WILD-CULTIVATION OF AMERICAN GINSENG
(Panax quinquefolius)

ITS HISTORY, BEST MANAGEMENT PRACTICES, and RELATED CONSERVATION ISSUES

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Executive Summary

American ginseng (*Panax quinquefolius*) is arguably the most valuable of any of the medicinal plants that occur in the world today. The consumer demand for American ginseng is centuries old and remains unabated. Humankind has an intimate and long-standing relationship with American and Asian ginseng (*Panax ginseng*). Paradoxically, humans have significantly contributed to the species' decline within its natural habitats. Large-scale forest clearance and landscape conversion have eliminated much of the species' critical forest habitat within its historical range. The species' inherently low seed-producing fecundity, restrictive seed dispersal strategy, strict habitat niche requirements, and its inability to form a persistent seed bank, predispose it to extirpation in the face of forest clearance. These factors, in combination with centuries of over-harvesting of the remnant wild populations, have resulted in American ginseng's precipitous decline from its northern range in Ontario and Quebec. The decline in these wild populations has prompted Canadian federal and provincial government agencies to designate American ginseng as an endangered species and to promulgate a variety of laws, policies, and regulations to protect the species. This has resulted in the prohibition of the export of wild American ginseng under the terms of the Convention in International Trade in Endangered Species of Wildlife Fauna and Flora (CITES) agreement. Despite these laws, regulation, and prohibitions, current population figures, if they are accurate, indicate the species is still in decline and those identified wild populations are prone to extirpation from a variety of causes.

While the wild populations of American ginseng have declined in Ontario and Quebec, the artificial cultivation of the species outside of the deciduous forest environment has maintained its population at a high level. The locus for these artificially propagated populations is Norfolk County in Ontario, where American ginseng has been grown for over a century. The ancestral stocks of these field-cultivated populations originated from the remnant wild populations of Norfolk and Brant Counties, as well as some introductions from Wisconsin. Many other field-cultivated populations of American ginseng have been established in British Columbia,

Wisconsin, and China, to name but a few locations. Despite a century of field-cultivation in Ontario and Wisconsin, no recognized cultivars, strains, or races of ginseng have been developed. The ginseng plant in the field and the forest are essentially identical.

There is an annual, multi-million dollar commercial trade in the dried roots of field-cultivated ginseng in Ontario alone; Canada is the largest supplier of field-cultivated ginseng root to its primary consumer, China. Most of these roots are exported to Hong Kong and thence into mainland China. Currently, the export of field-cultivated ginseng from Canada is permitted by the Canadian CITES Management Authority and its Ontario and Quebec partners. Until October 2007, the Canadian CITES export prohibition included all wild ginseng and the export of ginseng produced by a variety of cultivation methods known as "wild-cultivation". In October 2007, the Canadian CITES network approved an non-detriment finding statement which considers the permitting of wild-cultivated ginseng on "case by case" basis". Conversely, the United States allows the export of wild ginseng from19 states. These wild exports include ginseng roots produced by wild-cultivation techniques. There is a significant price differential paid for wild/wild-simulated ginseng over field-cultivated ginseng roots — as much as 20 times greater for the former. The market demand for wild and wild-simulated ginseng root is strong and steady. By comparison the market demand for field-cultivated root has been declining for over a decade. The CITES prohibition on the export of wild-cultivated ginseng roots prevented Canadian ginseng growers from accessing this lucrative international market. In October 2007, the Canadian CITES Scientific Authority — Environment Canada, Canadian Wildlife Service — released a qualified "non-detriment finding" for the export of the two categories of wild-cultivated ginseng — wild-simulated and woods-grown produced. The qualification is based on a case by case consideration of the production methods and current provincial policy in the province where the ginseng root is grown.

In addition, the recently enacted, and yet to be implemented, *Ontario Endangered Species Act, 2007* may have an even more profound effect on those persons in Ontario who are currently engaged in wild-cultivation of American ginseng. This act prohibits the harvest, possession, and sale of all *Panax quinquefolius.* Prior to this act's proclamation in March 2007, it was legal to

harvest and sell domestically, in Ontario, wild and wild-cultivated ginseng.

There is compelling evidence that in Ontario, and perhaps Quebec, there has been a longstanding tradition of planting ginseng in the forest as part of a rural subsistence economy linked to the early fur trade. Periodically, various Ontario governments have encouraged the growing of ginseng in the forests as well as in the fields as part of an economic strategy for rural regions of Ontario. Within the past 10 to 20 years, hundreds of people in Ontario and Quebec have purchased ginseng seed in an effort to establish American ginseng plantations in mature deciduous forest habitats.

As previously stated there are two types of wild-cultivation techniques, these are the woods-grown ginseng method and the wild-simulated method. The woods-grown method produces an easily identified root similar to the field-cultivated root. This production method is no longer popular since the root is of similar value to the field-cultivated product. Ginseng root produced by wild-simulated cultivation techniques, however, is indistinguishable from wild ginseng root. In essence, it is wild ginseng with the sole exception that it has been planted in the forest by human hands, usually from seeds obtained from field-cultivated plants. American ginseng is not a difficult plant to grow in a suitable forested environment. The difficulty arises, however, in finding such suitable habitats in a largely deforested landscape. The primary reason for the imposition of the Canadian export prohibition on ginseng root produced by wild-cultivation techniques, is the fear that wild ginseng root might be substituted for wild-simulated root, thereby, further depopulating wild ginseng colonies in Ontario and Quebec. In addition, there are number of other concerns often cited as reasons for discouraging the growing of wild-cultivated ginseng. These include: genetic pollution or dilution of remnant wild ginseng populations by wild-cultivated populations, introduction of fungal pathogens into wild populations from wild-cultivated ginseng, and ginseng habitat fragmentation.

