A Study to Investigate the Potential for Development of Non-Timber Forest Products and Values from the Boreal Forests of Newfoundland and Labrador

Commissioned by:
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Non-Timber Forest Products
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Summary:

The study of non-timber forest products is universal, and definitions of what constitutes NTFPs[1] are multifaceted. Around the world, many terms have emerged to describe non-timber forest products including 'non-wood forest products'; 'special forest products'; 'non-traditional'; 'speciality foods and products'; 'secondary'; and 'value-added products'.

The Food and Agriculture Organization (FAO) of the United Nations defines 'non-wood forest products' as being "of biological origin other than wood that are derived from forests, other wooded lands and trees outside forests. They may be gathered from the wild or produced in forest plantations, agro-forestry schemes, and from trees outside forests. Non-wood forest products may include products which are used as food and food additives, fibres, resins, gums, and plant and animal products used for medicinal, cosmetic, or cultural purposes".[2]

While the term 'non-timber forest products' has become the predominant trend in the United States in recent years, 'special forest products' has also been used widely in many areas of the country in the last decade. In either case, these products are described as being "biological and generally not cultivated. They are not timber; but can be made of wood, and are collected in the natural forests. These products fall within four general categories including edibles, medicinal and dietary supplements, floral products, and speciality wood products".[3]

In Canada, 'non-timber forest products' refer to "any commodity obtained from the forest that does not necessitate harvesting trees, including game animals, nuts and seeds, berries, mushrooms, oils, foliage, medicinal plants, peat, forage, etc."[4] These products are gathered from the forest and are used for a variety of purposes including foods, medicinal and personal care, garden and landscape, as well as for decorative and craft products.

[1] NTFPs (Non-Timber Forest Products)
[2] Food and Agriculture Organization (FAO)of the United Nations , www.fao.org/forestry/nwfp
[3] Hammett, A.L., and J.L. Chamberlain. 1998. Sustainable Use of Non-Traditional Forest Products: Alternative Forest-Based Income Opportunities. Conference Proceedings. Page 142.
[4] Natural Resources Canada: The State of Canada's Forest 2004 – 2005.

For the purpose of this report, non-timber forest products are those products which have originated and / or are harvested from the boreal forest, excluding timber-based products. These products are categorized as foods including berries and mushrooms; nutraceuticals; pharmaceuticals; cosmetics; as well as floral and craft products. Forest services such as recreation and ecotourism are often associated with non-timber forest products, thus a brief overview of their contribution will be included.

The development of this report is an attempt to compile existing research as a basis to investigate the potential for sustainable development of non-timber forest values from the boreal forests of Newfoundland and Labrador. Research has indicated that nontimber forest products can provide 'direct economic value' and offer an alternative to cutting down the forest. This approach must be cautioned as other jurisdictions have developed such an approach in the past and have experienced problems with a non-sustainable harvest, in some cases, causing depletion of harvested resources and negative impacts to the habitat and surrounding ecosystem. The forest offers multiple values such as providing habitat to wildlife and plants, providing ecological services such as water and air purification, providing sustenance for First Nation communities who hunt and fish, and providing spiritual and recreational value for humans throughout the world.[5] In order for these values to be maintained in a sustainable manner, the forest needs to be managed in such a way that protects their ecological integrity, while allowing for resource extraction that will benefit all people involved. With such conservation issues in mind, the potential for developing a non-timber forest product industry in Newfoundland and Labrador should only proceed with guiding principles in mind, particularly, understanding the importance of rare species in the province and restricted introductions of non-native species.

The report is based primarily on two main activities: a detailed literature search providing a review of the development of non-timber forest products from forests around the globe, with emphasis on nutraceuticals, pharmaceuticals, cosmetics, crafts, and food products. A bibliography referencing the articles reviewed is provided in A*ppendix I*. In addition, consultations were held including personal interviews, email correspondence and telephone conversations with 'experts' from Newfoundland and Labrador and other areas of

[5] Sierra Club of/du Canada

the country. These experts are largely representatives of industry and educational institutions.

This report also provides an overview of various non-timber forest product programs and initiatives from research institutions and agencies within Canada and around the world. These are referenced in A*ppendix II*. It reviews some of the most economically valuable non-timber forest products along with some sustainable management practices emerging from regions of Canada including British Columbia, Saskatchewan, Ontario, and Nova Scotia. In Ontario, for example, maple products, berries, mushrooms, nuts, honey, and wild rice are being harvested and sold to local markets as well as exported to countries around the world.

In comparison to other provinces of Canada, Newfoundland and Labrador has not kept pace in the development of its non-timber forest products. There are several reasons why this may be so. Many of the forest herbs, for example, that are harvested in other provinces of Canada are either not found on the island and Labrador, or are at the northern limit of their range. As a result, many botanicals experience lower density and smaller, isolated populations. Maidenhair fern (*Adiantum aleuticum*) for example, is wild harvested in other jurisdictions and used in the floral and craft sector industry, particularly for basket weaving. In this province, Maidenhair fern is considered rare; disjunct to the serpentine areas. Because of its rarity, it is recommended that Maidenhair fern not be harvested from the wild in this province. Wintergreen (*Gaultheria procumbes*) is another example of a non-timber forest product that is harvested from the wild in other areas for its oil. On the island, however, wintergreen is disjunct to the Southwestern region; the population is considered rare, bearing an S1 status (critically endangered). In addition to island populations, some plant species may be susceptible to the high density of non-native herbivores such as moose and snowshoe hare, which may pose a threat to some of some key plant species in this province. Elderberry (*Sambucus pubens*) for example, is found in central and western Newfoundland, and is often harvested for berries as food; also having medicinal value. Because there is little information on the sustainability of this forest botanical and it is browsed by herbivores, it is highly recommended that elderberry only be wild harvested with care.

Tables have been created throughout this report providing summaries of non-timber forest products from each of the following categories: food products, nutraceuticals, pharmaceuticals, cosmetics, and floral and craft products. Tables outlining the potential for

harvest have been included in A*ppendix III*, and products are rated based on the size of population intensity, fruiting yields, stand density, and threats from non-native herbivores. The wild harvest levels are rated as none, low, moderate and good, with high or long term sustainability; medium-term sustainability; low or poor sustainability; and recommended and preferred harvest.

Much of the harvesting of non-timber forest products in this province is done on a personal level and commercial development is limited. Thus, because there is a lack of comprehensive statistical data, the economic value of such products is difficult to measure, and often their overall contribution to the economy is under-estimated. The data contained in this report have been collected from several sources, and as such do not represent a comprehensive analysis.[6] It is intended to serve as a basis for the potential development of non-timber forest products in this province, and as a means to recommend opportunities on which to conduct future research.

A large portion of existing literature regarding non-timber forest products examines issues that are common throughout the world. These issues are primarily concerned with the sustainability of forest plants, and the impact of harvesting on ecosystems. Throughout this report, sustainability issues are examined as they pertain to Newfoundland and Labrador, and the viability of developing a *sustainable* non-timber forest product industry is overviewed. Knowledge gaps pertaining to a potential non-timber forest product industry in Newfoundland and Labrador is explored, as are recommendations for strengthening the development of non-timber forest products within the province. In addition, details of future research needs pertaining to a non-timber forest industry in this province are explored.

Because of the in-depth nature of this project, several objectives outline the terms of reference, and are listed below. Several of these are expected to be carried out over several phases / years, and could involve possible academic projects that would be the basis of a graduate or honours theses at Memorial University of Newfoundland.

- identify concerns pertaining to sustainability issues in both regional and provincial settings
- identify opportunities for research and sustainable development of new non-timber forest products from provincial forests and wildlands

[6] Data collected from various retail outlets, government reviews, and personal interviews, February, 2006.

- conduct a detailed review of research and developments of non-timber forest products from forests around the globe
- place major emphasis on development of nutraceuticals, pharmaceuticals, cosmetics, crafts, and food products
- develop linkages with national and international non-timber forest research institutes and agencies
- conduct applied research into the development of new non-timber forest products
- produce annual reports
- make recommendations for a strategy for the development and fostering of non-timber forest products in the province.

Literature Review:

Since this literature search encompassed forests from around the globe, terms such as 'wild-crafting'; 'wild craft harvesting'; 'ethnobotany'; 'herbalism'; 'agroforestry'; 'speciality food products'; 'value-added industries'; 'cottage industry'; 'forest botanicals'; and 'forest economics' were used to explore research and developments of non-timber forest products.

Many documents including government reports, forestry journals, conference proceedings, and books, etc. were reviewed to examine non-timber forest products from various forests around the globe. The concept of non-timber forest products have emerged in literature such as biology and ecology of the forest, the environment and economic development, economic botany, agroforestry, biodiversity and conservation, as well as forest management and policy. Among the literature, non-timber forest product types, harvesting methods, issues and concerns, as well as recommendations and new developments were key themes, and hence, considerable overlap was found. The recommendation to support the non-timber forest product industry while respecting the need for sustainable forest management was apparent world-wide. While many of the general principals and trends from other regions of the world could certainly be beneficial and transferable to the boreal forest of Newfoundland and Labrador, it is also important to consider preservation issues at the local level. Issues such as type of species, community type, and the type of harvest being proposed are extremely important when considering harvesting of non-timber forest products.

A considerable amount of literature has been published about non-timber forest product harvesting in the United States, and a significant number is also available from most provinces of Canada. Very little literature, however, has been found relating specifically to non-timber forest products in Newfoundland and Labrador. Of the information available, most encompasses small geographical regions, and focus mainly on the economic potential of non-timber forest products, location and documentation of non-timber values. In 2002, for example, the development of a "protocol to use as a guideline framework to identify, analyze, mitigate / enhance, and monitor the socio-economic impacts for resource development projects"[7] was commissioned by the Western Newfoundland Model Forest. The main focus of the impact assessment protocol was aimed at understanding the potential socio-economic

[7] Carreras, Ricardo, A. 2002. Socio-Economic Impact Assessment protocol: A Framework for Forest Resource Development Projects. Western Newfoundland Model Forest, Corner Brook, Newfoundland.

impacts of development projects within the forest resource sector of the economy. Thus suggesting that the development of any resource project need to consider the cost and benefit to the general population, and not just the economic spin-offs. In the case of non-timber forest product development, consideration must be given to the impact of the harvest. Several of these studies pertains to the west coast of the island, in particular, the west coast forest management districts.

In addition, reports from several mushroom forays, held in the Corner Brook area, have been very useful in identifying the availability of mushrooms in that area. Likewise, a smaller mushroom foray in Labrador produced a list of mushrooms common to that area. In addition, a study pertaining to mushrooms common to Terra Nova National Park is currently underway. A report outlining the concept of mushroom harvesting and its importance to community development in the Bonavista district was very useful. A working paper, prepared by the Public Policy Research Centre of Memorial University of Newfoundland in 2001 profiled forest policy and non-timber forest products in Newfoundland and Labrador. This analysis was based on a review of publications and other documents on sustainable forest management and the non-timber forest product industry in Canada and elsewhere. The report overviewed non-timber forest products and identified issues that required further research.

Methodology:

References were obtained through several online database searches including AGRICOLA, ASTIS, CIFOR, FAO, and IBIDS. Due to the volume of materials reviewed and time constraints, much of the search was restricted to articles published within the last 10 years. In many cases, the references provided in each article were also consulted, reviewed and documented if proven relevant.

Information was gathered from a number of sources including books, journals and Internet searches resulting in several hundred articles being reviewed. Many references were obtained from the periodical section of the Queen Elizabeth II Library at Memorial University of Newfoundland. Journals such as *Forest Ecology and Management, The Canadian Journal of Forest Resources*, and *The Journal of Forestry* were used to obtain such articles. In addition, the Centre for Newfoundland Studies at Memorial University also provided access to materials specific to this province. Some of the provincial references were dated; however, they were relevant and proved useful.

As each article was reviewed, it was given an accession number and referenced on a searchable database, using Endnote 9 software. Annotated citations for materials consulted or referenced are provided in *Appendix I*. Each article has an attached profile and includes information such as reference type, record number, author, URL, and research notes.

Attempts were also made to contact experts of non-timber forest products, both within the province and across the country. Consultations including personal interviews, email correspondence and telephone conversations with 'experts' were very useful in obtaining current information. These experts were largely representatives of industry and educational institutions.

In addition, visits to local retail outlets in and around the St. John's area were conducted and information on current market non-timber forest products was gathered.

There are many educational institutions across Canada and the United States that provides professional training in various sectors of the non-timber forest product industry and offers workshops to interested parties. These institutions and agencies are lacking in the Atlantic Provinces, particularly in Newfoundland and Labrador. *Appendix II* lists institutions and agencies that offer education on non-timber forest products.

Introduction:

Canada's Boreal forest is one of the last and largest intact forests remaining in the world, comprising of 1.4 billion acres.[8] Newfoundland and Labrador forms the most eastern section of the Boreal Forest region of North America and comprises of more than 20 million ha. The forest is primarily coniferous (softwood) trees intermixed with hardwoods such as white birch (*Betula spp.*) and trembling aspen (*Populus tremuloides*). The nutrient cycle is slowed by the cool, moist climate of the province, thus resulting in poorly drained soils with limited vegetation biomass and species diversity in comparison to other forest types of the world.[9] Typical of islands, Newfoundland has reduced species diversity compared with similar mainland forests.

The boreal forest offers multiple values including habitat to wildlife and plants, it provides ecological services such as water and air purification, provides sustenance for First Nation communities who hunt and fish, and provides spiritual and recreational value for humans throughout the world.[10]

The forest industry has been fundamental in shaping our society. It provides a wealth of products, and generates billions of dollars annually. Canada generates millions of dollars in the export of traditional timber-based products including lumber and newsprint on an annual basis. In 2004, the forest industry of Newfoundland and Labrador alone, generated over $522.5 million in exports, with more than 95 percent of this revenue from shipments of provincial newsprint. [11]

Non-timber forest products also contribute significantly to the value of the economy and includes foods such as berries, mushrooms, and herbs; medicinal plants that contribute to the nutraceutical and pharmaceutical industries; species that are beneficial to the cosmetic industry; and materials used in the floral and craft products industry.

In many Canadian provinces, non-timber forest products have become an important forest industry. In 2003, for an example, the non-timber forest product industry in Canada was valued at $500 million[12], up from $241 million reported in 1997. In 2004, nearly 500 types of NTFPs were commercially traded in Canada, with food products such as maple

[8] Counting Canada's Natural Capital.
[9] Forest Types: http://www.nr.gov.nl.ca/forestry/ourforest/forest_types.stm
[10] Sierra Club of/du Canada
[11] The State of Canada's Forest: 2004
[12] Provincial Sustainable Forest Management Strategy 2003.

syrup, mushrooms, and berries dominating. Researchers at Canadian Forest Service (CFS), has estimated that the economic output of forest-based foods range from $725 million to $1.3 billion, and it is expected that the future economic potential is between $2 and $7.4 billion per year. [13] The demand for nutraceuticals (natural dietary supplements) had also grown.

