustainable natural resource management activities through study groups that explore issues of concern to the three countries. Since together,

Canada, Mexico, and the United States contain a mix of boreal, temperate, and tropical ecosystems, the results of NAFC's work can be applied more broadly to assist other countries and regions facing similar conditions. The NAFC Web page is: http://www.fao.org/forestry/fo/statbod/nafc/nafc-e.stm.

Every 2 years, the North American Forest Commission brings together the Canadian, Mexican, and United States heads of forest service and other senior forest officials from those countries, FAO, and observers from non-governmental organizations to address forestry and natural resource matters, to advance scientific knowledge, to promote cooperation, and to facilitate the exchange of information. The biennial sessions of NAFC are held in each country in rotation. At its last meeting (19th session, 16-20 November 1998, in Villahermosa, Mexico), the state of forestry in the region was reviewed through national progress and study group reports. Technical papers were also presented and discussed on a) forest-related traditional knowledge, b) applications of criteria and indicators of sustainable forest management at the field level, and c) forest resource assessment and monitoring.

A feature of NAFC is the Bureau of Alternates (BOA), comprised of senior forest service members from Canada, Mexico, and the United States. BOA reports to NAFC and advises on current activities and future direction; it meets on a regular basis to guide and oversee the work of the seven study groups; evaluate progress of projects; commission analytical papers on emerging issues; and identify opportunities to advance cooperative objectives. Another key function of BOA is to distribute information to its extensive network.

The NAFC has established the following study groups that carry out cooperative research and management projects: atmospheric change and forests, fire management, forest products (including NWFPs), insects and disease, neotropical migratory species, silviculture, forest inventory and monitoring, and forest genetic resources.

North American Forest Products Study Group (FPSG)

The mission of the FPSG is to promote and enhance the efficient and sustainable use of forest products within North America by bringing together and expanding upon the body of information and scientific and technical expertise related to North American wood and non-wood products.

The goals and objectives of the FPSG are to:

- Facilitate the exchange of existing and emerging forest products technology within North America
- Identify appropriate expertise in each country
- Facilitate a network of scientific or technical experts to address issues of concern to the forest products sector in North America

The study group is composed of four task groups:

- Wood Products Standards
- Fiber Supply
- Certification
- Non-Wood Forest Products

More information on FPSG work and reports is available at: http://www.fs.fed.us/global/nafc/welcome.html.

The NWFP task group status report (output of the 1998 Merida meeting) recommends the following regarding future work on NWFP, and particularly regarding the possibility of holding a regional expert consultation on NWFP for the North American region: (quote)

> "Discussions taking place regarding holding a non-forest products workshop in Mexico. The suggested dates for this workshop have now been proposed for September 2000 or 2001 for a multinational workshop. Pinchot Institute provided funds to convene policy group after U.S. assessment is done. Best timing for workshop for U.S. is after credible report on assessment is completed."

Discussions among staff of BOA and FAO are continuing regarding the possibility of holding the above regional expert consultation for North America. More information on the purpose and proposed content of this meeting can be obtained from the writer.

Birch: The Original Tupperware®

The bark of the paper birch tree has been used for many generations by inhabitants of the northern forest around the world. Uses include covering for dwellings, canoes, containers for food storage, decorative containers, back packs, and shoes, among other things. Characteristics important in determining the use of bark include the density and size of lenticels (pores for gas exchange), bark thickness, and tendency to separate into annual layers. Betulin, a chemical compound making up 15-20 percent of the bark, gives the bark its white color. Betulin and other compounds in the bark are known to have fungicidal properties and are part of the reason that the bark decays so slowly, remaining long after the wood is gone. Bark kept dry and out of the elements seemingly lasts “forever.”

Bark can be removed from living trees without killing the tree, although the effect of bark removal on tree health is not well-known. Bark will regrow after removal. Care should be taken to remove the bark only in the appropriate season and to remove only the outer bark, leaving the inner bark undamaged.