The perceived threats to wild-ginseng populations from wild-simulated agricultural practice are minimal, when compared to those threats posed by ongoing suburban development within its natural range and the concomitant deforestation of deciduous forests in Ontario and Quebec. In

addition, herbivory by white-tailed deer, wild harvesting of ginseng, and climate changes brought about by global warming will also contribute significantly to this species' decline.

Although there is no genetic difference between wild and cultivated ginseng, certain basic best management practices on the part of wild-cultivated ginseng growers can be implemented to mitigate the perceived threats to those few remaining wild ginseng populations. These best management practices involve the use of protective buffer zones placed around those identified wild populations, as well as the use of disease-free ginseng seed originating from Canadian field-cultivated, or wild-simulated populations.

The problem of developing a traceability protocol to satisfy the primary conservation concern of wild ginseng being marketed as wild-simulated ginseng is more complex and difficult to solve. The entire price structure of the American ginseng trade in Asia is predicated on the physical attributes of the ideal wild ginseng root. The farther a root is from this ideal, the lower its grade and price. It is critically important to the wild-simulated ginseng grower that they be able to represent their product as wild ginseng root. Any system of ginseng root traceability must be able to guarantee the wild-simulated grower's confidentiality for themselves and for the locations of their wild-simulated ginseng plantations.

This report proposes a series of traceability protocol alternatives ranging from simple proof of the use of certified ginseng seed from non-wild ginseng sources, to a third party, individual grower certification system. In all probability, the solution to the traceability issue will be a combination of these proposed alternatives. Ultimately, it will be the responsibility of the various federal and provincial government policy makers to decide on the final course of action.

Wild American ginseng populations are reported to be in decline in Ontario and Quebec. This decline is attributable to a variety of factors, which include:

- continuing loss of mature deciduous forest habitat from those areas of American ginseng's historical northern range in Ontario and Quebec brought about by

urban/suburban development, and hardwood forest logging,

- persistent conditions of habitat fragmentation and inability of existing wild populations to expand across large areas of unforested habitats and the concomitant narrowing of these remnant populations' gene pools,
- the climatic effects of global warming,
- and continuing wild-harvesting of the few remnant wild populations and the logistical difficulties faced by government agencies in the enforcement of existing protective legislation.

The survival of American ginseng in Ontario and Quebec is inextricably linked to the actions of humankind. In Ontario, over a century ago, a handful of farmers from Norfolk County preserved some of the indigenous stocks of American ginseng. Today, in light of the foregoing circumstances, it would seem there is still a vital role to be played by wild-cultivated ginseng growers in maintaining and expanding secure ginseng populations in the remaining privately-owned forested lands of Ontario and Quebec. At the very least, the encouragement of an expanded wild-simulated ginseng industry will give impetus to some private landowners to keep their mature forested properties intact rather than to allow them to be logged. In addition, fostering a wild-simulated ginseng industry provides opportunities for the preservation and expansion of those few remaining wild ginseng colonies into other secure and diverse deciduous forest habitats. The positive benefits of planting more American ginseng in more forested landscapes vastly outweighs the perceived and mitigable threats these wild-cultivation methods pose to those few remaining wild ginseng colonies.

1.0 Introduction

This report has been be prepared as part of a project sponsored by the government of Canada's Interdepartmental Recovery Fund program for American ginseng (*Panax quinquefolius*) . The member agencies in the project include: Agriculture and Agri-Food Canada (AAFC), Ontario Ministry of Agriculture and Rural Affairs (OMAFRA), and Environment Canada/Canadian Wildlife Service (EC/CWS).

This report focuses on the agricultural and conservation issues surrounding the federal and provincial designation of American ginseng as an endangered species, which is regulated by the Convention on International Trade in Endangered Species of Wildlife Fauna and Flora (CITES) as well as several provincial statutes . The effect of the CITES agreement is to mandate an export permit for all American ginseng products leaving Canada and a prohibition on the export of wild American ginseng, which until recently included ginseng anthropogenically derived from a variety of wild-cultivation techniques. Further species at risk legislation — the *Ontario Endangered Species Act*, 2007 — will be implemented on June 30, 2008 and will also have influence over the wild-cultivation of ginseng. It is this category of wild-cultivation techniques with which this report will specifically concern itself.

The main objectives of this project are to:

- determine and define the stresses that the various wild-cultivation techniques may pose to wild populations of ginseng,
- identify best management practices that would support a CITES Scientific Authority "Non Detriment Finding" for these wild-cultivation techniques,
- and evaluate the use of traceability through certificates of origin to distinguish wild ginseng from ginseng produced by a variety of wild-cultivation techniques.

The Canadian international trade in American ginseng is approximately 291 years old and is

second only to the fur trade in terms of its longevity. This examination of the ginseng trade involves elements of biology, history, archaeology, socioeconomics, and international politics. Humankind has an intimate and long-standing relationship with this botanical species. Much of its history, however, has been obscured by time, the inherent secrecy and esoteric nature of the trade. In addition, many of the issues surrounding the international trade in ginseng, from the primary producer to its ultimate consumer in Asia, are not fully understood by those government authorities recently responsible for its conservation status and regulation. In order to rectify this situation and facilitate a better informed discussion regarding the conservation status of American ginseng, this report will of necessity trace the threads of these various elements to give a broader perspective of the ginseng trade and its relevance in addressing the three main objectives of the project.