In order for these values to be maintained in a sustainable manner, the forest must be managed in such as way that protects their ecological integrity, while allowing for resource extraction that will benefit all people involved. With such conservation issues in mind, the potential for developing a non-timber forest product industry in Newfoundland and Labrador should only proceed with guiding principles in mind, particularly, understanding the importance of rare species in the province and restricted introductions of non-native species.

The growing interest in non-timber forest products is evident in the number of educational initiatives, business developments, and public awareness programs that have developed throughout the country. The development of non-timber forest products in this province, however, is a slow process. While harvesting non-timber forest products from the wild for personal use is a recognized practice throughout Newfoundland and Labrador, statistics on the exact value of these products and the amount collected is very limited. Like many areas of the world, harvesting non-timber forest products in Newfoundland and Labrador, especially for personal use, is not followed closely, thus the potential and real negative impacts of harvesting on habitats and plant species is yet to be determined. Because the industry is largely unregulated, as it is around the world, there are very few rules and policies regarding harvesting. The bulk of data and economic figures accessible, are for cultivars of forest plants, managed as agricultural crops.

As with other provinces, there is an appeal in this province to document non-timber forest products, and promote sustainable growth in this sector. Building on the importance of sustainable forest management, Newfoundland and Labrador have made great progress since 1996. For example, District planning teams have worked to incorporate non-timber values into Forest Management district plans and forest inventories have been expanded to include non-timber forest product information. The *2003 Provincial Sustainable Forest*

[13] Counting Canada's Natural Capital, P.50

Management Strategy continues to foster such success, and has prompted the province to propose to initiate the development of a non-timber forest product industry in this province.

This study has been commissioned on behalf of the Newfoundland and Labrador Forestry Training Association in order to gain an insight into products that have the potential for sustainable commercial development from the forest of this province, and to provide an indication of the commercial value where possible. It also provides an opportunity to identify potential research projects that will form the basis for advanced training, such as graduate and honours degrees, or technology degrees. In doing so, the report will review briefly non-timber forest products that are currently obtained from provincial forest. While this report does not provide a comprehensive list of all the non-timber forest products collected for commercial purpose or for personal use, it does aim to provide an overview of the industry and the potential for sustainable future development.

Food Products:

Many non-timber forest products are harvested each year from forests around the world. Many of the products harvested are forest botanicals that are used personally or are sold as commercial trade in the food products industry. Berries, herbs and mushrooms are among some of the most valuable non-timber forest products being harvested and sold to established markets throughout the world. People around the globe are harvesting and consuming wild berries from the forest and for many, wild berries and fruit have become the natural food of choice. Other food products include essential oils, honey, nuts, seeds, spices, teas and saps.

In many developing countries, wild forest plants comprise a great portion of the daily diet for many people. In central and West Africa, for example, approximately 1,500 species of wild plants are collected for consumption. Oiled seeds, leaves and fruit are among the non-timber forest products which contain many of the necessary vitamins and other nutritional elements for survival.[14]

Many local and regional economies throughout the world are improved by the marketing of edible forest products. In 1995, for example, Austria produced 1,900 tonnes of wild berries, while Finland produced 9,188 tonnes of wild berries, generating $11.5 million to the economy. The most valuable berries were blueberry, lingonberry, referred to as partridgeberry in Newfoundland and Labrador, and cloudberry, referred to as bakeapples in Newfoundland and Labrador.[15] Throughout the United States, the non-timber forest product industry contributes millions of dollars to the economy each year. In the northeastern United States, for example, blueberries, blackberries, maple syrup production, and several species of wild edible mushrooms are harvested on a large-scale commercial basis.

Many provinces of Canada also harvest non-timber forest products as food products each year generating millions of dollars from world markets. It is estimated that more than 149,000 tonnes of wild berries was harvested in Canada in 2004, generating more than $278,000 to the Canadian economy. [16]

In Saskatchewan, fiddleheads, tree sap, berries, and wild mushrooms are harvested annually. Approximately 25,000 pounds of wild blueberries are harvested each year and are

[14] Nontimber Forest Benefits and HIV/AIDS in Sub-Saharan Africa, p38
[15] Non-Wood Goods and Services of the Forest
[16] The State of Canada's Forest: 2004-2005

sold primarily on the fresh market for greater economic gains. The harvest of wild mushrooms including morels, chanterelles and pine mushrooms has developed rapidly in Northern Saskatchewan as well, and is now considered the main non-timber forest product harvested in the region.

In Ontario, maple products, berries, mushrooms, nuts, honey, and wild rice are being harvested and sold to local markets as well as exported to countries around the world, generating millions of dollars into the regional economy.

Berries:

In 2003, 12 commercial blueberry producers existed in this province, with an approximate yield of 605,000 pounds. It is estimated that three times this amount is harvested from the wild in Newfoundland and Labrador. In comparison to the price paid for wild harvest of blueberries, harvesters can generally expect to receive between $1 and $2.50 a pound for fresh product, whereas, producers receive on average of 40-50 cents a pound from processors who export frozen products. [17]

Because the wild harvest of cranberries (*Vaccinium macrocarpon*) can be very inefficient and very destructive to the habitat, it is recommended that these not be wild harvested. Cultivation of the crop was proposed in collaboration with Agriculture and Agri-Food Canada and the Atlantic Cool Climate Crop Research Centre, with the establishment of four commercial sites. Because insect pests invaded and threatened commercial plantings from the wild cranberry in other parts of Canada, one objective of the project was to find out if insect pests were present in the wild berry of this province, posing a threat to commercial development. In 2002, the first commercial cranberries were harvested as a cultivated crop in the province. In 2004, five commercial sites produced 120,000 pounds of cranberries.

The partridgeberry (*Vaccinium vitis-idaea*), known elsewhere in Canada as lingonberry, is widespread in this province, and is widely distributed throughout Canada. Despite its nation-wide distribution, only four areas of the country harvest this crop to varying degrees. In Saskatchewan, First Nations peoples harvest approximately 500-2,500 kg of partridgeberries; harvesters receiving approximately $4.50 (Cdn)/kg, and the product is marketed locally. A small local harvest of partridgeberries exists in Nova Scotia along the Eastern Shore and into Cape Breton Island. In the Goose Bay area of Labrador, residents harvest partridgeberries for personal use. In 1994, Newfoundland processors attempted unsuccessfully to acquire supplies of the fruit from Labrador to meet market demand, however, the price demanded by local harvesters made the acquisition impossible. A problem typical of the partridgeberry harvest each year is the premature harvesting of the fruit. This results in the waste of a valuable resource as much of the immature fruit is often rejected at the processing plant at the opening of the processing season because of poor quality.[18] The island portion of the

[17] An Overview of the Newfoundland and Labrador Agrifoods Industry, 2004
[18] The Wild Lingonberry (Vaccinium vitis-idaea) Industry in North America

province is North America's largest producer of wild partridgeberries. In 2003, approximately 110,000 pounds were produced. Unfortunately, a slight decrease in demand over the past few years may be due to the increased production of the berry in many Scandinavian countries. In Germany and Scandinavia, this berry is grown commercially on farms using cultivars.

In Newfoundland and Labrador, many berry species are considered edible, and with the exception of a limited commercial industry involving the harvest of cultivated berries such as blueberries (*Vaccinium angustifolia*), partridgeberries / lingonberry (*Vaccinium vitis-idaea*), raspberries (*Rubus ididaeus*), cranberries (*Vaccinium vitis-idaea*) and strawberries (*Fragaria spp.*), the wild harvest of such products in this province is difficult to characterize. Few data exist regarding the wild harvesting of such products simply because during the wild berry harvest season, many berries are wildcrafted and sold locally or are used for personal use. Thus, little information is available regarding the number of harvesters involved, channels of distribution and product market, and price paid to harvester. In an attempt to note the value of the wild berry harvest in this province, interviews were held with harvesters, personnel from various retail outlets and members of family-operated businesses.

Harvesters generally sell berries to small family-operated businesses or local restaurants. The most well-known of such edible species are the wild blueberry, partridgeberry and bakeapple. The partridgeberry harvest is similar to that of the blueberry with respect to the wild harvest. Harvesters are generally paid on a cash-basis, based on collected weight. On average, harvesters are paid between $1.00 - $1.50 per pound for blueberries and partridgeberries.

As with many non-timber forest products, fluctuations in yield, and thus price paid to harvesters, are primarily related to environmental conditions such as weather and seasonal values such as late spring frosts. One example of such fluctuation is the harvest of bakeapples. Harvesters can generally expect to receive up to $4.50 per pound, depending on the availability of berries. When supplies become limited at the end of the season, for an example, the price paid to harvesters may increase. According to information provided during the interviews with many business owners, demand often outstrips supply of the bakeapple in this province and as a result, production of speciality products is difficult due to the high cost of the raw product and fluctuating supply. While bakeapples are widespread in this province,

they are more common in the northern regions. Wild collection of bakeapples in the south yields low efficiency. While noted in an earlier report[19], efforts to fully exploit this crop should be investigated, it is recommended that bakeapples should only be wild harvested with care and caution since the impact of wild collection has yet to be determined. Because the harvest of the bakeapple is currently from the wild sector only, it is recommended that cultivation potential of the bakeapple be investigated further.

A continued percentage of the wild berry crops are being utilized locally by commercial berry wine producers and local preserve processors. Local businesses generally purchase approximately 10,000 pounds of each of blueberries, partridgeberries, and bakeapples from the wild harvest sector each year. Berries are purchased from a network of between 100 - 150 local pickers. Because there is a limited fresh market for the berries, many business operators process the berries into value-added products, yielding greater profits. The most common products include preserves such as jams, syrups, and jellies. These products are generally sold in 125 ml, 250 ml, and 375 ml bottles, and can range from $6.00 - $13.00. To meet demands in the tourism industry, often businesses will create gift baskets and other value-added products that retails from $25.00 - $100.00. These speciality products are often sold and shipped to markets throughout Canada, the United States and Europe.[20]

It has been noted that in several areas of the province, it is difficult to meet the market demand for wild harvested berries, and often businesses need to purchase berries from outside the province or purchase frozen berries from larger producers. In one case, for example, bakeapples were imported from Sweden. This often leads to paying above the industry standard for wild berries.

A second obstacle in the wild berry harvest sector as noted by small businesses is the difficulty of securing local harvesters. Often harvesters do not consider the wild berry harvest as a lucrative attraction simply because of the low economic pay-off when compared to the profits incurred by processors, and the time-consuming task of hand-picking the berries. Thus, most harvesters utilize the wild berry harvest as a means to supplement ones income or participate in the harvest as a recreational value in which harvesters gather berries for personal consumption.[21]

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[19] Overview of the Newfoundland and Labrador Agrifoods Industry: 2004
[20] Information collected from various retail outlets and business owners.
[21] Information collected from personal interviews with various business owners

Squashberries (*Viburnum edule*) are deciduous shrubs which grow to 2.5m, and are considered hardy to Zone 5. Squashberries are considered a high quality, palatable, viburnum and are widespread throughout Newfoundland and Labrador. Despite its occurrence, the production of fruit is limited, particularly due to moose browsing, and very low quantities are available on the market. The berry can be eaten raw, cooked, and dried. The fully ripe fruit is mildly acidic with a pleasant taste, and is highly valued for its preserve.

In addition to its value as a food source, squashberries have also been used for its medicinal value. Research indicates that the bark of a squashberry shrub is an antispasmodic and astringent. The bark, stems, flower buds and roots have all been used traditionally for its medicinal value. An infusion of the crushed inner bark for example, has been used in the treatment of dysentery and has also been used as a purgative. Bark and stems has been chewed and the juice used in the treatment of whooping coughs.

While the squashberry does tend to be an exceptional hardy plant, the sustainability of a wild harvest is unknown. Thus, it is recommended that a wild harvest of squashberry only proceed with care and caution. There is potential, however, for cultivar selection of the squashberry, providing excellent opportunities for farming and ensuring a sustainable harvest in this province. In cooperation with post-secondary and research institutions, the propagation of squashberries may contribute to a potentially viable non-timber forest product industry.

Table 1 represents some of the wild edible fruit found in Newfoundland and Labrador. It illustrates species name, common name and the preferred habitat. Not all of the fruit listed is considered viable for a sustainable wild harvest. A more detailed table identifying species of potential wild harvesting is provided in *Appendix III.*

Table 1: Wild Edible Fruit of Newfoundland and Labrador[22]

Species	**Common name**	**Habitat**
Amelanchier spp.	chuckley pear	roadside / streams
Arctostaphylos alpina	alpine bearberry	coastal areas
Arctostaphylos rubra	red bearberry	limestone rocks
Arctostaphylos uva-ursi	evergreen bearberry	exposed heathlands / forest floor
Aronia spp.	chokeberries	heaths / bogs / wet woods
Empetrum nigrum	black crowberry	coastal areas / barrens / bogs
Fragaris spp.	wild strawberry	wood clearings / fields
Ilex verticillata	winterberry holly	swamps / moist woods / stream banks
Juniperus communis	common juniper	woods / fields / heaths
Prunus pensylvanica	pin cherry	roadside / burn-overs
Prunus virginiana	chokecherry	wood clearings / moist areas
Ribes spp.	gooseberry / bristly black currant	open woods / swamps
Rosa nitida	northeastern rose	roadside / woods / streams stream edges
Rosa virginiana	virginia rose	wet thickets / clearings
Rubus spp.	red raspberry / blackberries	roadsides / clearings / thickets
Vaccinium angustifolium	low sweet blueberry	heathlands / bogs / open woodlands
Vaccinium cespitosum	dwarf bilberry	woods / shorelines / talus slopes
Vaccinium nubigenum	newfoundland bilberry	rocky and peaty soils
Vaccinium oxycoccus	marshberry	bogs / fens / wet heaths
Vaccinium uliginosum	tundra bilberry	heaths / coastal peatlands / woods
Vaccinium vitis-idaea	partridgeberry	heaths / barrens / coastal headlands
Viburnum cassinoides	northern wild raisin	clearings / along streams / around ponds
Viburnum edule	squashberry	along brooks / edges of woods

[22] Information collected from Native Trees and Shrubs of Newfoundland and Labrador

Herbs:

Many food products are being sold to established markets throughout the world primarily as flavourings, preservatives, and beverages. In many places, plants are sold for propagation purposes in the form of seeds, potted plants or dried plant parts. Many herbs are used as seasonings to add flavour, aroma, or color to many foods or beverages, while others are harvested as edible greens.