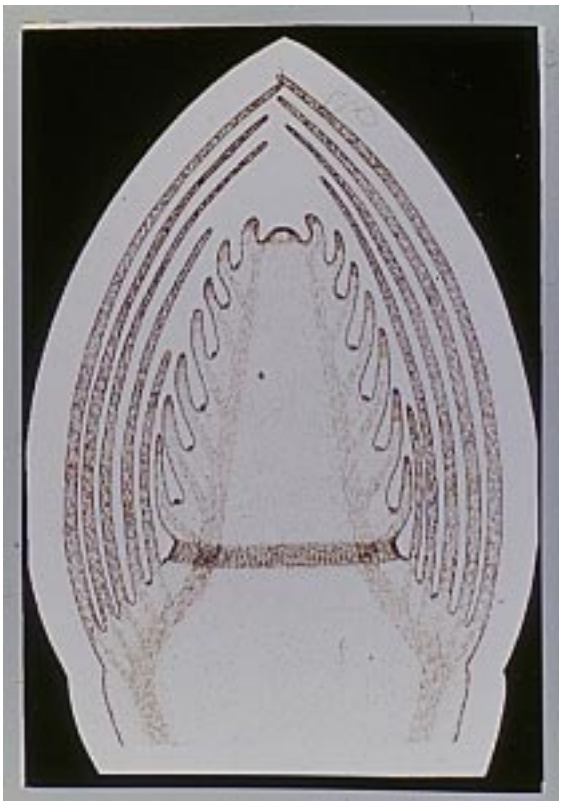
Removal of bark from living trees drastically changes the appearance of the tree as shown here. Although a new layer of outer bark forms over time, the tree never looks the same as a tree from which bark has not been removed. The best trees from which to collect bark are those that will be cut for other purposes, as in a commercial timber sale. From an aesthetic point-of-view, it is best not to collect bark from trees growing along highways and well-traveled backroads. The tree in this photo has been damaged more than necessary because the vertical cut made to remove the bark damaged the inner bark layer and the outer part of the wood.

Large basket made from a single sheet of bark. The design on the body of the basket is porcupine quill work. The figure on the basket cover is made by scraping away the dark brown layer that is characteristic of winter bark. The body of the basket is from summer bark. Split spruce roots are used to sew the bark together.

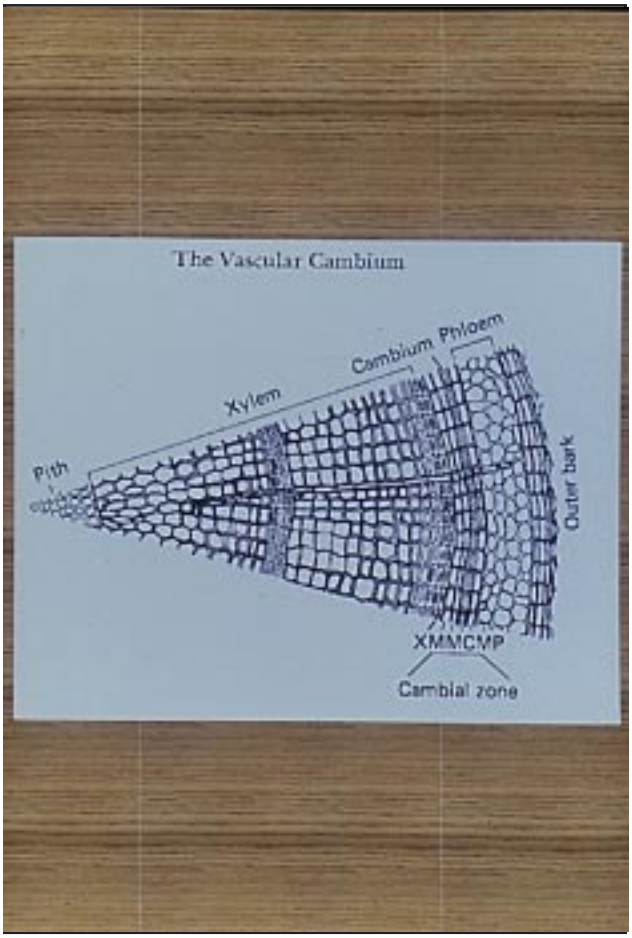
Slipper made by weaving strips of birch bark. Birch bark weaving was the traditional method used in Finland and Sweden for making various items from bark.

This container, from Siberia, illustrates the intricate designs cut into the bark and then layered on bark of a different color to highlight the design. In this basket, the darker bark is the inner layer of the outer bark. The lighter bark is from the outer layer of the outer bark and is the color normally associated with birch bark.

Small decorative basket illustrating a different basket style and use of other natural materials. The seams between the pieces of bark are reinforced with sweet grass and the design is made with dyed porcupine quills. This basket was made with the white side of the outer bark showing.



Idealized drawing of a bud. Buds formed during the summer contain embryonic leaves, flowers, and cells that will form next year's new growth. Any harvesting practice should take care to preserve an adequate number of buds so that the plant can recover following harvest.



Cross section of conifer stem. The cambium is the zone of cells that produces all of the wood to the inside and the phloem (sometimes called inner bark) to the outside. The cambium is directly or indirectly involved in producing many important NTFPs. Severe damage to the cambium can cause the tree to lose vigor or even die.