1.1 Terminology

One of the primary challenges associated with the discussion surrounding the relationship of ginseng as an endangered wild botanical species and a widely cultivated and highly-valued commercial crop, is the utilization of differing terminologies. For the purposes of this report, the author has applied the following definitions:

- **wild ginseng** refers to any ginseng which is now found growing untended by humans in a mature deciduous forest, it does not impute a provenience either natural, or anthropogenic;
- **field-cultivated ginseng** refers to ginseng cultivated using artificial shade producing structures;
- **wild-cultivated ginseng** refers to any number of cultivation practices which involve ginseng seed being planted in a forested environment by humans (see Section 3 for more detailed definitions).

2.0 A Short History of Ginseng

American ginseng is arguably the most valuable of any of the medicinal plants that occurs in the world today. Its history of exploitation closely follows that of Asian ginseng (*Panax ginseng*) which grew wild in parts of northeastern China, Korea, and eastern Russia. The use of Asian ginseng as a medicinal plant originated between 4,000 and 5,000 years ago in China and Korea (Persons and Davis 2005; KT& G Corporation 2007). By the 3rd century AD it was extirpated from China (Persons and Davis 2005). This stimulated an international trade in the Asian ginseng root with Korea. Eventually, the combined pressures of forest clearance for agriculture and over-harvesting of the plant from its remaining wild refuges resulted in its functional extirpation, in the wild, by the early 20th century (KT& G Corporation 2007).

In the face of declining wild populations and increasing demand for the Asian ginseng root, field-cultivation of the plant began in Korea approximately 600 years ago (KT& G Corporation 2007). With the exception of some remnant populations of wild Asian ginseng in eastern Russia, the species is now extirpated from its former wild range. There are, however, approximately 9,713 ha (24,000 acres) of Asian ginseng produced in South Korea utilizing artificial shade field-cultivation techniques (KT& G Corporation 2007). Currently, South Korea is planning to increase its production of the more lucrative wild-cultivated ginseng in the forested areas that have grown up in the demilitarized zone between North and South Korea (KT& G Corporation 2007).

Until the early 18th century, the existence of the North American species of ginseng was unknown to European or Asian botanists. The Jesuit priest, Father Joseph Francois Lafitau, wrote of the Iroquois of the Five Nations Confederacy using American ginseng as a blood tonic; however, he also wrote that he had to instruct a Mohawk woman in its use as a febrifuge (Lafitau 1718, in Fenton 1941). Although the aboriginal peoples of northeastern North America were aware of ginseng, and had an extensive *materia medica* based on indigenous botanical species, it would appear they did not consider American ginseng to have any significant medicinal qualities

(Yarnell 1964; Densmore 1928; Vogel 1970). In 1830, the writer James A. Jones describes the Potowatomi use of ginseng as a cure for female infertility (Jones 1830). Apocryphal accounts such as this of Ojibway and Iroquois peoples valuing ginseng may relate to the post-European contact period following their extensive participation in the 18th and 19th century ginseng trade (Huron Smith 1933 in Vogel 1970).

Various aboriginal groups did, however, utilize other members of the genus, specifically, wild sarsaparilla (*Aralia nudicaulis)*, and spikenard (*Aralia racemosa*). These two plants were used as both medicine and perhaps their berries as food (Yarnel 1964; Densmore 1928). No evidence of carbonized ginseng remains has been found in any prehistoric sites although the seeds of wild sarsaparilla and spikenard do occur infrequently (Dr. Stephen Monckton, paleo ethnobotanist, University of Toronto, pers. comm.).

Although there is some evidence that 17th century Dutch merchants, in what is today New York state, were the first to trade American ginseng into Europe, the Jesuits of French Canada were the first to export ginseng to China (Heriot 1803; Warburton 1849; Lafitau 1718 in Fenton 1941). The Jesuit Father Jartoux, stationed in Tartary (China), wrote describing *Panax ginseng* in 1702. This information was communicated to Father Lafitau, who was living with the Iroquois near Montreal. Lafitau showed drawings of the Asian ginseng to the Iroquois which they identified as similar to a plant which grew locally — American ginseng. Other sources credit the King of France's official physician to Quebec, Michel Sarrazin, with discovering American ginseng, in 1702 (Appleby 1983). It was, however, Lafitau who encouraged the Iroquois, other aboriginal peoples, and early French settlers, to find and dig the ginseng root for trade to the French fur traders (Heriot 1803; Warburton 1849; Lafitau 1718 in Fenton 1941; Persons and Davis 2005). Thus began the long association of American ginseng with the fur trade, which continues today in parts of northeastern United States.

An extensive and destructive period of over-harvesting of ginseng ensued and continued for approximately thirty years. Furs and ginseng were exported in sailing ships to France and thence to Tartary (China). As much as 20,000 pounds of dried ginseng root were exported annually with

an estimated value of $100,000 (Persons and Davis 2005). Heriot (1803) and Warburton (1849) state that in 1752 the value of Quebec ginseng exports totalled 20,000 British pounds sterling. In 1858, a writer in the Canadian Naturalist and Geologist, identified only as T.S.H, gives the French equivalents of exports for 1752 as 500,000 French francs. The writer adds that the price of ginseng root in Quebec in 1752 was 25 francs per dried pound (T.S.H. 1858). By the mid-18th century the trade in ginseng was waning, owing to a scarcity of the plant combined with the inferior quality of the roots being harvested and poor handling of the roots during the drying process. China had temporarily lost its taste for American ginseng and the plant was nearly extirpated from much of its range in 18th century French Canada (Heriot1803; Warburton 1849; Tuttle 1877). In 1749, Pehr Kalm, the famous swedish botanist who collected extensively in North America, reported that "...ginseng formerly grew in abundance round Montreal, but at present there is not a single plant to be found...This obliged the indians this summer to go far within the English boundaries to collect the root." (Kalm in Warburton1849).