The leaves and roots of dandelion (*Taraxacum officinalis*), for an example, are commonly used in salads and beverages. Dandelion is considered a popular beverage in many European countries, and can be purchased as a carbonated soda. In Canada, dandelion seeds can be purchased for propagation and retails for $1.75 per package; dried root cut for $5 per 25g; dried leaf cut for $8 per 50g; and fluid extract root for $24 per 50ml bottle. Dandelion is also important as a medicinal herb. It has been used in many cultures for hundreds of years to protect against colds and pneumonia, and also as a remedy for liver and kidney ailments. The dandelion is known for its antifungal, diuretic, and nutritive properties. Because of its wide distribution in Newfoundland and Labrador, the wild harvest of dandelion, a naturalized, non-native species, does have potential as a sustainable non-timber forest product industry.

Chickweed (*Stellaria media)* can also be purchased in various forms for propagation. In Canada, chickweed seeds are available for $1.75 per package; dried herb cuts for $60 per 1 kg; or as a fluid extract herb for $10 per 50 ml bottle. The fresh leaves of chickweed are eaten as a delicacy in salads or cooked like spinach.[23] In Newfoundland and Labrador, Chickweed is a naturalized, non-native widespread weed, and wild harvesting of this species is recommended, however, care should be taken, as with any harvest of wild product, to ensure that the plant is not collected from toxic sites.

Table 2 represents several species of culinary herbs that occur throughout Newfoundland and Labrador. Eight of the twenty species listed are naturalized, non-native species and are represented in bold type-face. While some species may have the potential for wild harvest, cultivation of non-native species should be avoided as the effects on habitat and ecosystem are unknown. See *appendix III* for suggestions on potential harvest.

[23] Richters 2006 Herb Catalogue

Table 2: Edible herb species of Newfoundland and Labrador

Species Name	Common Name	Edible Aspect	Habitat
Barbarea vulgaris	winter cress	leaves and flower buds	parking lots and gravel pits
Cakile edentula	sea rocket	leaves or whole young plant	gravel and sandy beaches
Capsella bursa-pastoris	shepard's purse	young plants	disturbed areas
Chenopodium album	lamb's quarters	leaves and stems	gardens, parking lots, and gravel pits
Epilobium angustifolium	fireweed	young shoots	fire disturbed areas
Fern Fiddleheads	ostrich fern	fiddleheads	moist areas as well as heaths and rock barrens
Juniperus communis	common juniper	berries	woods, fields and heaths
Ligusticum scothicum	scotch lovage	leaves and stalks	around the coastline
Mentha arvensis	Mint	leaves	wet areas and edges of streams
Myrica gale	sweet gale	leaves and fruit	wetlands (bogs)
Plantago maritima	seaside plantain	leaves	around the coastline, steep gravel slopes
Rhododendron ledum	labrador tea	leaves	throughout the province
Rumex acetosella	sheep sorrel	shoots	along roadsides and disturbed areas
Stellaria media	common chickweed	young plants	roadsides and grassy areas
Taraxacum oficinale	dandelion	whole plant	most areas of the province
Trifolium spp.	clover	leaves, flowers, seeds	meadows
Urtica dioica	stinging nettle	young shoots	along roadsides and disturbed areas

The herbal tea market continues to grow in this country and around the world. It is estimated that herbal teas make up 25 percent of Canada' tea market, which generates over $390 million. Many of the native plants that are used in manufacturing herbal teas are found throughout Newfoundland and Labrador and may have the potential to provide opportunities for future sustainable development of the tea industry in this province. Plants commercially used in herbal teas are represented in *Table 3*.[24]

Table 3: Plants used commercially in herbal teas

Scientific Name	**Common Name**
Fragaris spp.	Strawberry
Juniperus communis	Juniper
Mentha spp.	Mint
Rhododendron ledum	Labrador tea
Rosa spp.	Rose
Rubus spp.	Raspberry
Taraxacum officinalis	Dandelion
Urtica dioica	Stinging nettle
Vaccinium angustifolium	Blueberry

[24] Information gathered from various retail outlets and health food stores.

Syrups:

Syrups from tree saps are common in many areas of the country, especially the production of maple syrup in Ontario and Quebec from the sugar maple (*Acer nigrum*). Maple syrup is a multi-million dollar industry in central Canada; however, only two trees from the maple family are actually native to this province. Red maple *(A. rubrum)* is native to the island with scattered populations in western and central Newfoundland. Mountain maple *(Acer spicatum)*, while native to the province, also has a scattered population, found most abundantly in the southwestern section of the island and southern Labrador.[25] While red maple is suitable for syrup production, the tapping season for red maple is shorter than that for sugar maple. In addition, because of its scattered population, the potential for maple syrup production and sap collection in this province is relatively poor. Red maple is also a desirable food for the non-native snowshoe hare and moose, and reproduction may be almost completely suppressed in areas of excessive hare populations.[26]

Birch has been important to many cultures for many years. Birch tapping for syrup production is not a new initiative; however, it has not received the market attention that is attributed to maple syrup production. While birch syrup is popular in Alaska and Russia, it is estimated that less than 7,500 litres is produced annually, world-wide.[27]

Three species of birch trees are found throughout Newfoundland and Labrador. Paper birch (*Betula papyrifera)* is found in various habitats throughout the province, but it is most plentiful in central and western parts of the island. It can be found in mixed forests, open woods, cut-over areas, hillsides, and exposed coastal areas. It grows best on well-drained moist soils. White birch is the most common hardwood species in the province. Mountain white birch *(B. cordifolia)* occurs throughout the same range as the white birch in Newfoundland and Labrador. Yellow birch *(B. alleghaniensis* a.k.a *B. lutea*) is found mostly in the rich, moist woodlands. It is not common in Newfoundland occurring south of Deer Lake on the west coast, in the Bay d'Espoir area on the south coast, and in sheltered parts of the Avalon Peninsula.[28]

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[25] Native Trees and Shrubs of Newfoundland and Labrador, Glen Ryan
[26] Acer rubrum: http://www.na.fs.fed.us/spfo/pubs/silvics_manual/volume_2/acer/rubrum.htm
[27] Buy BCWild: 2005 BC Directory of Buyers and Sellers of NTFPs
[28] Native Trees and Shrubs of Newfoundland and Labrador, Glen Ryan

Tapping birch trees for its sugary sap is a challenging process; however it has been a common practice in Alaska, Russia, China, and Scandinavia for many years, with Alaska being the world's largest producer. The method of collecting birch sap is similar to the labour-intensive collection of maple sap. Birch sap differs significantly from maple sap in that it contains glucose and fructose (simple) sugars rather than the sucrose or more complex sugars of the maple. Unlike maple syrup in which 40 gallons of sap will produce 1 gallon of syrup, 100 gallons of birch sap is required to yield 1 gallon of syrup. Birch tapping is a process in which 99 percent of the water has to be removed from the sap, leaving behind only the sugar and its natural nutrients. Thus, birch sap requires more cooking time at low temperature evaporation.

Many factors are important when harvesting birch sap for syrup production. First of all, large numbers of trees are necessary. It is estimated that 100 trees per acre is the minimum tapping size. In addition, factors such as southern exposure, percentage of snow coverage, and proximity to the processing facility are equally important. When taking sap samples to measure sugar content in the spring, it is estimated that sugar content of the sap should be 1 percent or greater. When measuring sap quantity, it is recommended that one gallon per tap is collected each day for 20 consecutive days. In addition, determining the correct time to tap will avoid contaminants and eliminate degradation. Appropriate tapping equipment is required; proper drills and bits as well as sterilized spouts and clean buckets are necessary. Tap-hole locations, site preparations, sap collection systems, and proper transportation should also be carefully considered.

Until recently, no attempt has been made in this province to produce birch syrup on a commercial scale. In 2006, two experimental sites were established for birch sap collection, one on the Baie Verte Peninsula and the second near Millertown in central Newfoundland. Because birch is found throughout Newfoundland and Labrador, the potential does exist for the development of a sustainable harvest of a birch syrup industry in this province. However, because of the knowledge gaps regarding the effect of harvesting on birch trees, such harvesting should only proceed with proper care and responsible collection methods.

Although tapping a tree for sap does not kill the tree, little is known about the effects of the tap-holes on wood quality, decay, and tree vitality. Birch is known to have a shorter life span, thinner bark, and a shallower root system than maple and literature suggest that it may

be more susceptible to damage from tapping.[29] In addition, as with maple, birch is a desirable food for non-native herbivores such as moose and snowshoe hare. Regeneration is often compromised in some areas by browsing of moose and snowshoe hare. Investigating the effect of tap-holes and non-native herbivore browsing on birch trees could provide an opportunity for future research and study.

Table 4 provides a list of plants that occurs throughout Newfoundland and Labrador, and is harvested from the boreal forest in many areas of the world as either commercial or non-commercial edible forest products. The table indicates the scientific name and common name of the species, edible aspect, provincial distribution and the potential for harvest in this province. The potential for harvest is based on three criteria: population density, harvesting techniques, and browsing by non-native herbivores. The table in A*ppendix III* provides reference to native and non-native species, as well as the general status listing in the case of rare plants.

[29] The Alaskan Birch Syrup Producer's Manual

Table 4: Edible commercial and personal use non-timber forest products.

Scientific Name	Common Name	Edible Aspect	Provincial Distribution	Potential Harvest
Acer rubrum	red maple	sap for syrup	west and central island	Poor; population scattered; browsing pressure high
Acorus americanus	sweetflag	roots used as flavouring agent in candy	Southwest Newfoundland	None; rare; restricted population
Amelanchier spp.	chuckley pear	Fruit	Newfoundland and Labrador	Good; widespread population
Angelica atropurpurea	angelica	roots used in condiments	Newfoundland to central Labrador	Moderate on the GNP; Low elsewhere
Aralia nudicaulis	wild sarsaparilla	berries and rhizomes (wine and root beer)	Newfoundland and central Labrador	Low; widespread but low population density; browsing pressure high
Arctostaphylos uva-ursi	evergreen bearberry	Berries	Newfoundland and southern Labrador	Good on the GNP; Poor elsewhere
Betula alleghaniensis	yellow birch	sap for syrup	Newfoundland except GNP	Moderate; population scattered; browsing ..
Betula papyrifera	paper birch	sap for syrup	Newfoundland and Labrador	Good; browsing….
Cardamine pensylvanica	pennsylvania bittercress	young shoots	Newfoundland to central Labrador	Low; widespread but low population
Chenopodium album	lamb's quarters	seeds ground into flour	Introduced to Newfoundland	Low
Chimaphila umbellata	pipsissewa	herb in root beer, berries, dried leaf	Exploits River, disjunct in GNP, Indian Pond area	None; restricted population; rare
Clintonia borealis		leaves	Newfoundland and Labrador	Good
Corylus cornuta	beaked hazel	nut oil in food preparation, nuts (crushed or roasted)	Island except northern region and Labrador	Low; scattered population
Crataegus monogyna	hawthorn	berries	Introduced and uncommon on island	Low
Empetrum nigrum	crowberry / blackberry	berries	Newfoundland and Labrador	Good
Epigaea repens	mayflower	leaves, flowers	west, central, and southern Newfoundland and southern tip of Labrador	Moderate; west coast; Low elsewhere – also one of the plants that is slow growing
Fragaria vesca	wild strawberry	berries	Newfoundland except GNP	Good
Fragaria virginiana	common strawberry	berries	Newfoundland and Labrador	Good
Gaultheria hispidula	creeping snowberry	berries, oil in flavouring	Newfoundland and Labrador	Moderate; low berry yields
Gaultheria procumbens	wintergreen	berries, leaves, oil in flavouring, chewing gum, candy, and toothpaste	Sandy areas in central, west and south Newfoundland	None; population rare
Heracleum maximum	cow parsnip	first-year root; young sprouts (cooked)	Newfoundland to central Labrador	Good
Juniperus communis	common juniper	fruit to flavour gin and other cordials	Newfoundland and Labrador	Good
Lathyrus maritimus	beached pea	Seeds	Newfoundland and Labrador	Moderate; ocean areas

Ligusticum scothicum	scotch lovage	stems and leaves	Newfoundland and Labrador	Good
Lonicera villosa	northern fly honeysuckle	berries	Newfoundland and Labrador	Moderate; scattered population and low berry yield
Matteuccia struthiopteris	ostrich fern	young shoots (fiddleheads) steamed	Southwest Newfoundland and GNP	Good; widespread population – but low density!
Mentha spp.	mint	leaves	Native and introduced species Newfoundland and Labrador	Good; river areas
Mitchella repens	Two-eyed berry	berries	mossy bogs of south-western Newfoundland	None; population rare
Monotropa uniflora	indian pipe	whole plant	Newfoundland to central Labrador	Low; scattered population
Picea mariana	black spruce	leaves in spruce beer	Newfoundland and Labrador	Good
Pinus strobus	white pine	inner bark, seeds	Newfoundland except GNP	Low; scattered population
Plantago major	Common plantain	young leaves	Introduced to Newfoundland	Low; scattered population
Prunus pensylvanica	pin cherry	fruit (jams and preserves)	Newfoundland except northwest and Labrador except northern regions	Moderate; browsing….
Ribes hirtellum	smooth gooseberry	berries	Newfoundland	Good
Ribes lacustre	bristly black currant	berries	west, central and northern Newfoundland; southern and central Labrador	Low
Ribes triste	swampy red currant	berries	western Newfoundland and GNP; southern and central Labrador	Good
Rosa spp.	rose	hips	Newfoundland	Cultivation research underway
Rubus spp.	raspberry, bakeapple	beries (preserves and distilled liqueur)	Newfoundland and Labrador	Good
Sambucus pubens	red elderberry	berries (preserves and wine)	Central and western Newfoundland	Good; browsing …
Shepherdia Canadensis	soapberry	fruit	Limestone areas of west, north and central Newfoundland and disjunct in northern Labrador	Good in GNP and west coast
Smilacina racemosa	false soloman's seal	berries	western Newfoundland	None; population rare
Sorbus americana	american mountain ash: dogberry	ripe berries in juice or ground for flour	Newfoundland	Good; browsing….
Sorbus decora	Showy mountain ash: dogberry	berries	Newfoundland and Labrador	Good; browsing…
Stellaria media	chickweed	plant	Introduced Newfoundland and Labrador	Good
Taraxacum officinale	dandelion	roots roasted and ground as coffee substitute, spring leaves, seeds, entire plant used in brewing	Introduced Newfoundland and Labrador	Good

		beer, leaves boiled		
Urtica dioica	stinging nettle	young plants (cooked)	Introduced Newfoundland and Labrador	Low; population declining
Vaccinium angustifolium	lowbush blueberry	berries	Newfoundland and Labrador	Good
Vaccinium macrocarpon	large cranberry	berries	Newfoundland	Good
Vaccinium ovalifolium	Bilberry / mathers	berries	West, central Newfoundland , GNP and southeast Labrador	Low; widespread but low fruit yield
Vaccinium oxycoccos	small cranberry / marshberry	berries (tart preserves and juices)	Newfoundland and Labrador	Moderate
Vaccinium uliginosum	alpine bilberry	berries	Newfoundland and Labrador	Low; low fruit yield
Vaccinium vitis-idaea	partridgeberry	berries (preserves and wine)	Newfoundland and Labrador	Good
Viburnum edule	squashberry	berries	Newfoundland and Labrador	Low; population scattered; browsing….
Viburnum nudum var. cassinoides	northern wild raisin	berries	Newfoundland, rare on GNP	None; population rare on GNP; Good elsewhere; browsing…
Viburnum opulus var. americanum	highbush cranberry	berries	Newfoundland	Low; population scattered; browsing…

Mushrooms:

Mushrooms are the visible, fruiting-body, reproductive or spore-bearing structures produced by some species of fungi. Mushrooms are often collected for its medicinal value; however, wild mushroom harvesting is a lucrative food industry in many areas of the world, notably Japan, the United States and Canada, primarily in British Columbia and Northern Saskatchewan. In Northern Saskatchewan, for example, wild mushrooms are the main non-timber forest products being harvested, and many people earn a large portion of their income from the harvest. In 2000, for example, harvesters earned more than $1 million. [30] In many European countries, the harvest of mushrooms appears to be dominated by personal use; however, commercial demand appears to be increasing in Europe. In 1995, for example, Finland harvested $875,000 in edible mushrooms, while in 1992; the Pacific Northwest harvested approximately $41,100,000 in edible mushrooms. [31]

Mushrooms cover a wide variety of species; however, most research on edible mushrooms has concentrated primarily on morels, chanterelles, boletes, and pine mushrooms.