CONCLUSION

The Future of the Non-Timber Forest Product Industry

Luc C. Duchesne[1], Iain Davidson-Hunt[2], and John C. Zasada[3]

The boreal and northern forests of North America cover a vast area and have low population density with many inhabitants living in small communities. The inhabitants of these communities as well as those from urban areas are dependent on the forest resource for many commodity and non-commodity values. Although the socio-cultural outlook is changing somewhat, past and current development has been mainly geared toward the extraction of wood and fiber products and their manufacturing. Indeed, there is a rich history of gathering many plant materials for food, technological, medicinal, and spiritual values among the First Nations peoples and Europeans that migrated to and settled these lands. But commercial development of the non-timber forest products (NTFPs) industry, with a few exceptions (e.g., Christmas trees, blueberries, mushrooms), is in its infancy. The purpose of the first international conference on non-timber forest products in cold temperate and boreal forests was to bring together people from different walks of life and with varying views on NTFPs in this vast region that spans the entire continent from east to west and more than 25 degrees of latitude.

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To our knowledge, this was the first widely publicized international forum to focus on the development of an NTFP industry in this northern region. Many people from a variety of organizations, e.g., universities, federal governments, First Nations organizations, and private enterprise helped to plan this conference and they each deserve credit for their efforts. Moreover, this conference was successful because of the insights, caliber, and charisma of the presenters and participants, along with everyone's willingness to share their valuable experience and expertise. Many participants made new friendships and found kindred spirits with whom to collaborate and move the NTFP industry forward.

The Kenora meeting illustrated the growing interest in the NTFP industry and its potential for socioeconomic development, biodiversity conservation, and the reinforcement of cultural identities. It also demonstrated the concerns of many from First Nations and other heritages about the fast-paced economic development that can occur with little account for traditional and personal use of NTFPs. Many entrepreneurs, academics, scientists, and policymakers have demonstrated that there is a growing NTFP industry worldwide. Speakers described how the NTFP industry is fueled by large international, national, and regional demands for NTFPs. Although this recognition is critical, it is also a cause for concern among those who have a more traditional view of NTFPs. This international forum demonstrated that cultural barriers that prevent the consumption of a particular NTFP at the local level may not exist in other countries. Although there is no doubt that development at the global scale is critical for the expansion of an economically viable industry, concerns for regional and local use must be seriously considered.

Although we are satisfied that our conference presented the growth potential of the NTFP industry at the global level, we are also mindful that the sustainability of this new industry, along with biodiversity conservation, depends

on various types of research and political efforts. History is replete with many examples of plants and animals that are commercially extinct because of overharvesting. In practice, the growing success of the NTFP industry may deplete natural stocks and reduce the sustainability of this resource. Therefore, promoters of the NTFP industry must recognize that they also carry the responsibility to preserve this natural resource. In this proceedings, several authors emphasized specific research needs dealing with domestication, ecological, and economic research that must be addressed. We advocate that such research activities be conducted now in support of the growing industry. Particularly, we wish to see research activities conducted at the international level.

Certification of NTFP is important and should also be undertaken and recognized at the international level. Certification has three roles. First, it must ensure that the harvesting of NTFPs is sustainable while biodiversity is conserved. NTFP harvesting is largely unregulated in temperate and northern ecosystems. As such, this situation may lead to difficulties in generating a sustainable harvest of products that are in high demand or are highly valued and may be conducive to losses of biodiversity at regional levels. Second, because many NTFPs are food products as well as medicines, consumers must be guaranteed that the NTFPs they consume are free of pesticides or environmental contaminants in a way that is similar to the organic certification of agricultural products. Certification will also be necessary for domesticated NTFPs that are grown in agricultural settings. Finally, certification must also address a concern for the socioeconomic status of the people who depend on NTFPs for their livelihood or for supplementing their income. During the conference we were challenged with the notion that by promoting the NTFP industry, we may be creating a new class of poorly paid migrant workers who spend backbreaking days harvesting in harsh conditions for the benefit of others. While we recognize that there is potential for this kind of labor malpractice, we see an exception in the current NTFP industry. In practice, there are several acceptable models for the development of an equitable NTFP industry, including the cooperative approach.

One important task to come is the creation of an NTFP culture that will support this industry as NTFPs start competing with mainstream consumer products. On the one hand, people in remote areas must be made aware that there are international markets for NTFPs that are found in their vicinity. For this, we need to diffuse this information in an acceptable format to potential entrepreneurs and harvesters and to present them with data showing the economic feasibility of NTFP harvesting and processing. As well, there is a strong need for societies at large to develop respect for the NTFP culture. In turn, such respect will elicit pride in a way of living that is often consistent with ancestral values, especially for Aboriginal people, but that has been neglected in favor of industrial and post-industrial cultural values. Also, NTFP harvesting is often seen as an activity conducted by entire families, and as such, can enhance family values.