As a result of this initial trading boom in ginseng and its linkages with the fur trade, the gathering of wild ginseng became firmly entrenched as part of a subsistence economy practiced by many early European and aboriginal inhabitants of the northeastern North America. The ginseng trade with China gradually recovered and by 1781, Sir Frederick Haldimand, the British Captain General and Governor-in-Chief of the Province of Quebec, complained that he could scarcely raise 30 Mississauga warriors from the northern shore of Lake Ontario to defend against the Americans, since most were engaged in the "peaceful employment of gathering ginseng" (Senecal,1888; McIlwraith 1904). Similarly, Kalm in Warburton (1849) reports that during these times — 1749— the Montreal area farmers could not find any indians to work during the harvest since they were all occupied with ginseng gathering.

Ginseng along with furs became the principal items of commercial exchange in both colonial United States and Canada (Lambert 1813; Griffis 1891). By 1852 large quantities of ginseng were being exported from United States to China — 158,455 pounds valued at $102,703 — and the plant was reportedly still common in Quebec (T.S.H. 1858).

As large-scale land use conversion from forest to agricultural fields progressed into the 19th and 20th centuries, ginseng habitat was destroyed and the species was relegated to remote landscapes unsuitable for agriculture such as the Appalachian Mountains. Even in these areas, clear-cut forestry practices brought about a further contraction of the species's range.

In Ontario in 1880, the wanton, reckless destruction of deciduous forests was decried by the Ontario Agricultural Commission, which cited the shocking disappearance of Ontario's forests as a waste of a valuable resource. The Commission identified the farmers of all of the settled districts as the unconscious stewards of the remaining forests and recommended reforestation efforts be initiated in the province (Glazebrook 1971). This destruction of woodlands and concomitant settlement is also cited as a reason for the decline in Ontario's wild ginseng. In this same time period —1890— the Ontario government promulgated regulations to limit the harvesting season for wild ginseng (McRae 1921).

As with *Panax ginseng*, American ginseng became the subject of attempts to artificially propagate the species. As early as 1738 the well known Philadelphia botanist, John Bartram, wrote in a letter to a fellow botanist of his successful experiments in growing ginseng under artificial shade structures (Mr. Eric Burkhart, doctoral candidate and ginseng historian, The Pennsylvania State University, School of Forest Resources, pers. comm.). The standard histories of American ginseng cultivation, credit Abraham Whisman of Virginia and George Stanton of New York with being the first growers of artificially cultivated ginseng in the 1870s (Persons and Davis 2005). In pre-confederation Canada, John C. Schultz wrote in the Canadian Agriculturalist, and Journal and Transactions of the Board of Agriculture, that ginseng production in Quebec and Ontario could be increased by "artificial means" (Schultz 1861).

In Canada the first grower of field-cultivated ginseng was Clarence Hellyer, who began a small ginseng garden under an artificial shade structure near Waterford, Ontario in 1896. Hellyer had read about the field-cultivation of ginseng in an article in an American hunting and trapping magazine while travelling with his wife on a railway trip to the US in 1896 (Mr. John Race, field-cultivated ginseng grower and former buyer of wild ginseng root, pers. comm.). The early

growers of ginseng cultivated the plant as an addition to a general small-farm economy. Initially, they obtained local ginseng seed from a variety of remnant wild populations located in the wooded sections of eastern Norfolk County, forests along the banks of the Grand River in Brant County, and the woods near Oakland also in Brant County (Mr. Walter Hellyer, former field-cultivated ginseng grower and buyer of wild ginseng root, great-grandson of Clarence Hellyer, pers. comm.) As their ginseng gardens grew larger, they began harvesting and replanting their own ginseng seed.

Over time, a few growers of ginseng — the Hellyer and Race families in Ontario and the Fromm brothers of Wisconsin — specialized in growing large acreages of ginseng, (Walter Hellyer and John Race, pers. comm.). These specialized ginseng farmers developed markets for the crop with China and established the century long trade with the ginseng merchants of Hong Kong.

Eventually, American ginseng became the preferred ginseng of the Chinese. Today between 4 and 5 million pounds (1,814,000 kg - 2,268,000 kg) of dried field-cultivated ginseng root are produced annually in Ontario and British Columbia (Serecon 2007). The average yield is around 2,500 pounds per acre (2,800 kg/ha), but this can vary greatly with weather, soil, disease, and insects. The field cultivation of the American ginseng is taking place in countries as far away as China, Korea, New Zealand and Australia.

There is still a trade in wild American ginseng, most of which is supplied by US exports. Its supply is very limited and its value much higher than field-cultivated root (Serecon 2007). In Canada, there is also a domestic wild ginseng market which is only a fraction of the overall Canadian ginseng export market. It is, however, difficult to affix numbers to this esoteric trade, which focuses on the highly lucrative upscale Asian market.

3.0 Ginseng Cultivation Techniques

In a natural deciduous forest environment, the ginseng plant produces an elongated root which over time becomes stained with the darkly coloured, organically rich forest soils. The main root grows tendrils and it may become forked. Roots are between 5.0 cm to 10.0 cm (2 in to 4 in) long, depending on its age and the site's growing conditions — soil fertility, sunlight, moisture, and the growing season's duration. In rare instances, the root may resemble a human figure, hence the mandarin chinese word *ginseng* refers to "man root". The ginseng trade is based on the appearance and flavour of the root. The wild root is considered the epitome of the desired root, against which all cultivated roots are judged and valued (Serecon 2007).