Commercial harvesting of mushrooms typically involves the harvester, buyer, mushroom company and exporter. Harvesters sell the mushrooms to buyers, who are often employees or contractors of the mushroom company. The company performs the cleaning, packaging and processing operations, and distribution of the mushrooms to market. These companies aid in establishing prices, while exporters establish domestic and international marketing.

The collection of wild mushrooms and the amount paid to harvesters may fluctuate throughout the season. As with many non-timber forest products, fluctuations in yield are primarily related to weather and seasonal values as well as the price paid to harvesters. In good years, harvesters have earned over $1million in harvesting wild mushrooms. The fluctuation in price often means higher prices in times when few mushrooms are available, and a decline in price as the availability of mushrooms increase. Despite the commercial interest in wild mushroom harvesting, domestic markets are not well developed, and like

[30] Online article: http://www.agr.gov.sk.ca/docs/crops/northern_agriculture/non-timberprod.asp
[31] Non-Wood Goods and Services of the Forest

domestic wild berry harvesting, the industry is often difficult to characterize simply because there are very little statistics available for the domestic market.

As with many other non-timber forest products in this province, with the exception of *species type inventories*, very little formal study has been completed on mushroom harvesting to determine whether or not such an industry could potentially be viable and sustainable in this province.

In 1992, a preliminary investigation of the potential for a wild mushroom harvest in Newfoundland was conducted by the Department of Biology, Memorial University of Newfoundland. This study particularly investigated the potential for such a harvest on the Bonavista Peninsula and the Deer Lake region.

Four species of edible mushrooms were investigated including chanterelles (*Cantherellus cibarius*); pine mushrooms (*Armillaria ponderosa*); King bolete (*Boletus edulis*); and morels (*Morchella esculenta*) The study comprised of two parts, with the first part involving compiling data to identify mushroom harvesting practices in the study areas as well as to identify potential habitats for edible mushrooms in these regions. The second portion of the investigation focused on collection and identification of mushrooms.

Results of the Bonavista and Deer Lake study indicated a limited collection of wild mushrooms, particularly chanterelles by locals who harvested primarily for personal consumption.

Based on the past study and recent interviews conducted with local business owners in the St. John's area, there is very limited commercial harvest of wild mushrooms. Few restaurants and speciality shops purchase fresh wild mushrooms during the harvest season. However, similarly to the wild berry harvest, records do not exist to indicate the level of harvest.

Several years ago, a commercial harvest of wild edible mushrooms existed in the White Bay area. The local business employed 60 harvesters during the picking season. During the peak season, harvesters would collect 125 – 200 pounds of edible mushrooms each day. While an established market in Germany and Boston did exist, the business eventually closed because of unsecured funding to establish a canning facility in the province.[32]

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[32] Forest Policy and Non-Timber Forest Products in Newfoundland and Labrador

In recent years, mushroom forays have been held in the province, primarily on the west coast of the island as a means to inventory mushrooms that exist in Newfoundland and Labrador. The first provincial mushroom foray was held in Gros Morne National Park in 2003 and was the first step in surveying the province to develop a province-wide mushroom species list. The event was jointly sponsored by the Department of Tourism, Culture and Recreation, The City of Corner Brook, Gros Morne National Park, and the Western Newfoundland Model Forest, and gave way to subsequent forays in 2004 and 2005, as well as a first for Labrador.

During each foray, small groups foraged for mushrooms on selected trails within the park. All specimens collected were documented using collecting slips, and attempts were made to identify each species. In 2005, the foray revealed more than 300 identified mushrooms, 208 were identified from Gros Morne National Park, while 144 were identified from Labrador, with an overlap of 43 species. 57% of the species identified were new to the forays, thus bringing the cumulative list of provincial mushrooms to over 450 species.[33] *Table 5* provides a list of mushrooms that were common to the Gros Morne National Park area and Labrador.

A preliminary survey of mushrooms contained within protected areas[34] on the Avalon Peninsula was conducted in September, 2005 to determine which trails might be suitable for a 2006 Mushroom Foray on the Avalon Peninsula. The results of this initial survey revealed 99 identified mushroom species.

A study to map mushroom distribution in Terra Nova National Park is currently underway.

A personal interview was recently conducted with mushroom harvester, Mark Wilson, former owner and operator of Fung Kee: Medicinal Mushrooms, Wildcrafting, and Urban Food Concepts, who relocated to St. John's, Newfoundland in 2004 to continue his study of mushrooms at Memorial University. Mark, who is also interested in Organic Farming, brings a wealth of knowledge to the province from his 10 years of experience in the mushroom business. He believes that a sustainable commercial mushroom industry has tremendous potential in Newfoundland and Labrador. Through his experience in the development of both

[33] Mushroom Foray Report: 2005

[34] Results of the study limited to Butter Pot and Le Manche Provincial Parks, Salmonier Nature Park and Cape St. Mary's Ecological Reserve.

the wild gourmet and medicinal mushroom industries across North America he has made contacts with both buyers and harvesters in New England, Europe, Asia, and throughout Canada. He has been a guest lecturer at Trent University where he has discussed fungal diversity and other non-timber forest products.

While there may be potential for a sustainable mushroom harvest in this province, knowledge gaps continue to exist and there is a need for further exploration and research. The harvest and identification of wild mushrooms can be very challenging thus educational workshops and proper training for amateur harvesters is vitally important. In addition, information on the ecology of wild mushrooms is still lacking, and scientific research regarding the diversity and biomass is essential in order for a sustainable harvest to exist. Harvesting regulations are very important in order to maintain a sustainable harvest. In British Columbia, for an example, mycologists, ecologists, and members of the general public were concerned about the impact of harvesting on the forest environment and conflict among industry groups. The Forest Practices Code of the British Columbia Act enables the future development of licensing regulations for botanical forest products and establishes objectives for protecting rare and endangered plants and fungi. In the United States, commercial harvest of botanical forest products from federal forested land requires strict adherence to regulations. Harvesters, for example, must obtain permits in order to harvest such products.[35]

[35] Botanical Forest Products in British Columbia: An Overview

Table 5: Wild Mushrooms of Newfoundland and Labrador[36]

Species Name	**Habitat**	**Distribution**
Boletus edulis	under conifers or mixed conifer-hardwoods	Newfoundland
Cantharellus cibarius	under hardwoods and mixed woods	Newfoundland
Clavariadelphus truncatus	under conifers in needle litter	Newfoundland
Clitocybe clavipes	under conifers or mixed woods	Newfoundland & Labrador
Clitopilus prunulus	scattered in open woods	Newfoundland
Cortinarius violaceus	on ground in northern evergreen forests	Labrador
Fuscoboletinus spectabilis	under eastern larch in bogs in Northeast	Newfoundland & Labrador
Lactarius camphoratus	on the ground or rotting wood	Newfoundland
Lactarius deliciosus	scattered under conifer forests	Newfoundland
Leccinum scabrum	under aspen and birches	Newfoundland & Labrador
Mycena galericulata	decayed logs and stumps of hardwoods	Labrador
Pholiota aurivella	living trunks and logs of hardwoods and conifers	Newfoundland
Pholiota squarrosoides	on hardwoods	Newfoundland
Polyozellus multiplex	under conifers, often in blueberry patches	Newfoundland
Rozites caperata	mixed conifer-hardwood or conifer stands	Newfoundland & Labrador
Russula brevipes	under conifers or mixed conifer-hardwoods	Labrador
Russula paludosa	under mixed hardwoods and conifers	Newfoundland & Labrador
Tricholomopsis rutilans	on conifer logs and stumps	Newfoundland

[36] Mushrooms with a Newfoundland distribution refer to those common in the Gros Morne National Park area.

Nutraceuticals and Functional Foods:

Nutraceuticals are natural, *bioactive chemical compounds* (substances that have an effect on living organisms) that have health promoting, disease preventing or medicinal properties.[37] In Canada, natural health products are also referred to as complementary medicines or traditional remedies, and are subject to the *Food and Drugs Act and Regulations*. Throughout the world, the regulation of natural health products varies. Generally they are regulated as drugs in the European Union countries. Australia has recently classified many of these products as complementary medicines and has made legislative and regulatory changes to regulate these products as a subclass of 'therapeutic goods'. In the United States, many natural health products are regulated as 'dietary supplements', a category that does not require pre-market review or proof of safety by the manufacturer before marketing, and is not permitted to make treatment-cure claims.[38]

More and more Canadians are using natural health products or nutraceuticals on a regular basis because of their role in promoting health and disease prevention; however the efficacy of many of these bioactive chemicals has not been tested by Health Canada. Nutraceuticals are found in a number of products emerging from the food industry, herbal and dietary supplement markets, and the pharmaceutical industry. These products are available in retail outlets and health stores in many forms, including vitamins and minerals, herbal remedies, homeopathic medicines, traditional medicines, *probiotics* (a substance that contains microorganisms claiming to be beneficial to humans and animals or to promote their growth), and other products such as amino acids and essential fatty acids.[39] Within Canada, nutraceuticals are isolated from conventional and functional foods, they are available over-the-counter, and are sold in dosage form in various forms including tablets, capsules, powder, and liquid extract. Unlike, pharmaceuticals, a prescription is not required to purchase nutraceuticals; however, consultants are usually available to offer advice on any product or literature is provided for personal perusal.

Functional foods are similar to conventional foods; however, functional foods may contain components such as dietary fibre, soy protein, flavonoids, and fatty acids. Scientific research indicates that these components may provide a health benefit beyond basic

[37] The Nutraceuticals Institute
[38] Health Canada
[39] Health Canada: Natural Health Products Regulations, January, 2004

nutrition.[40] According to Health Canada, functional foods are similar in appearance to a conventional food, consumed as part of the usual diet, with demonstrated physiological benefits, and / or to reduce the risk of chronic disease beyond basic nutritional functions.[41] Examples include unmodified foods such as fruits and vegetables, as well as modified or fortified and enhanced foods. The interest in healthy diets and lifestyles has increased the demand for functional foods, and according to recent research, is among one of the fastest growing segments of the food economy, exceeding more than $10 billion annually in the United States. *Table 6* provides examples of functional food sources along with dietary components and potential benefits.

Table 6: Functional Food Components and Potential Benefits[42]

Component(s)	**Source(s)**	**Potential Benefit(s)**
Dietary Fiber		
Beta glucan	oat bran, rolled oats	may reduce risk of coronary heart disease (CHD)
Whole grains	cereal grains	may reduce risk of CHD and cancer
Fatty Acids		
Monounsaturated fatty acids	tree nuts	may reduce risk of CHD
Omega-3 fatty acids	tuna and fish oil	may reduce risk of CHD
Flavonoids		
Anthocyanidins	berries, cherries	bolster cellular antioxidant defenses
Flavonols	tea	neutralize free radicals which may damage cells

While people have used medicinal plants and herbs and have relied on traditional medicines for years, Health Canada introduced the *Natural Health Products Regulations* on January 1, 2004. These new regulations will be phased in over the next six years, and will ensure that natural health products are safe and effective to use. The regulations include provisions on product licensing, site licensing, good manufacturing practices, adverse reaction reporting, clinical trials, and labelling. Products that fall within these regulations include herbal remedies, homeopathic medicines, vitamins, minerals, traditional medicines, probiotics, amino acids, and essential fatty acids. Natural health products or nutraceuticals does not require a prescription for purchase, however, under the new regulations; natural health products that have been approved for use will either have a *Natural Product Number*

[40] International Food Information Council Foundation, February 2004.
[41] Health Canada, 2006
[42] IFIC Foundation, February 2004

(NPN) or *Drug Identification Number-Homeopathic Medicine (DIN-HM)* on the label[43]. While the intent for nutraceuticals is to promote health, consumers should be aware of the possibility of side effects. Many medicinal compounds are used as folk or home remedies and include many varieties of herbs to make teas, oils and other products which are alleged to have health benefits or healing effects on many common ailments. Some of these products may not actually contain real medicinal properties but have been on the market for many years, and continue to provide economic opportunities for many harvesters of non-timber forest products.

In November, 2005, as part of an international strategy on traditional medicines, the World Health Organization (WHO), in partnership with Health Canada, held consultations in Ottawa on the harmonization of the regulation of herbal medicines. This strategy was established in 2002 in response to a number of global factors and concerns regarding traditional and alternative medicines, such as safety, efficacy, quality, availability, preservation and future development. A key outcome of the 2005 consultation process was the establishment of the "International Regulatory Cooperation of Herbal Medicines" network (IRCH). This new organization will act as a forum to support dialogue and discussions between agencies which regulate herbal medicine, with the overall aim of supporting the safety and quality of herbal medicines across the world.