Governments need to invest money in NTFP research to promote the NTFP industry. To date there has been little organized NTFP research, presumably because the bulk of the past research was conducted to target specific commercial needs and was supported by private agencies. In addition to the paucity of information about NTFPs, some valuable findings are held exclusively by private industries. Governments and their agencies should increase the level of funding to provide public research that is undertaken in cooperation with NTFP entrepreneurs and enterprises and that responds to the research topics they identify as priorities. The full-scale development of a sustainable NTFP industry requires several steps. The first step is to make entrepreneurs and governments alike understand the potentials of the NTFP industry. The next stage is to implement pilot studies that will demonstrate how NTFPs can be harvested and processed while generating adequate income. A third step involves conducting research on the domestication of NTFPs to create a sustainable industry. Representatives of large commercial buyers demonstrated that the supply of an NTFP often cannot meet the international demand for such a product. At times it will be necessary to domesticate certain species to meet commercial demand. However, local users of NTFPs often find that they are no longer able to find certain species due to both the pressures of commercial harvesting and/or habitat

conversion. These situations may not require the domestication of a product but may benefit from increasing the abundance of a product through semi-domestication or new cultural practices (e.g., "seeding a forest" - woods-grown ginseng in New Brunswick). Other people may prefer to look at the restoration of habitat or species so that they can continue their personal use of an NTFP.

First Nation participants spoke eloquently about their long relationship with the many inhabitants of the boreal and cold temperate forests. First Nation people reinforced their interest in defining an approach to NTFPs through specific pilot cases that would not focus solely on commercialization but could include a variety of topics of concern to different First Nations.

In summary, we present six recommendations for the development of the NTFP industry in the boreal and cold temperate forest regions:

1. **Increase the knowledge held by local, provincial/state, and national governments**, along with capital providers (i.e., private banks, public lenders, economical development agencies, etc.), about the potential and structure of the NTFP industry. In particular, stress how this potential can serve the residents of forest communities in socioeconomic development and as a means to address poverty and family issues.
2. **Governments and their agencies need to support forest communities, local institutions, and entrepreneurs in the research and development of NTFP opportunities.** Several NTFP entrepreneurs demonstrated that successful NTFP enterprises, cooperative or private, could emerge as successful small businesses based in forest communities.
3. **Governments should support local resource stewardship to ensure biodiversity conservation in accordance with the needs of forest communities and national and international laws.** As commercialization of NTFP occurs, it is imperative that NTFP enterprises are able to adequately monitor and assess the impact of harvest levels. This is an area where the cooperation between state agencies, local NTFP enterprises, and international buyers is critical to the success of a sustainable NTFP industry. Presenters from the United States Forest Service provided examples of research projects that focus on inventory and monitoring of NTFPs in cooperation with NTFP enterprises to ensure that harvests are sustainable. NTFP certification was also a possibility raised by the Forest Stewardship Council as an area that needs further clarification.
4. **Implement pilot studies** that will bring together public sector researchers, NTFP enterprises, and local institutions to facilitate the growth of sustainable NTFPs. As was made clear in this conference, too often NTFP studies are considerably weakened through a narrow treatment of marketable products or species biology. The development of the NTFP industry draws on several fields of expertise, so there is a need to integrate different types of information by dealing simultaneously with both the marketing (demand) and the ecology of NTFPs (supply).
5. **Investigate the domestication, semi-domestication, or restoration of NTFPs with significant commercial, or use value, for those species that are under harvest pressure or threat from habitat conversion.**
6. **Work cooperatively with First Nations** to investigate topics such as the use of plants in healing practices of First Nations; tenure; commercialization; threat analysis; restoration; domestication; education; natural and cultural heritage tourism and other issues identified by Aboriginal people and peoples for NTFPs.

Davidson-Hunt, Iain; Duchesne, Luc C.; Zasada, John C., eds.
2001. **Forest communities in the third millennium: linking research, business, and policy toward a sustainable non-timber forest product sector**; Proceedings of the meeting; 1999 October 1-4; Kenora, Ontario, Canada. Gen. Tech. Rep. NC-217. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 151 p.

Contains a wide variety of papers given at the first international conference on non-timber forest products (NTFP) in cold temperate and boreal forests. Focuses on many facets of NTFPs: economics, society, biology, resource management, business development, and others.

KEY WORDS: Non-timber forest products, NTFP, traditional ecological knowledge, Aboriginal culture, forestry harvesting, use of northern forests.

Our job at the North Central Research Station is discovering and creating new knowledge and technology in the field of natural resources and conveying this information to the people who can use it. As a new generation of forests emerges in our region, managers are confronted with two unique challenges: (1) Dealing with the great diversity in composition, quality, and ownership of the forests, and (2) Reconciling the conflicting demands of the people who use them. Helping the forest manager meet these challenges while protecting the environment is what research at North Central is all about.