Ginseng root grown in natural forest conditions is much smaller than cultivated ginseng root. It has a variety of root shapes depending on the soil conditions and texture in which it grew. Perhaps its most distinguishing feature is the concentric wrinkles which encircle the wild root from top to bottom. These are the result of the root's contractile nature. A contractile root is a thickened specialized root which acts to shrink vertically under conditions of environmental adversity brought about by drought or cold temperatures (Usher 1996). This adaptation helps to position the plant's root at an optimum level in the ground. The ginseng root, grown in a natural forest setting, has a patina of black humic soil particles embedded in its surface and within the contractile wrinkles.

In order to understand the issues surrounding the wild-cultivation of ginseng and wild ginseng conservation concerns, it is essential to clearly define the various techniques of ginseng cultivation. In particular, it is important to explain the difference between woods-grown ginseng cultivation and wild-simulated ginseng cultivation, as well as the types of root they produce.

3.1 Field-Cultivation Technique

The vast majority of ginseng production in Canada is done under the field-cultivation system

utilizing some type of man-made shade structures. The ginseng seed is densely planted in rows. In this relatively unnatural and crowded situation, the plants are subject to a variety of fungal diseases and therefore require a high degree of management intervention on the part of the grower. The ginseng plants are fertilized and the sunlight reaching the plant is controlled. These optimal growing conditions produce an abnormally large root in a very short period of time — 3 to 4 years — when compared with the size and growth of ginseng in the forest. The appearance of these roots is very different from that of natural forest-grown ginseng. They are large, yellowish white in colour, somewhat similar in appearance to a carrot, and do not usually have the concentric wrinkles of the wild root. To enhance the value of field-cultivated root, growers will often subject fresh living roots to a cooling process prior to drying to cause the roots to contract and impart some semblance of the wrinkles of the wild root (Ms. Jan Schooley, provincial specialist, ginseng and medicinal plants, OMAFRA, pers. comm).

3.2 Woods-Grown Technique

Woods-grown ginseng cultivation is very similar to field-cultivation, but it uses the natural shade of a modified forest canopy. The forest floor is tilled and various soil amendments are made to produce an optimal growing medium. The ginseng is planted in rows and the planting density is similar to field-cultivated ginseng. It also requires management intervention to avert diseases and control weeds. The roots are larger than the wild root ideal and although they have some of the forest soil patina, they are easily distinguished from the wild forest root. This type of ginseng cultivation technique saves the grower the price of a shade structure and, at one time, brought a slightly higher price than field-cultivated ginseng. In the past decade the decline in the price of field-cultivated ginseng, brought about by overproduction, has also lowered the price of the woods-grown product. In addition, the CITES prohibition on export of woods-grown ginseng has reduced the marketability of the resultant crop. For these reasons, this method of production is becoming unpopular since the final product is only slightly higher in value than the field-cultivated root (Persons and Davis 2005; Mr. Keith Rainey, former field-cultivated ginseng grower and buyer of wild ginseng root; Jan Schooley, pers. comm).

It is estimated there may be as much as 1,000 acres (404 ha) of wild-cultivated ginseng in Ontario — some of this may be woods-grown, but most of it is assumed to be wild-simulated (Jan Schooley, pers. comm.). The growers practicing these techniques are, however, secretive concerning their involvement with this type of ginseng production technique. This stems from fears of crop theft and legal issues arising from the CITES prohibition on the export of the woods-grown ginseng root (Jan Schooley, pers. comm.).

3.3 Wild-Simulated Technique

Wild-simulated ginseng cultivation includes a number of variations all of which involve an absolute minimum of disturbance to the forest environment. There is no tillage of the forest soil and the plant seeding rate produces a lightly spaced cluster of plants. In essence, the wild-simulated growers select a section of forest that has a suitable growing environment for ginseng; they plant their seed, which is usually from field-cultivated or wild-simulated sources, and wait 8 to 12 years to harvest the roots (Persons and Davis 2005; Eric Burkhart; Mr. Robert L. Beyfuss, Cornell Cooperative Extension Agent for Greene County, New York; Jan Schooley; pers. comm.). Site selection is usually predicated on the grower's assessment of the site and the presence of certain other botanical indicators species. Most of the indicator species utilized are calciphiles, which may vary regionally. In Ontario and New York State, these species are: maiden hair fern (*Adiantum pedatum*), rattlesnake fern (*Botrychium virginiana*), baneberry (*Actaea* spp.), leatherwood (*Dirca palustris*), blue cohosh (*Caulophyllum thalictroides*), wild leeks (*Allium tricoccum*), sweet cicely (*Osmorhiza claytonii*) and wild ginger (*Asarum canadense*) (Robert L. Beyfuss, pers. comm.; author's pers. obs.).

Although there is little documentation concerning the origins of this planting method, it was probably practiced by 18th and 19th century aboriginal peoples and early European settlers, long before the advent of field-cultivation techniques, as a way of ensuring a reliable source of ginseng roots to trade or sell. In particular, aboriginal peoples have a long history of moving their medicines with them (Huron Smith 1933 in Vogel 1970; Densmore 1928; Yarnell 1964; Dr.