The natural health products sector continues to grow rapidly due to consumer interest in products that are derived from natural sources. In this province, research involving nutraceutical development is evident and exists on a limited scale. In 1998 and 1999, a St. John's business was awarded a contract to supply a quantity of St. Johns Wort (*Hypericum perforatum;* non-native to the province) to Bioriginal Food and Science Corporation in Saskatchewan for medicinal purposes. The herb was harvested from the wild, dried, and then shipped across the country in bulk.

At present, research involving the development and trials of ENNAID herbal oil for various skin ailments, is underway. The project examines the possibility of St. John's Wort combined with the Greater Celandine Poppy (*Chelidonium majus*) to create an oil formula that would help psoriasis. Both herbs have been traditionally used for healing various skin problems including leprosy, warts, and corns. Both herbs have been traditionally recognized

[43] Health Canada: http://www.hc-sc.gc.ca/iyh-vsv/med/nat-prod_e.html

for their antifugal and antiviral properties. Thus far, the oil has shown positive results in treating a variety of skin ailments including psoriasis, dry skin, fungal nail disease, cuts, calluses, burns, acne, insect bites, and warts, including difficult planter's warts. While St. Johns Wort grows profusely on the Avalon Peninsula, the Greater Celandine Poppy must be cultivated as it is not known to have been used or grown in Canada as a medicinal herb. [44] Further research to investigate the growth patterns and ecological properties of the greater celandine poppy to determine the possibility of potential escape and the impact it may have on native species is necessary.

In keeping with nutraceutical development, research to investigate the chemical, bioactivity and antioxidant properties of various bioactive compounds from wild rose hips from Atlantic wild roses (*Rosa virginiana, R. nitida* and *R. carolina*) is being conducted in Atlantic Canada.[45] While the research is centred at the University of Prince Edward Island (UPEI), Memorial University of Newfoundland (MUN) Botanical Garden is involved in the potential commercial production of native rose hips (*Rosa virginiana* and *R. nitida*) as sources of health protective and disease prevention constituents.

Roses and rose hips have been used for centuries. Traditionally, roses have been used in perfumery, decorative floral arrangements, food products, and as a vitamin supplement, and are well accepted and recognized by the public. Until recently, the native wild roses of Atlantic Canada remained an untapped resource. In 2003, Memorial University of Newfoundland (MUN) Botanical Garden partnered in the Atlantic Canada Network on Bioactive Compounds (ACNBC)[46], a five-year research initiative, funded by the Atlantic Innovation Fund and several private and public partners. The project was established to identify and pursue commercial applications for health products from the development of wild rosehips, particularly the antioxidant activity and vitamin C levels. This research will lead to an investigation into the development of a rosehip powder that could be commercially developed and produced in Atlantic Canada and for sale on a global market.

The Atlantic Canada Network on Bioactive Compounds is also currently investigating the health-benefiting oxidants properties of various compounds in wild blueberries. Earlier studies have indicated that wild blueberries are high in *antioxidants* (help to protect against

[44] Based on personal interview, March 2006
[45] http://www.gov.pe.ca/200years/index.php3?number=80095&lang=E
[46] http://www.upei.ca/acnbc/html/about_acnbc.html

cell damage that can lead to cancer and heart disease). In an earlier study conducted by Agriculture and Agri-Food Canada in Kentville, Nova Scotia, researchers examined the difference between wild and cultivated blueberries. The results of this study revealed that wild blueberries were higher in antioxidant quality. The goal of the current ACNBC wild blueberry project is to advance understanding, establish evidence and develop intellectual property and commercial products and services related to the health-protective and disease-prevention properties of wild blueberries and wild blueberry fractions.[47]

The increasing pressure on wild stocks of plants used in traditional medicine emphasizes the need to address sustainability issues. Medicinal herbs, not native to the province, such as Echinacea, Goldenseal (elaborated on in the pharmaceutical section of this paper), Ginseng and St. John's Wort have also been selected and trialed by the Agrifoods Department of Newfoundland and Labrador. The invasive potential of each of these species was screened prior to their use as crops.

Echinacea (*Echinacea angustifolio*) is considered by many herbalists as an effective antibiotic. It is a popular medicinal herb that has become one of the top selling herbs in the United States and Canada. While much has been written about Echinacea, most of the literature from the past ten years has focused on the immuno-stimulant properties of the plant. Studies suggest that Echinacea is slow to germinate, rarely exceeding 50%, however certified seeds are available in many herbal catalogues, and selling price range from $2.50 per package to $600 per 1kg, Canadian.

Ginseng (*Panax ginseng*) is probably the most widely recognized plant used in traditional medicine. Ginseng is native to China, Russia, Japan and some regions of North America. Ginseng contains vitamins A, B-6 and the mineral Zinc. Because of its popularity in increasing mental and physical efficiency and resistance to stress and disease, it has suffered persistent harvest and poaching by some harvesters in some regions. In Appalachia Ohio, for example, approximately 30 tons of Ginseng was illegally harvested in one year. Ginseng has been listed under Appendix II of CITES since 1973, and was designated "*threatened*" in 1988 by COSEWIC. In spite of restrictions on international trade, high rates of collection continue

[47] http://www.upei.ca/acnbc/html/blueberry_project.html

to exist, and there have been significant losses of populations over the last decade. COSEWIC confirms the status of Ginseng in Canada (as of May, 2000) as "*endangered*". [48]

Table 7 provides a list of species that are used commercially as medicinals, and may have the potential for a sustainable harvest in this province, given pertinent knowledge of species ecology, community ecology and sustainable harvest.

One such example is Chaga (*Inonotus obliquus*). Chaga is a folk remedy presumed to have anticancer properties, and has been used in Russia and the Far East for hundreds of years. Chaga is a northern fungus that grows on birch, alder and beech trees. It is often known as a birch mushroom and polyspore. Since 1955, a refined extract of the chaga fungus has been manufactured and sold in Russia, Eastern Europe and Japan for the treatment of stomach related illnesses. For years, it was ignored by western pharmacologists; however, chaga is currently experiencing resurgence as a possible treatment for a wide variety of diseases.

There is now scientific research to support the claims of the folk medicine. Recent work conducted by a pharmacognycist at the School of Pharmacy, University of Helsinki, Finland have indicated that chaga contains high levels of *antioxidants* (compounds with a theoretic anticancer activity), particularly *inotodial*. It also contains compounds alleged to strengthen the immune system. The fungus is rich in oxygenated triterpenes, obliquol, lanosterol as well as some other sterols. The compound *betulin* was also reported present. Betulin is actually a compound that has anticancer properties found in birch trees. The chaga fungus absorbs and concentrates the betulin from the birch and transforms it into a form that can be ingested orally. Other researchers have found active polysaccharides, a common occurrence in most medicinal mushrooms such as miatake and shitake. Those polysaccharides are known to stimulate the immune system. In Japan, for example, researchers have found similar antiviral activity, but also discovered that chaga shows activity against HIV. Chaga has also been classified as a medicinal mushroom under World Trade Organization (WTO) codes.

In March, 2006, a chaga foray was held in the Humber Valley region of Newfoundland and Labrador. Results of the foray are not yet available.

[48] COSEWIC assigns the status of wild species suspected of being at risk.

Pharmaceuticals:

Pharmaceuticals are natural or artificial substances that are given as medicine to treat, prevent, or diagnose a disease or to lessen pain.[49] There are many forest plants and fungi that are commonly synthesized to produce chemical compounds that can be used medicinally. Common compounds include complex acids, lactones and anthocyanins. Pharmaceuticals differ from nutraceuticals and functional foods in that they require a prescription from a physician, and are regulated under the *Food and Drug Regulations*. It is estimated that more than 120 prescribed drugs are derived from 95 plant species worldwide, and approximately three-quarters of these selected are based on ethnobotanical use.[50] *Ethnobotany* is the scientific study of the traditional classification and uses of plants in different human societies.[51] Many forest plants have been used for their medicinal value for many years. In Sub-Saharan Africa, for example, health care is largely a forest-based service. The forests and trees are valued for their supply of medicinal products and plant-based remedies are used increasingly in that region to treat illnesses related to HIV/AIDS.

There are many reports that caution the extraction of non-timber forest products from the forest, especially of medicinal plants. It has been noted that plants used for medicinal purposes are harvested more than any other product from the natural world. China, for example, is home to approximately 24,000 native species, with more than 10,000 of these being used medicinally. It is also estimated that 50,000 species of plants are used medicinally throughout the world. Many of which are used as folk medicines. Unfortunately, wild harvested plants are frequently harvested with little regard for the environment and the long-term viability of the species being harvested; with the result of non-sustainability of the target plant.

One such example is Goldenseal (*Hydrastis Canadensis*). Goldenseal was historically used by North Americans for medicinal purposes. As urban areas, agricultural areas and roads expanded, it caused a decline in the goldenseal population in many areas of North America. The increased fragmentation, coupled with the unsustainable collection of roots and the plants sensitivity to soil disturbance has caused the wild population of goldenseal to

[49] Encarta Dictionary: English (North America)
[50] Joyce, 1991
[51] Encarta Dictionary

further decrease. With the advent of modern medicine and technology, the growing awareness of possible medicinal benefits of goldenseal continued to increase worldwide consumption, reducing wild populations even further. Goldenseal has been found to have antibiotic, anti-inflammatory, antispasmodic and tonic effects. The usefulness of the plant has led to excessive collection, resulting in the listing of goldenseal under CITES[52] since 1997, thus banning cross border importation of this species. It is estimated that only 1,000 – 5,000 populations of goldenseal exists globally, with the many local populations harvested to extirpation. Because of the potential pharmaceutical properties, and the increased pressure for identifying and quantifying active constituents of goldenseal such as berberine, canadine, and hydrastine, the demand for cultivated roots has increased as wild populations become scarce. This demand has initiated various research programs including propagation and cultivation techniques in order to reduce the strain on wild populations.

In recent years, modern technology has enabled pharmaceutical industries to synthesize chemical compounds, thus leading to new discoveries such as the anticarcinogen, taxol, and anti-inflammatory, betulin. These new discoveries have once again renewed interest in the chemical composition of wild plants, leading to extensive over-harvesting and unsustainable harvest practices of such plants.

Taxol, an anticarcinogen was initially extracted from the bark of the Pacific yew (*Taxus brevifolia*) in the 1960's, and since that time has been used as an anti-cancer drug. Taxol has been sold by Bristol Meyers Squibb (BMS) for clinical use since 1992. The Pacific yew and taxol is a compelling example of the unknown values in forests. However, like many naturally derived products, harvesting in the wild can quickly exceed sustainable levels. Uncontrolled and unregulated harvesting has resulted in serious over-harvesting of wild populations of most yew species worldwide. Taxol has been chemically synthesized and semi-synthetic versions have been developed from other yew species grown in agricultural settings. This has been reducing the pressure on natural stands of the *Pacific yew*; however bark is still being used for paxol production. This has resulted in extensive over-harvesting of Pacific yew and even loss of local populations.

Aboriginals have used Canada yew *(Taxus canadensis)* for medicinal purposes for generations. In recent years, as Pacific yew began to decrease, Canada yew, also known as

[52] Convention on International Trade in Endangered Species of Wild Fauna and Flora

Ground hemlock has undergone extensive harvesting in eastern Canada for its constituent, taxol. As the demand for biomass began to increase, as with the case of Pacific yew, wild populations of Canada yew began to decrease. With decreasing numbers of yew in the Maritime Provinces, biopharmaceutical companies began to seek harvesting the yew in Ontario.

In 2003, taxane products registered worldwide sales in the amount of $4.2 billion US. With sales expected to continue to climb, concerns began to arise that if not managed correctly, the increased interest in harvesting Canada yew may affect the sustainability of this species.[53] Because Canada yew may be the world's last untapped source of yew biomass, harvesters, pharmaceutical companies, and governments in Atlantic Canada has taken precautions to ensure this resource does not become depleted.

In 1997, scientists at the Canadian Forest Service – Atlantic Forestry Centre in Fredericton, New Brunswick initiated a research program which focused on the conservation of Canada yew. The domestication project was designed to improve taxane yields in the cultivar selection, nursery propagation with rooted cuttings, intensive nursery culture, tissue culture and methods to increase taxane yields.[54] As part of this research, harvesting guidelines have been developed using results from pruning trials conducted by the Eastern Canadian Ground Hemlock Working Group.[55] Since the first draft of guidelines was released in 1999, several revisions of such guidelines have been released. The number of revisions reflects efforts to incorporate new knowledge and information as soon as it has become available.

Many plant species have a worldwide distribution, and biomass containing the same bioactive compounds may be collected throughout the world. However, to avoid over-harvesting, as in the case of the *Pacific yew*, should demand outstrip the supply, cultivation as a conservation measure may have potential. Species such as evening primrose (*Oenothera biennis*), and cranberry are examples of plants that have been cultivated to replace wildcrafting, thus reducing strain on wild populations.

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[53] Ontario Woodlot Association
[54] Building Partnerships for the Sustainable Management of Non-Timber Forest Products
[55] The Eastern Canadian Ground Hemlock Working Group is comprised of representatives from the federal government, the provincial governments of Quebec, New Brunswick, Prince Edward Island, Nova Scotia and Newfoundland, ENGO and the private sector.

Research and conservation groups such as Plantlife International and TRAFFIC have brought attention to challenges posed by over-harvesting of medicinal plants throughout the world. Over-harvesting of forest plants is threatening sustainability of non-timber forest products in many countries. Factors that contribute to the vulnerability of forest plants include the rate of growth, rare habitat, multiple-purpose use, and popularity in the market place. Over-harvesting can lead to local extinction, loss of genetic diversity and habitat degradation, especially when the key species affects other species in the habitat.

There is much research currently underway throughout the world to improve the sustainability of non-timber forest products, especially medicinal plants. A program funded by the Forestry Research Program of the UK, for example, is currently underway in India and Nepal to evaluate methods for the sustainable harvesting of medicinal plants. This research involves monitoring the effects of new methods of collection and managing the select species. The Foundation Revitalisation of Local Health Traditions in India and ForestAction in Nepal work with local community groups to establish and monitor the health and yield of medicinal plants in trail plots in forests. Task teams have been established to help with the research, including monitoring and inspection of selected sites. Because this research is still relatively new, few results are available.

Companies which purchase medicinal plants and manufacturing agencies are becoming more concerned about how and where plants have been harvested. Thus, there is a growing need to trace the harvest of medicinal plants from the harvester. This traceability has been identified as a means of introducing more sustainable harvesting practices. In south-eastern Europe for example, purchasing companies are more directly connected with the harvesters, and are in a good position to influence how the plants are harvested. Training programs in sustainable harvesting practices have also been developed for employees of such purchasing companies. These programs include information on harvesting techniques, social requirements such as the need to have a responsible person for each harvest area, and organic certification.