Valerie Assinewe, Unit Head, Monograph Development, Health Canada, Bureau of Product Review and Assessment, former ginseng phytochemistry researcher, pers. comm.). In two separate annual reports — 1898 and 1899 — to the Superintendent General of Indian affairs, John Scoffield, Indian Agent, lists ginseng gathering as an occupation of the Chippewas of Saugeen in Bruce County (Dawson 1900).

In some areas of the northeastern United States the term "wild-simulated" is not used and there is a substantial blurring of the line between wild ginseng harvesting and wild-simulated cultivation on the part of participants in the ginseng industry, since it is considered to be one and the same thing. The traditional wild ginseng harvesters also replant and move ginseng seed to other suitable forest habitats (Eric Burkhart; Robert L. Beyfuss, pers. comm.). The term "virtually wild" is occasionally used in the US to describe this cultivation technique.

The most minimalist of the wild-simulated growing technique is the "scatter method". The grower takes stratified seed and plants it along a suitable forest ridge, or hillside, by simply scattering the seed down the hill slope. As with all ginseng planting, this occurs in the late summer or early autumn. Ideally, this technique is used just before the leaves fall and optimally, just before a rain storm. The rain running down the slope serves to further distribute the seed and the leaf fall covers it over protecting it from dessication and the predation of forest rodents. Nothing else is done and the grower may, or may not, get a crop of wild-simulated ginseng in 8 to 12 years. The more usual method of planting a wild-simulated crop is to rake aside the leaf litters, lightly scarify the humus layer with a rake then scatter the stratified seed and rake the leaf litter back over the planted area (Persons and Davis 2005).

Depending on the wild-simulated grower, there may be some slight management interventions to control growth of sapling trees and perhaps to thin the forest canopy to improve light conditions. Undoubtedly, there are a large number of permutations of this technique, however, the result is, widely-spaced plants which grow slowly depending on the climate, light, and soil fertility of the site. The root produced by this method is indistinguishable from a wild plant and is usually sold as such. To ensure the root is identical to the wild ideal, wild-simulated growers only lightly

wash their roots so they retain the dark, forest soil patina as a positive confirmation of their "wild" origins. Currently, the price for wild or wild-simulated ginseng is approximately 20 times that of field-cultivated ginseng.

Currently in Quebec, there are at least 150 persons actively engaged in wild-simulated ginseng production. This is a relatively new practice for the province and none of these individuals has yet harvested a crop of wild-simulated roots (Ms. Isabelle Nadeau, Ginseng Boreal, ginseng consultant, pers. comm.). In Ontario, the actual number of wild-simulated growing enterprises is unknown. The previously mentioned estimation of 1,000 acres (405 ha) of wild-cultivated ginseng assumes much of this to be wild-simulated. Persons engaged in this type of cultivation technique are highly secretive about their activities. This stems from concerns over crop theft, legal issues arising from the CITES prohibition on the export of the wild-simulated root, and a desire to sell to buyers wild-simulated roots which they represent as "wild".

4.0 The Ginseng Market

The demand for all types of ginseng — *P. ginseng* and *P. quinquefolius* — is estimated to be 4,536,000 kg (10 million pounds) per year. The majority of this demand is satisfied with *P. quinquefolius* production from Canada and United States (Serecon 2007).

The market for all types of American ginseng is almost exclusively in Asia — more specifically China. The marketing environment has always been extremely complex and esoteric. Almost all of the ginseng imported into Hong Kong, is shipped into mainland China — mostly illegally — for grading, sorting, packaging, and resale (Serecon 2007). A significant proportion (perhaps 20% or more) is then exported back through Hong Kong and thence into other markets, including those in North America.

China, via Hong Kong, imports 92% of Canada's exported field-cultivated ginseng — between 1,814,000 kg (4 million pounds) and 2,268,000 kg (5 million pounds) annually (Serecon 2007).

There is, however, some wild harvest of American ginseng which is supplied to the market from some US states. This practice is not allowed in Canada since the CITES Management Authority has prohibited the export of wild ginseng, because it is protected under the federal *Species at Risk Act*. The wild ginseng is valued at a much higher price than cultivated ginseng, but the total supply in terms of quantity is very limited (Serecon, 2007). It is highly probable, however, that some wild-harvested and wild-simulated ginseng, from Ontario and Quebec, is smuggled into Hong Kong and China (Mr. Lawrence Cheng, Sun Ming Hong, Canada, field-cultivated ginseng exporter; John Race; Keith Rainey, pers. comm.).

Since 19 US states allow the export of wild ginseng root, there are export figures available which give a partial picture of the wild ginseng trade. In 2006, the US exported 91.7 tons (83.2 metric tonnes) of dried wild ginseng root to Hong Kong and the Peoples Republic of China (United States Department of Agriculture (USDA) Foreign Agricultural Service (FAS) 2007). The value of this export to the US economy was $22.6 million (USDA FAS, 2007). Somewhere buried in these figures is a large amount of wild-simulated ginseng root which has entered the market as "wild". This hidden wild-simulated factor has the effect of obscuring many aspects of the wild-ginseng trade particularly around the issues of wild ginseng population statistics (Gabel 2005).

Canada is a signatory to the CITES agreement, which obligates Canadian CITES authorities to restrict the international export of the species. Currently, Canadian authorities allow the export of field-cultivated ginseng products, but owing to concerns about the population status of wild ginseng in Ontario and Quebec, the export of wild, wild-simulated, and woods-grown ginseng has until recently been prohibited. This does not prohibit the wild harvest, or sale of wild, wild-simulated, or woods-grown ginseng within the boundaries of Canada — except in Quebec where wild harvesting is prohibited by provincial statute. There does, however, appear to be a flourishing trade in these restricted categories of ginseng both domestically (legal) and internationally (illegal). The four buyers of wild ginseng, interviewed for this report, had no difficulty in selling all the ginseng they purchased from wild harvesters. The markets for the wild root were in the Asian communities of Toronto, Montreal, and Vancouver. All of these buyers speculated that some portion of this harvest would have been smuggled out of Canada and into

China, (John Race; Walter Hellyer; Lawrence Cheng; Keith Rainey, pers. comm.).