Developing sustainability standards (labelling) for wild harvested non-timber forest products is currently being investigated by the UN Conference on Trade and Development. To date, this group has established principles, criteria and indicators for its *BioTrade* Initiative. BioTrade refers to those activities of collection, production, transformation, and

commercialisation of goods and services derived from native biodiversity under the criteria of environmental, social and economic sustainability.[56] As a result of a workshop held in Vienna in 2005, a project to produce a new "International Standard for the Sustainable Wild Collection of Medicinal and Aromatic Plants" was initiated. A draft of this document covers issues such as product quality, Fair Trade, and sustainability. Recommendations to further develop this document have been suggested. [57]

A number of plants in this province has been identified as having potential for its medicinal and pharmaceutical value, and are recorded in *Table 7*. This table summarizes this information based on species and medicinal value. The table provided in Appendix III provides information on plants potential for harvest and includes provincial distribution.

[56] BioTrade Initiative: http//www.biotrade.org/
[57] PlantTalk, January 2006

Table 7: Wild Medicinal Plants of Newfoundland and Labrador

Scientific Name	**Common Name**	**Medicinal Value**
Abies balsamea	balsam Fir	resin in aromatherapy
Achillea millefolium	wild tansy	oil in aromatherapy
Alnus rugosa	alder	
Arctostaphylos uva-ursi	bearberry	leaf extract in Doans pills
Betula papyrifera	white birch	wood and bark oil in aromatherapy
Chimaphila Umbellata	Pipsissewa	Leaf oil in salicin
Hypericum perforatum	St. John's wort	herbal antidepressant, oil in aromatherapy
Juniperus communis	common juniper	flower oil in aromatherapy
Rhododendron groenlandicum	Labrador tea	oil from aerial parts in aromatherapy
Picea spp.	spruce	oil from needles and twigs in aromatherapy
Pinus strobus	Eastern white pine	volatile oil in inhalants; inner bark in cough syrup; extract in analgesic Prunicodeine
Pinus sylvestris	Scots pine	oil from needles, twigs and cones in aromatherapy
Rubus spp.	raspberry	fruit in pharmaceutical syrup
Salix alba	willow	bark salicin previously used in aspirin
Sorbus americana	dogberry	bark and leaf
Solidago Canadensis	goldenrod	oil in aromatherapy
Thuja occidentalis	Eastern white cedar	leaf oil (pharmaceuticals, aromatherapy, cologne, and incense)
Viola odorata	sweet violet	leaf oil in aromatherapy

Cosmetics:

Essential oils are extracts from trees such as balsam fir, birch and spruce and forest botanicals such as sage and mint. Essential oils are used for many purposes, particularly in the cosmetic industry. *Cosmecuticals* 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 (itching, stinging and burning). The use of cosmetics continues to grow throughout the world, and there are many types available on the market including sunscreens, shampoos, skin moisturizers, aromatic bath oil, hair conditioning formula's, and eye creams.

In recent years, an extract from the birch tree has received popular attention. *Betulin*, is a powdery substance found in the bark of birch trees, and has been found to have pharmaceutical effects such as stimulating wound healing. Because of its cosmecutical potential, many cosmetic companies are now looking at birch bark extracts, particularly betulin to identify compounds found in skin toners.

In Russia, a company has developed a method to isolate betulin from birch bark and has been producing commercial quantities of the compound. The company currently sells cosmetics and food supplements containing betulin in Europe and Japan. The company however, has no customers in the North American cosmetic market.

In 2002, the University of Minnesota-Duluth's Research Institute formed a partnership with an energy company and a paper company to develop and patent a process that would cost-effectively isolate pure betulin and other compounds from birch bark in large quantities. Before birch compounds could be offered to the cosmetic industry, scientists needed to find ways to extract *betulinic acid* (a naturally occurring compound) from the bark. Building on the university's research ability, scientists have patented a way to successfully convert betulin to betulinic acid. Because the Minnesota company did not have large production capabilities, a company from Prince Edward Island was hired to conduct the large scale production, while a company from Chicago was hired to do smaller-scale derivative work, mostly for cosmetic use.

Birch bark compounds, especially betulinic acid are currently being tested for its medicinal potential in the treatment of various diseases. For more than a decade, betulinic acid has been explored as a possible treatment for skin cancer. Betulin, its derivatives and

other birch bark compounds are also being tested fro effectiveness in testing HIV and respiratory syncytial virus. The Minnesota company hopes to supply betulinic acid and its derivatives to other scientists doing clinical testing on disease treatments.

In addition to its medicinal potential and cosmetic usage, betulin is also being tested for its effectiveness in crop disease management and prevention of fungus growth on golf course turf.

Other wild plants are also known to have pharmaceutical effects and are commonplace in the cosmecutical industry. Plants such as *Achillea millefolium* contain anti-inflammatory sesquiterpenes, antimicrobial, monoterpenes, and hemostatic alkaloids. Cow parsnip (*Heracleum maximum*) contains skin darkening furanocoumarins used commercially to treat psoriasis; and leaves of fireweed (*Epilobium angustifolium*) contains the active constituent in a line of anti-inflammatory skin care products, having prostaglandin inhibitory activity due to its flavonoid glycoside content. The table provided in A*ppendix III* provides examples of native and non-native plants that are used commercially in the cosmetics industry.

Floral and Craft Products:

The use of non-timber forest products such as mosses, ferns, cones, berries, bark, boughs, and branches are commonly used in the floral and craft products industry throughout the world. The forest of Newfoundland and Labrador provides a rich diversity of shrubs, herbs, mosses, and other raw materials that may have potential for future development in the commercial floral and craft product industry. It should be cautioned however, that while the sale of floral greenery products can be vitally important to the economy, some jurisdictions throughout the world have lost the sustainability of this industry in many regions as a result of over-harvest (i.e., salal); and so over-harvesting of these often slow-growing species must be avoided. In the Pacific Northwestern States, for example, plantations of European holly (*Ilex aquifolia*) have been established. During the 1930's and 1940's, harvesting of American holly (*Ilex opaca*) foliage was so heavy and damaging to trees in the natural forests that the American holly was practically eliminated from the northern part of its range.[58]

Floral and craft materials can be fresh, dried or preserved. Birch bark, for example, can be used in the construction of baskets, boxes, vases, and many other products. Willow branches are used to make twig wreaths and baskets. Evergreen boughs are used to make many decorative items including wreaths, swags, and centerpieces. The aromatic oils of some plants are used to create potpourri, and various mosses and cones are also used in a variety of products.

Throughout the world, evergreen plant species are the most desired commodity in the craft product industry. The characteristic properties of the evergreen plant such as their ability to retain their needles for prolonged periods is what make such plants the most sought-after in the market place.

Evergreens are popular choices in the floral industry to accent or complement flowers in floral arrangements. Scotch Broom (*Cytisus scoparius*) from the Pacific Northwest states for example, is designated by law as a noxious weed. It is marketed to fresh and preserved floral arrangement industry. The plant's deep green colour and waxy stems provide an ideal accent to flowers. The stems are in demand domestically particularly for floral decoration on special holidays such as mothers day, as well as in Europe and Asia throughout the year. Canadian goldenrod (*Solidago canadensis*) is a popular cut flower in Europe; however, the

[58] Non-Wood Forest Products from Temperate Broad Leaved Trees.

plant is not used in this province. The Canadian goldenrod, native to this province, if collected with care and responsible collection methods can have a high or long-term sustainability for the floral industry. With further research, it may have the potential for cultivar selection.

Evergreen boughs, in particular, balsam fir, are also used extensively during the Christmas season for manufacturing wreaths, swags, and centerpieces. In New Brunswick, for example, approximately three million wreaths are produced annually, generating an approximate wholesale value of $8 million dollars. Many of these wreaths are exported to the U.S. market.

The abundance of balsam fir and limited capital investment would make the wreath industry seem an obvious choice for many residents of Newfoundland and Labrador. The production of wreaths involves harvesting balsam fir tips and the actual tying of the wreaths. The collection of tips involves people properly trained in the selection and harvest of tips in order to produce high quality wreaths. Harvest periods may vary in different regions of the province, depending on weather conditions. It is extremely important to collect tips only when trees are dormant and not to collect too early in the season as they will not hold their needles through the Christmas season. The harvesting of balsam fir tips for commercial purposes requires a permit which can be obtained from the Department of Forestry office. [59]

Currently, in Newfoundland and Labrador, several harvesters produce Christmas wreaths on a small scale operation, producing less than 1000 units annually.[60] The harvest season is relatively short, with tip collecting beginning around the first week on November (based on weather), and continuing for approximately two – three weeks. Wreaths are produced and sold by the harvester, either to local markets, or through customers visiting roadside stands. Wreaths are usually sold decorated with berries, cones, and a bow. The typical price paid for an 18 inch decorated wreath is $30.00. The wholesale value of an 18 inch wreath sold undecorated is valued at $3.49 per wreath. In addition to the supplemental income, harvesters enjoy the social aspect of meeting devoted customers on an annual basis. While Balsam Fir is widespread and common in Newfoundland and Labrador, wild harvesting should only proceed with care and responsible collection methods. While wild collection of

[59] Production of Christmas Wreaths in Newfoundland and Labrador factsheet
[60] Based on person interviews, 2006

balsam fir does not tend to pose extreme environmental danger, there are problems with re-growth as it is a favourite food source for moose, and thus can limit any viable harvest should caution not be taken.

Florals and craft products make up an extensive industry with significant opportunities for further development. Aromatic oils, for example, are used in the production of potpourri, a homogenous mixture of dried sweet scented flowers and leaves with aromatic spices and stabilizing agents or fixatives. The market for potpourris is approximately $500 million to $1 billion. Mitchell and Associates (1997) suggested that a boreal forest potpourri could have a market niche, from a value-added or speciality product perspective. Developing the packaging for such products would be as important as developing the product. [61] As with any community within the boreal forest region, the development of such a product could have market potential in Newfoundland and Labrador.

Birch and alder tops are currently being harvested to create artificial trees in many provinces throughout the country. Birch tops generally measure 2 inches in diameter and are 10 – 12 feet high, while alder generally measures 3 – 5 feet high. Holes are drilled into the natural trunk and branches with silk leaves are then inserted into the trunk. These silk trees are sold for use in shopping malls and hotel lobbies. [62] Alder tops are more commonly harvested in Newfoundland and Labrador. They are often painted with a coloured spray paint and used for decorations, especially at wedding receptions.

The use of decorative woods is also increasing in the craft industry. Many species of woods have decorative appeal due to colour, grain or form. Woods modified by disease and insects, are appealing for various purposes such as hiking sticks, canes, lamps, bowls, and furniture. Walking canes, for example, are made from scrap wood. They are carved, painted and decorated and sold in several retail outlets and tourist attraction centres throughout the city.[63] The price paid for walking canes and hiking sticks vary, depending on size and detail, but generally fall within the $20 - $40 range. Traditional craft items from native communities are sold in many tourist chalets around the province. The bark and stems of many wood species are carved into an assortment of ornamental and functional pieces such as miniature canoes, baskets, dream-catchers, trivets and Christmas tree ornaments.

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[61] NTFP in Ontario
[62] http://www.agr.gov.sk.ca/docs/crops/northern_agriculture/non-timberprod.
[63] Based on personal observation

Interviews with local residents have helped to identify a number of different species having the potential for use in a floral and craft product industry in this province. [64] A summary is presented in *Table 8*. The available data is based on plant species, including scientific and common names; species distribution; plant material utilized including floral, foliage, and branch products which may be sold either in bulk quantities or crafted into finished products. The type of product produced is grouped into categories such as floral greenery, aromatic oils, and decorative items such as wreaths, swags, centerpieces, baskets, etc. The potential for wild harvest of plants for the floral and craft sector in this province is outlined in *Appendix III.*

[64] Based on personal interviews, 2005-2006

Table 8: Species used in the floral and craft product industry

Scientific Name	**Common Name**	**Provincial Distribution**	**Material Utilized**	**Product Produced**
Abies balsamea	balsam fir	province wide	bough, resin	floral greenery, decorative item, aromatic oil
Adiantum aleuticum	aleutian maidenhair fern	only in Serpentine areas of island	fronds	floral greenery
Alnus spp.	alder	province wide	branch tops, roots, bark	decorative item, natural dyes
Betula spp.	birch	province wide	bark	decorative item
*Chamerion angustifolium**	fireweed	province wide	branches	decorative item
Coptis trifolia	goldthread	province wide	rhizomes	natural dyes
Cornus stolonifera	red-osier dogwod	province wide	young branches, bark	decorative item, natural dyes
Dryopteris carthusiana	spinulose wood fern	province wide	fronds	floral greenery
Equisetum sylvaticum	woodland horsetail	province wide	plant	natural dyes
Galium triflorum	fragrant bedstraw	province wide	dried flowers	aromatic
Juniperus spp.	juniper	province wide	foliage, berries	decorative item, aromatic oil
Picea spp.	spruce	province wide	cones, bough	floral greenery, decorative item
Rhododendron groenlandicum	labrador tea	province wide	leaves	natural dyes
Salix	pussy willow	province wide	branches, catkins	decorative item, floral greenery
Sphagnum spp.	peat moss	province wide	foliage	decorative item, floral greenery
Typha latifolia	cattail	island	flower spikes	decorative item

Ecotourism:

The forest environment is a major attraction for tourism and leisure activities. In BC for an example, eco-tourism represents the largest growth sector in the tourism industry and contributes more than $165 million annually to BC's economy[65]. In the Pacific Northwest, non-traditional forest products are considered to be the most viable option for strengthening those rural communities suffering from decline in timber harvests from government lands.[66] Ecotourism is a growing industry in this province as well, and has the potential to contribute even greater amounts to the economy. Wild berry harvesting for example, has a high recreational value and tourism potential. As earlier research indicated, the opportunity for recreational experience may be just as important to some as the opportunity for picking natural foods.

On the Northern Peninsula of Newfoundland, for example, an ecotourism museum provides visitors with information on the historical significance and medicinal qualities of native wild berries. In addition to interpretive panels and displays, the museum also hosts a processing area where wild berries are converted into hundreds of products. Tourists are also encouraged to walk along the boardwalk to view various types of wild berries in their natural habitat.

In addition, many local businesses purchase wild berries and offer special products for the tourism trade in the form of gift baskets, and other value added products. Herbal shops that specialize in many aspects of culinary and medicinal herbs also provide visitors to this province an opportunity to lean more about native plants and their importance. Local nature trails provide visitors an opportunity to hike and camp within the boreal forest ecosystem. In addition, places such as MUN Botanical Garden have become a hub of natural education and a tourist attraction.

[65] BC Wild Magazine
[66] Clayoquot Green Economic Opportunities Project

Conclusion:

The study of non-timber forest products has become a global pursuit. Researchers, government representatives, and industry leaders throughout the globe are continuing their efforts to find ways to develop and maintain sustainable harvesting practices of such products as part of larger sustainable forest management strategies.

To date, volumes of literature have been written regarding the harvest of non-timber forest products throughout the world. Much of the early literature and research focused on defining non-timber forest products, identifying botanical products, and describing how people use these products. For years, non-timber forest products have been wild-crafted for personal use, and until recently, very little thought was given to the sustainability of such products or the ecosystems in which these products were being exploited. Unfortunately there are few examples of truly sustainable harvest practices globally, and many tales of habitat degradation and loss of resource due to over-harvest. Over-harvest is the primary reason why species such as Ginseng, orchids and many species used in the horticultural trade are listed as highly endangered and listed on *Appendix 1* of CITES.

Today non-timber forest products are being utilized on a commercial basis, and forests and wild places are seen as valuable, not only in the provision of ecosystem services, but also key in the development of ecotourism ventures; as a result of these opportunities, the non-timber forest industry is being recognized as a forest management concern. In Newfoundland and Labrador, the new Provincial Sustainable Forest Management Strategy (2003) endorses sustainable forest management as a process to maintain the long term health of forest ecosystems while providing ecological, economic, and cultural opportunities for the benefit of present and future generations.[67] A current concern in ensuring sustainability of non-timber forest products is the impact that increased harvesting may have on the sustainability of ecosystems, habitats and species.

According to research, there are significant knowledge gaps that impede efforts to improve sustainable management of non-timber forest products and the ecosystems from which they are harvested. These include: lack of knowledge of the biology and ecology of the flora and ecosystems from which these products originate; impact of harvest on both the

[67] Provincial Sustainable Forest Management Strategy (2003), Department of Forest Resources and Agrifoods

target product and its habitat; lack of knowledge of the diverse nature of the products and their collectors; and lack of knowledge regarding the market value.

In this province, many knowledge gaps have been identified with regard to sustainable non-timber forest product harvesting, and are included in table format in *Appendix IV*. For the purpose of this report, these knowledge gaps have been categorized into several groups including biological; horticultural; socio-economic; food science and technology; education and marketing. While there is a large body of knowledge about how non-timber forest products are used (i.e. medicinal, floral and craft industry, food products), there is a lack of basic knowledge about the population biology and ecology of many of the plants that are harvested as non-timber forest products. It has been well documented that sustainable development can only be achieved with improved scientific knowledge of the ecological dynamics of the plant species being harvested. Very little of this information is currently available for native plants that may have the potential to sustain a non-timber forest product harvest. Provincial databases associated with the *Rare Plant Project* and various other Wildlife Division biodiversity projects such as the *General Status* of S*pecies* are available that provide information on the distribution and the status of a number of plant species of interest to determine if these are candidates for potential harvest. Many of the plants traditionally wild-harvested are at the northern periphery of their distribution, and therefore have populations that are usually smaller and less dense then at the centre of their distribution. This is an extremely important consideration when harvesting these types of species, as they will not be as resilient to harvest as other more northerly distributed species.

There is a continued need to collect ecological data in order to accurately determine sustainability levels. Species biology should include physical descriptions, geographical distribution, habitat range, information on known cultural or traditional use, effects on wildlife, edibility, toxicity, demographics, and chemical analysis (active components or natural biological extractions). [68]

It is often difficult to assess the potential or limitations of a site for producing future crops of non-timber forest products. Plant species can convey a great deal of information about the ecological nature of a site. They are valuable indicators of soil nutrients, general forest types, and properties such as pH levels. Non-timber forest products are essential tools

[68] Indicator Plant Species in Canadian Forests, p. 1-14.

that have the potential to identify and monitor critical characteristics of forest biology. By knowing the ecological characteristics of a plant species we can begin to infer information about the physical and chemical environment and associated plants. Because there is a lack of detailed information about the ecology and distribution of native plants, using plant species to indicate site quality will be limited. When site potential or limitations are recognized, sustainable practices can be maintained to its productive potential. In addition the negative impact of non-native herbivores such as moose and snowshoe hare on forest species health and resilience will limit the potential of certain NTFP species for harvest. For example Canada yew is a preferred species of some non-native herbivores and has been all but extirpated from most areas across the island, with the exception of those areas with low moose densities.

Due to the many examples of negative impacts associated with harvest, forest managers and biologists are concerned about the potential impact that harvesting will have on plant species and the surrounding forest ecosystem. There is currently insufficient information to definitively state that harvesting is (or will) have any known impact, negative or otherwise, on specific plant populations. There have been no studies in this province to track the impacts of ongoing harvest. Little is known about the extent of harvesting or the long-term effects of extraction. Much less is known about the multitude of products found in the forest but not widely marketed. Information is needed that draws attention to critical issues related to non-timber forest products.

Potential Future Research:

In co-operation with educational institutions, undergraduate and graduate studies are an integral way to focus on developing ecological and biological informational sources for various native plant species. *Appendix IV* provides information on potential student theses, both undergraduate and graduate. *Appendix III* provides a list of potential species for harvest and the type of product they produce. Species were identified based on occurrence, distribution, rarity, known population status and potential as a NTFP. Research would include data collection on specific target plants that have the potential for harvest in this province. Post-secondary students could include studies to investigate potential for future horticultural crop development of non-timber forest products through the study of ecological and biological properties of plants.

In cooperation with post-secondary institutions, students would investigate the impact of harvesting on the health and persistence of specific plant or fungi species deemed as a potential NTFP and its surrounding environment. Species would be assessed and based on a priority list. Optimal time for harvest, as well as harvesting techniques and their impacts would be fundamental to such studies. Examples might include mushroom harvesting or harvesting berry types with home-made rakes.

Although tapping a tree for sap does not kill the tree, little is known about the effects of the tap-holes on wood quality, decay, and tree vitality. Birch is known to have a shorter life span, thinner bark, and a shallower root system than maple and literature suggest that it may be more susceptible to damage from tapping.[69] Investigating the effect of tap-holes on birch trees could provide an opportunity for future research and study (or other methods of collection depending on species type).

Basic demographic studies to determine the growth, yield, regeneration and persistence of individual priority NTFP species would help identify any impact of harvesting. In cooperation with post-secondary institutions or local crop farmers, study areas could be set up to investigate harvest impact on select species, based on a priority species list.

[69] The Alaskan Birch Syrup Producer's Manual

There is also the possibility of research facilities and small businesses to produce native plants for the horticulture trade and develop horticultural liaison towards conservation goals. Currently in the province, research such as *Plant Atlantic* is underway. This research project is designed to research and develop new and under-used ornamental plants for the Atlantic Canadian nursery industry. The project is funded by the Atlantic Innovation Fund (AIF) and administered by ACOA (Atlantic Canada Opportunities Agency). The project is led by Dr. Wilf Nicholls, Director of MUN Botanical Garden, and partnering with Nova Scotia Agricultural College (NSAC) and commercial nursery operations in Newfoundland and Nova Scotia. Plant Atlantic employs methods such as classic plant breeding, selection and exploration with modern tissue culture and micro-propagation methodologies. Following protocol development, industry partners will commercially produce and market plants into the local, national and international markets.

There is also need to bring species into cultivation in order to protect them in their wild habitat. Cultivation as conservation is one such way of helping to sustain wild populations. In Newfoundland and Labrador, a research project at MUN Botanical Garden has seen partnership with Newfoundland and Labrador Hydro to assist in the revegetation of newly constructed fish habitat (Granite Canal Fish Habitat Compensation Facility - FHCF) following a large hydroelectric development in south-central Newfoundland. The Garden will plant over 100,000 plants and seedlings along the river banks of the FHCF. The aim is to provide cover and shade for fish, stability for banks, and to provide food for insects that, in turn, become food for fish. In short, this project focuses on creating habitat, not just greenery. The plants and seedlings are being propagated at MUN Botanical Garden Nursery from seeds and cuttings collected from the Granite Lake area. These include such genera as *Betula*, *Viburnum*, *Aronia*, *Rubus*, *Myrica*, and *Spiraea*.

A similar project involving orchids as a conservation initiative has potential for transfer to this province. The *Sainsbury Orchid Conservation Project*, established in 1983 to propagate and reintroduce endangered British orchids, has the backing of English Nature, The Royal Society for Nature Conservation and the County Naturalists Trusts. It continues to research propagation methods for re-introduction programmes in the UK and abroad. More than 40 British, European and North American orchid species have been successfully

propagated. Five endangered British species: *Cypripedium calceolus*, *Orchis militaris*, *O. simia*, *Himantoglossum hircinum*, *Liparis loeselii*, have been successfully reintroduced into selected sites as well as more common species of *Anacamptis* and *Dactylorhiza*. *Cypripedium calceolus* and *Liparis loeselii* have recently flowered in the wild from re-introduced seedlings. The techniques developed in the project have been used successfully elsewhere to raise seedlings for conservation and horticultural purposes. An orchid micropropagation techniques course was given in Mexico at the request of the Latin American Association of Botanic Gardens and demand for information is high. Derivative programmes have been developed abroad e.g. Denmark, The Netherlands, Switzerland and the USA. It also provided the inspiration for Hanne Rasmussen's recently published book *Terrestrial Orchids: From Seed to Mycotrophic Plant*. New techniques and developments are occasionally published through the *Micropropagation Newsletter*.

Seed of rare tropical species in the Living Collection are routinely distributed to other interested parties and for exchange. In a project funded by the Weston Foundation, the first steps to establishing a nursery in Madagascar have been completed successfully in conjunction with the Parc de Tsimbazaza, the national botanical garden. The aim is to provide *in vitro* plants raised from seed to enrich the educational and scientific collections at Tsimbazaza, for possible reintroduction of certain rare species. It is hoped that sale of excess repatriated plants will help to raise funds there to help research and perhaps eventually provide alternative income sources to collecting in the wild.[70]

While the boreal forest of Newfoundland and Labrador is home to a significant number of plants, a non-timber forest product food industry, either on a commercial or personal scale should only proceed if the product can sustain harvesting levels without having a negative impact on habitat or species. Ensuring ecological integrity and sustainable harvest levels is extremely important throughout the world. The Saskatchewan Environment, for example, issues Special Forest Product Permits, if items are being collected and sold directly to the public or if products are purchased from harvesters to re-sell. There are no permits required to collect for personal use or to sell directly to a dealer.[71] In addition, because many non-

[70] http://www.rbgkew.org.uk/science/orchids/research.html
[71] Environment Newsline, Saskatchewan Environment

timber forest products have been an important source for many First Nations and aboriginals in Northern Saskatchewan, they are involved in all aspects of the planning and development of the non-timber forest product industry.

Appendix I: Bibliography

Appendix II: Forest Research Institutes and Forest Programs

Forest Research Institutes and Forest Programs

The boreal forest ecosystem is complex. Defining its values, identifying unknown values, understanding the implications for development, and promoting sustainable forest harvesting are all important aspects in understanding the multifaceted role of the forest. Forest research institutes, environmental agencies, and forest programs conduct research at various levels regarding the implications for the boreal forest ecosystem. In addition to the countries forest research institutes, the forest industry works with individual companies and associations to examine forest ecosystems. A list of dedicated research facilities from around the world follows.

- Memorial University of Newfoundland Botanical Garden provides research in areas of conservation of the province's rarest plants, re-vegetation of newly created fish habitat in south-central Newfoundland, investigation of native rose species as sources of new medicinal and nutritional compounds, research and development of new ornamentals for the Atlantic Canadian nursery industry, and participates in Plantwatch Newfoundland and Labrador.
- Forintek Canada Corp constantly examines innovative ways to enhance the value of our forest while maintaining profitability and sustainability.
- The Forest Engineering Research Institute of Canada (FERIC), a non-profit organization, as part of their mandate, focus' on environmental impacts of forest operations, as well as harvesting and regeneration systems in the boreal forest.
- The Pulp and Paper Research Institute of Canada (Paprican), is a non-profit research organization which focus' on the fibre value chain, product innovation, and sustainability.
- Canadian Forest Service (CFS) of Natural Resources Canada is the main federal organization conducting forest research in this country. Their research focuses on understanding forest ecosystems and developing strategies for advancing sustainable forest management (i.e., climate change, forest fires, forest and landscape management, silviculture, etc).

- Western Boreal Conservation Initiative (WBCI) of Environment Canada is an ecosystem initiative that is working to achieve ecosystem conservation and protection, specifically in the western and northern boreal forest. (i.e., habitat and species at-risk, monitoring programs for migratory birds, collaborates with government, agencies and groups).
- The Canadian Model Forest Program is a program which sees model forests located in and around the boreal forest. Each model forest is a "hands-on laboratory" which focuses on things such as the effect of climate change, the impact of natural disturbances, insects, disease, fire and floods on the boreal forest, as well as monitor and assess some of Canada's wildlife habitat requirements and management (i.e., Western Newfoundland Model Forest – Newfoundland Pine Martin).
- The Sustainable Forest Management Network (SFM Network) is also conducting research into the social and economic consequences of actions in the boreal forest. It is a university-based research program that crosses scientific disciplines and sectors. It is hosted by the University of Alberta.
- The Canadian Boreal Initiative is one such example of the innovative partnerships that are characteristic of boreal forest research. It is an alliance of conservation organizations, resource companies and First Nations who have come together to articulate a vision and plan for Canada's boreal forest and wetlands. The organization released the "Boreal Forest Conservation Framework" in December 2003. This framework calls for an interconnected network of large-scale protected areas and Aboriginal group engagement on land management decisions.
- Researchers at the Prince Edward Island Health Research Institute are conducting research on diverse projects ranging from addressing the effect of bioactive compounds and nutraceuticals in health and disease to interventions to reduce complications of diabetes.
- University of Prince Edward Island - Atlantic Canada Network on Bioactive Compounds. Researchers with this network are developing commercial products and technologies based on bioactive compounds extracted from wild blueberries and rosehips.
- World Health Organization (WHO)

- Natural Health Products Directorate (NHPD) is the regulating authority for natural health products for sale in Canada. It is part of the Health Products and Food Branch of Health Canada. The role of the NHPD is to ensure that Canadians have ready access to natural health products that are safe, effective and of high quality while respecting freedom of choice and philosophical and cultural diversity.
- The Northern Forestry Centre is located in Edmonton, Alberta, and is one of the five Canadian Forest Service research establishments across Canada. The Canadian Forest Service is a sector of Natural Resources Canada.
- The Social Science Research Group is an interdisciplinary team of economists, sociologists, and social psychologists. Their mandate is to conduct original, nonrecurring scientific research on issues related to the human dimensions of forest management and to publish research in a variety of medium. Research topics fall within forest economies, non-timber values, forest sociology, and economics of climate change.
- The Nutraceuticals Institute, Department of Food Science, Rutgers University, New Brunswick, NJ 08901-8520 This is a research, education and outreach program formed through the partnership of Rutgers University and St. Joseph's University. The mandate of the institute is to provide a systematic problem-solving approach in which universities, government and industry partner to perform the scientific research to develop safe and efficacious products, link with the health care industry and develop markets.
- Virginia Tech, Center for Forest Products Marketing and Management, Department of Wood Science and Forest Products, VA
- Royal Roads University, Victoria, British Columbia provides many educational programs regarding non-timber forest products, and the growing industry. The Center for Non-Timber Resources has played a vital role in developing training programs and literature regarding non-timber forest products in the British Columbia area.
- The Taiga Institute of Land, Culture and Economy, Kenora, Ontario, works with community-based initiatives that support ecological diversity and equity within social and economic relationships. It promotes local access to resources, recognition of community knowledge, diversity in local economies and fair trading relationships. The

institute was established as a non-profit corporation in 1995 by people living in Northwestern Ontario. The Taiga Institute provides experience and expertise in non-timber forest products, community forestry, culturally appropriate tourism, protected areas planning, and Indigenous knowledge documentation.