In October 2007, the Canadian CITES Scientific Authority released a qualified "non-detriment finding" for the export of the two categories of wild-cultivated ginseng — wild-simulated and woods-grown produced. The qualification is based on a case by case consideration of the production methods and current provincial policy in the province where the ginseng root was grown (Environment Canada 2007).

Originally all ginseng, whether it was harvested from the wild, or grown by the field-cultivation techniques, was sold for about the same price per pound (John Race, pers. comm.). As the supply of field-cultivated ginseng increased, and the price per pound decreased, the Asian market began to discriminate between the two types of ginseng product. The price of wild ginseng and, by default wild-simulated ginseng, increased and eventually far exceeded the field-cultivated product price.

The price structure for all types of American ginseng is as convoluted as its market environment. The price and grading structure is predicated on the ideal wild ginseng root. The farther a root is from this ideal, the lower its grade and price. The criteria used by the Chinese ginseng traders in judging the quality of all ginseng is, in order of importance: root shape, root size, country of origin, price, taste, smell, and outside colour (Serecon 2007). These selection criteria were used in the grading of mostly the field-cultivated root. In the instance of wild, or wild-simulated root, an additional selection criterion would be the age of the root; hence the practice of wild ginseng harvesters and wild-simulated growers of marketing their dried roots with the "neck" intact. This elongated rhizomatous structure exhibits the abscissa of the plant stem from previous growth seasons and can be used to approximate the age of the root. The older the root, the higher its value.

It is interesting to note, that there is little value placed on ginseng's ginsenoside content by the Asian buyers and consumers of the product (Serecon 2007; John Race; Keith Rainey, pers. comm.). This lack of concern regarding the amount of ginsenoside in the product is a reflection

of the longstanding values and traditions of the Chinese buyers and consumers, which have their origins in ancient Chinese history. The health giving qualities of the herb are entwined with myths and legends. Traditional Chinese medicine practitioners view the ginseng's health giving properties through an entirely different lense than those practitioners of western medicine. The preoccupation of western medical research with the levels and types of ginsenosides contained in the ginseng plant have more relevance to the provision of processed ginseng products to North American and European markets than to the Asian market.

This report focuses on various aspects of wild-cultivated ginseng and particularly on wild-simulated ginseng. This is a "high-end" product that can only be afforded by wealthy consumers. An appropriate analogy would be the difference between "no name" brand coffee and the coffee known as "kopi luwak" — coffee beans past through the digestive track of the Sumatran civet cat. Although they both provide a palatable drink, kopi luwak is exceedingly rare — 200 pounds are produced annually — and that is its primary attraction to the wealthy consumer. Wild American ginseng and its indistinguishable counterpart wild-simulated ginseng, occupy the same market niche. The more rare it becomes, the more attractive it is, and the higher the price paid for it.

The market for wild and wild-simulated ginseng is in a perpetual state of under-supply, hence the wide price discrepancy between it and field-cultivated root — $15-$30 per pound for field-cultivated; $400-$1,000 + per pound for wild/wild-simulated root. The market could absorb a 10 fold increase in the supply of wild-simulated ginseng root and it would have little effect on the current price structure (Robert L. Beyfuss and Eric Burkhart, pers. comm.).

5.0 The Ginseng Conundrum

Prior to European colonization of North America, the deciduous forest environment necessary to sustain the ginseng plant was abundant. The ginseng plant is a habitat specialist, which requires a relatively stringent niche in the deciduous forest environment. These requirements are well drained, organic-rich, calcitic soils. In addition, its survival is critically dependent on a narrow

range of sunlight requirements — too much sunlight results in phototoxicity and too little diminishes and ultimately precludes growth (Charron and Gagnon 1991; Gagnon 1999; Fournier *et al.* 2003). In the wild, the species is primarily a self-pollinator with limited capabilities to outcross with nearby individuals (Schluter and Punja 2000; Schlessman 1985). As such, it exists in population clusters in preferred deciduous forest micro-habitats. These population clusters are separated by areas of less suitable forest environment (Cruse-Sanders and Hamrick 2004a) .

The ginseng plant's long-term survival adaptations rely on the longevity of the individual specimen and its ability to sustain a population with very little influx of new genetic material. This type of survival adaptation is typical of habitat specialists. It is sometimes referred to as a metapopulation. A metapopulation is literally, a "population of populations". Typically, metapopulations — at least in the "traditional" sense of the word — are found in patchy landscapes, where a species inhabits small, relatively isolated "islands" in a "sea" of uninhabitable area (Hjermann 1997). Each of the populations — often called a "local population"— are so small that they may eventually become extinct. However, there is occasional dispersal between the patches, founding new populations in "empty" patches (Hjermann 1997). In the case of ginseng, its survival adaptations are vulnerable on two fronts: the loss of the individual specimen, and the destruction of the intervening habitat between population clusters. These two threats to its survival are posed by over-harvesting and large-scale deciduous forest destruction.