- Natural Resources Institute, University of Manitoba, Winnipeg, Manitoba. The institute is interested in areas such as traditional ecological knowledge (ethnobotany / ethnoecology), forests and land-use planning, non-timber forest products, and community development.
- Northern Diversification Center, Manitoba, Canada acts as a northern research facility for non-timber forest products and eco-tourism. The center offers community-based training, business development, and product research and development.
- CABI Bioscience, Bakeham Lane, Egham Surrey, is a research facility with interest in biodiversity, ecology, non-wood forest products, social forestry, and biotechnology.
- Overseas Development Institute, London, is a research institute with interest in forest policy, social forestry, natural forests, conservation, non-wood forest products, and agroforestry.
- Ohio State University, School of Natural Resources, Columbus, Ohio, conducts research relevant to tree improvement, non-wood forest products, forest health and silviculture.
- College of Biological Science, Human Nutraceutical Research Unit, has a special interest in research directed towards natural health products and value-added novel foods. It offers consultation to determine feasibility of human trail with products, literature searches, and access of library materials.
- Falls Brook Centre is a non-profit community demonstration and training centre located in rural New Brunswick. Its mandate is to promote sustainable practices in Forestry and Agriculture through organic gardens, trails and promotion of ecological certification.

Appendix III: Species Tables for Potential Food, Medicinal / Nutraceutical, Cosmetic, Arts and Crafts, and Ornamentals

Table of NF&L naturalized (non-native) species for potential food (F), medicinal/nutraceutical (M), cosmetic (C), arts and crafts (A/C) and ornamental (O) use

WILD-HARVESTING OF THESE SPECIES (MANY OF WHICH ARE WEEDY) IS RECOMMENDED AND EVEN PREFERRED (Care should be taken to ensure plants are not collected from toxic sites)

Scientific name	Common name	Dist./rarity	F	M	C	AC	O	Part harvested	Knowledge gaps/comments
Cardamine pensylvanica	Pensylvania bittercress	Widespread	X					Young shoots	Salad green
Chenopodium album	Lamb's quarters	Widespread weed	X					seed	Salad green
Crataegus monogyna	Black hawthorn	Uncommon but widespread	X				X	Fruit	Suitability to orcharding
Mentha species	Mint	Widespread	X	X				Leaves	Flavouring, tea
Plantago major	Common plantain	Widespread weed	X					leaves	
Stelleria media	Chickweed	Widespread weed	X					Leaves	Salad green
Taraxacum officinale	Dandelion	Widespread weed	X	X				Leaves, flowers, roots	Mild diuretic, salad green
Urtica dioica	Stinging nettle	Common weed	X	X				Young shoots	High vitamin levels
Hypericum perforatum	St. John's wort	Widespread weed		X	X			Leaves. Flower buds	Toxic to livestock, very invasive. Pernicious weed in NS

Table of NF&L native species with a high or long term sustainability for potential food (F), medicinal/nutraceutical (M), cosmetic (C), arts and crafts (A/C) and ornamental (O) use

WITH CARE AND RESPONSIBLE COLLECTION METHODS, WILD COLLECTION OF THESE SPECIES POSE MINIMAL ENVRONMENTAL DANGER

Scientific name	Common name	Dist./rarity	F	M	C	AC	O	Part harvested	Knowledge gaps/comments
Abies balsamea	Balsam fir	Widespread, common		X	X		X	Branches, tree, resin, cones	Harvest timing to minimize damage. Harvesting equipment development
Alnus spp.	alder	Widespread, common				X	X	Cut branches	Somewhat browsed but plentiful
Betula spp.	Birch	Widespread, common	X	X	X	X	X	Bark, sap, branches	Long-term tapping effect unknown
*Chamerion angustifolium**	fireweed	Widespread, common	X		X			Leaves	Herbal Teas
Cornus stolonifera	red-osier dogwod	Widespread, common				X	X	Winter branches, whole plant	Moose/hare browsing heavy
Dryopteris carthusiana	spinulose wood fern	Widespread, common				X	X	foliage	No knowledge of sustainable harvest
Empetrum nigrum	Crowberry, blackberry	Widespread	X	X			X	Fruit, plants	Under-used for fruit. Potential for cultivar selection.
Juniperus spp.	juniper	Widespread, common	X	X	X	X	X	Berries, branches	No knowledge of sustainable harvest
Picea spp.	Spruce	Widespread common	X			X	X	Branches, cones	Harvest timing to minimize damage. Harvesting equipment development
Prunus pensylvanica	Pin cherry	Widespread common	X	X				Fruit	Moderately moose/hare browsed
Rhododendron groenlandicum	labrador tea	Widespread, common	X	X			X	Leaves	Used by BC coastal nations. No selections exist
Salix	pussy willow	Widespread, common		X		X	X	Dried flowers, branches	Ornamental cut branch. Easily cultivated for crafts.(basketry)
Solidago canadensis	Canadian goldenrod	Widespread		X		X	X	Flowers, foliage	Aromatherapy. Popular cut flower in Europe, unused here. Potential for cultivar selection
Sphagnum spp.	peat moss	Widespread, common		X			X	Whole plant	Absorbent, sterile. Used in soil mixes.
Typha latifolia	cattail	Widespread, common					X		Invasive if unchecked, high potential as biofilter

Vaccinium angustifolium	Blueberry	Widespread	X	X				Fruit	Well-used, appears sustainable. Potential for cultivar selection
Vaccinium vitis-idaea	Partridgeberry	Widespread	X	X			X	Fruit and whole plant	Ornamental groundcover. Fruit already well-used. Potential for cultivar selection

Table of NF&L native species with medium-term sustainability for potential food (F), medicinal/nutraceutical (M), cosmetic (C), arts and crafts (A/C) and ornamental (O) use.

IT IS RECOMMENDED THAT THESE BE WILD-HARVESTED ONLY WITH CARE

Scientific name	Common name	Dist./rarity	F	M	C	AC	O	Part harvested	Knowledge gaps/comments
Clintonia borealis	Blue-bead lily, poisonberry	Widespread	X	X				Leaves	Sustainability unknown, edibility questionable, tea may induce labour. Berries toxic
Monotropa uniflora	Indian pipe	Widespread but low density		X				Arial portions	Mostly subterranean saprobe; no information on sustainability
Pinus strobus	Eastern white pine	Central, western NL	X			X	X	Boughs, seeds, bark	Populations scattered. No information on sustainability
Ribes lacustre	Bristly black currant	N. central NL, S. Lab.	X	X				Berries	Potential for cultivation. Wild-cropping poor/inefficient
Rubus chamaemorus	Bakeapple, cloudberry	Widespread, more common in north	X	X				Berries	Wild-collecting in south low efficiency. Cultivation potential in need of investigation. Impact of wild-collection to be determined
Sambucus pubens	Elderberry	Central/western NL	X	X				Berries	Browsed. Little information on sustainability
Shepherida canadensis	Soapberry	Cent. & N.NL, Lab.	X	X				Berries	Sustainability unknown
Sorbus americana	american mountain ash	Widespread	X	X			X	Berries	Sustainable harvest levels unknown
Sorbus decora	dogberry	Widespread	X	X			X	berries	Sustainable harvest levels unknown
Viburnum edule	squashberry	Widespread	X				X	Berries, plant	Sustainability unknown. Potential for cultivar selection
Viburnum nudum var. cassinoides	northern wild raisin	Widespread					X	Berries, plant	Potential for ornamental selections. Potential for berry development
Viburnum opulus var. americanum	highbush cranberry	Widespread	X				X	Berries, plant	Sustainability unknown. Potential for cultivar selection
Viola odorata	Sweet violet	Frequent		X	X			Leaves	Aromatherapy oils. Sustainability unknown but doubtful.

Table of NF&L native species with a low or poor sustainability for potential food (F), medicinal/nutraceutical (M), cosmetic (C), arts and crafts (AC) and ornamental (O) use.

IT IS RECOMMENDED THAT THESE NOT BE WILD-HARVESTED

Scientific name	Common name	Dist./rarity	F	M	C	AC	O	Part harvested	Knowledge gaps/comments
Acorus americana	Sweetflag	Poss. extirpated	X					Roots	Cultivation methods requ'd
Adiantum aleuticum	Maidenhair fern	Rare; found only on serpentine				X	X	Fronds, whole plants	Cultivation methods unknown
Aralia nudicaulis	Wild sasparilla	Widespread but low density	X	X				Berries, rhizomes	Easily over-harvested, heavily browsed. Potential crop plant
Chimaphila umbellata	Pipsissewa	Rare, limitied distribution	X	X				Leaves, fruit	S1 rarity in NL (critically endangered)
Coptis trifoliata	Goldthread	Widespread but small				X		Rhizomes for dyes	Highly destructive to collect. Cultivation methodology required
Epigaea repens	Mayflower	Western NL	X	X			X	Leaves, flowers	Limited distribution, easily over-harvested. Cultivation protocols unknown
Gaultheria procumbes	Wintergreen	SW NL	X		X	X	X	Whole plants, berries	Populations rare. S1 status (critically endangered)
Matteuccia struthiopteris	Ostrich fern	Low density, s.w. NL	X				X	Young leaves, whole plants	Easily over-harvested. NL populations non-sustainable. Potential for cultivation
Michellia repens	Two-eyed berry	SW NL bogs	X	X				Berries	S1 rarity (critically endangered). Destructive collection and unsustainable
Smilacina racemosa	False Soloman's seal	Rare in SW NL	X	X				Berries	Very rare. S1 (critically endangered) common on mainland
Vaccinium macrocarpon	Large cranberry	Widespread	X	X				Berries	Cultivation research underway. Wild-harvesting can be destructive/innefficient
Vaccinium oxycoccus	Marshberry	Widespread	X	X				Berries	Cultivation research underway. Wild-harvesting can be destructive/innefficient

	Knowledge gaps	Recommendations
Biological information To be garnered through undergraduate and graduate research opportunities at MUN Biology Dept., Environmental Science, Forestry, Provincial Wildlife, Parks Canada	**Biological** NL lacks basic knowledge of abundance, range and distribution of native plant species. Little knowledge on population variation in component levels Levels of sustainable harvest unknown Effects on community ecology resulting from species removal and harvesting practices are mostly unknown Wild-harvesters often lack species identification skills Little knowledge of the weed potential of non-native new crops	**Recommendations** Investigate species biology to understand ecological requirements of target NTFP species Establish inventory of locations, variety, and quantity of species and Investigate infra- (within) species variation Determine non-destructive harvest methods and sustainable harvest levels Monitor species for effects of harvesting in terms of changes in size and ranges of populations Conduct weed risk assessment with goal of encouraging and discouraging the cultivation of new crop species

Nutraceutical/cosmeceutical Research		
Research potential for Faculty of Medicine (history of medicine) and clinical trials. Biochemical analyses of species and populations	NL lacks information on chemical properties of select plants NL has little dedicated capacity for biochemical analysis of species and populations for target NTFP. Knowledge about toxic levels of bio-active compounds or non-target components	Establishment of a biochemistry lab dedicated to chemical analysis of natural products. Conduct research on chemical composition of select species
Horticultural research		
To be garnered through R&D opportunities and partnerships at MUN Botanical Garden, Biology, Provincial Agrifoods, Agriculture/Agrifoods Canada	Knowledge of horticultural potential of native NTFP Knowledge of species variation leading to cultivar selection Lack knowledge of cultivation needs (soil, nutrients, etc.) Lack of knowledge regarding tissue culture production of NTFP species Lack knowledge of propagation methods for NTFP	Develop methods of agro-forestry, nursery production and tissue culture to avoid over-harvesting Establish a dedicated provincial tissue culture facility
Socio-economic, historical		
Research potential for Dept. of Anthropology, Folk Law, History,	Continued loss of indigenous knowledge of plant use	Encourage further ethnobotanical research
		Recycle plant materials that would other wise be destroyed (i.e. burned)
Harvesting		
To be garnered through partnered research opportunities with MUN Engineering, Industrial Research Assistance Program (IRAP), Marine Institute	NL lacks low-impact harvesting equipment for NTFP NL lack technology regarding utilization of NTFPs waste materials	Develop harvesting equipment Develop technologies and opportunities for waste/unused materials from NTFP

Food Science and Technology		
Product development potential research partnerships with Marine Institute and Food Technology Centre	little information regarding proper handling of products little information regarding chemical composition of plants need proper equipment for harvesting NTFPs	Develop methods for proper harvesting, storage, transport, and chemical extraction Develop laboratory methods for synthesis of active ingredients Ensure proper harvesting techniques to avoid destruction of plant habitats
Marketing and promotion		
Gardiner Institute and Dept. of economics at MUN	Few education programs available for potential harvesters/growers compared to other provinces little information for testing new products	Implement training and education programs for collectors and developers Develop workshops in areas of wild harvesting and cultivation
Legislative		
Provincial guidelines and regulation	NL lacks any regulation regarding collection (except for listed rare and endangered species) NL lacks any guidelines/recommendation for sustainable harvest levels and methods of harvest	Development of regulations/guidelines for wild-harvesting Development of compliance criteria/penalties Development of workshops regarding regulations