Although there is little information available on the abundance of the ginseng plant in northeastern North America, those few accounts that do exist and initial 17th century harvesting information indicate that in suitable deciduous forest habitat, it was a common species. Warburton (1849), however, states the plant was not common everywhere and that a person could travel many miles through the forest and not encounter a single ginseng plant, but in those spots where it grew, it was abundant. Some researchers have postulated the densest populations were located in areas of rich forested, riverine flood plains, which were also highly sought as agricultural lands by European colonists (Eric Burkhart, pers. comm.). Most populations found today are located in areas that were unsuitable for agricultural tillage — mountain slopes, ravines, areas of shallow or infertile soils.

In the US, where ginseng has an extensive range, it is estimated that the populations may be in the billions of individuals (Nault 2006). There are a few remaining small, isolated and putatively wild populations of American ginseng growing in the few remnant forest patches of southern Ontario and parts of Quebec. Current population estimates of ginseng in Ontario and Quebec are approximately 50,000 individuals (Nault 2006). These populations are at risk of extinction brought about by ongoing:

- habitat fragmentation and consequent loss of gene flow,
- natural forest successional changes, i.e. increased canopy closure,
- climate change resulting from global warming,
- forest clearance for suburban development,
- timber harvesting,
- herbivory by white-tailed deer, introduced wild turkeys, and a variety of small forest rodents,
- as well as increased wild-harvesting of the root for the growing Canadian Asian market and illegal export market to China.

Concern over these rapidly declining wild populations of ginseng has prompted various federal and provincial government agencies to designate the species as threatened or endangered. These various designations currently provide some limited regulatory protection for these wild populations, but do not totally ban the harvest, or sale, of the plant within the confines of Canada's borders, with the exception of Quebec. The CITES agreement, however, prohibits the export of wild and wild-simulated ginseng and the *Ontario Endangered Species Act*, 2007 which comes into force on June 30, 2008, will prohibit the harvest, possession and sale of all *Panax quinquefolius* (Mr. Chris Risley, OMNR species at risk biologist, pers. comm.).

At the same time, and within the same geographical area, where these declining remnant populations of ginseng are found, approximately 6,000 acres (2,428 ha) of American ginseng are annually grown in fields under shade structures — an additional 2,000 acres (809 ha) was recently grown in British Columbia. American ginseng is a widely cultivated medicinal plant and

Canada supplies most of the world's North American field-cultivated ginseng root (Serecon 2007). Between 4 and 5 million pounds (1,814,400kg - 2,268,000 kg) of dried ginseng root are annually sold to a primarily Chinese market. Another one-half million pounds (226,800 kg) is produced and sold by growers in the US — almost all of this comes from Wisconsin. In the late-1990s, there were approximately 8,000 acres (3,238 ha) of ginseng being grown in Canada — approximately two-thirds is from Ontario and the remaining one-third is from British Columbia. Recently, the production of ginseng in British columbia has declined. Current proportional estimates of ginseng production are 80% from Ontario and 20% from British Columbia (Dr. Richard Reeleder, AAFC, ginseng researcher, pers. comm.). The growing of ginseng in open fields under artificial shade structures is part of a century-old system of agriculture in Ontario. Currently, the CITES authority in Canada issues export permits for field-cultivated ginseng. The October 2007 "non-detriment finding" will perhaps allow for the issuance of export permits for ginseng root produced by wild-simulated and woods-grown methods, but it remains to be seen how the new *Ontario Endangered Species Act, 2007* impacts the multi-million dollar ginseng industry in Ontario.

An unknown, but fractional amount of this Canadian market is made up of wild, wild-simulated, and woods-grown ginseng. The growers and harvesters involved in this market cannot avail themselves of the lucrative international market and must confine their sales within Canada's borders. In addition, unless a way is found to differentiate between wild and wild-cultivated ginseng, the recently legislated *Ontario Endangered Species Act, 2007* may actually make it illegal for these growers to continue their operations, or even harvest the crops they have planted (Chris Risley, pers. comm.). Currently, the Quebec legislation makes it illegal to trade in or export ginseng from Quebec if its production methods involves the use of wild ginseng materials such as seeds or roots.

6.0 What is Wild Ginseng?

Although this may seem like a simple question, it is the essence of the issues surrounding the

international trade in ginseng and its partial export prohibition. Wild ginseng and all forms of cultivated American ginseng are the same botanical species. There have been no successful attempts to create strains, races, or cultivars of the species (Schluter and Punja 2000). Cultivated plant populations consist largely of unimproved "land races" with a high degree of variation within populations (Bai *et al.* 1997; Boehm *et al.* 1999 in Schluter and Punja 2002; Dr. John Proctor, professor emeritus, Guelph University and ginseng researcher pers. comm.; Dr. Daniel Brown AAFC, ginseng researcher, pers. comm.; Dr. Richard Reeleder, pers. comm.). The ancestral stock of cultivated American ginseng came from the remnant forests of southern Ontario and other parts of its range in the US (Walter Hellyer; John Race; Keith Rainey; John Proctor, pers. comm.). No other threatened, or endangered, species of plant or animal has a population that is so widely cultivated, or a population that could be increased, or populations which could be reintroduced into suitable forest environments, at will.

6.1 Ginseng Reproduction

To understand the question, "what is wild ginseng?, requires some knowledge of the floral and reproductive biology of the ginseng plant. Almost all sources agree that American ginseng is, for the most part, a self-pollinator (Schlessman 1985; Proctor 1987; Schluter and Punja 2000; and Grubbs and Case 2004). The plant also has the ability to outcross with adjacent individuals, but the only observed pollinators of the species are hoverflies (*Syrphidae*) and sweat bees (*Halictidae*) (Duke 1980; Lewis and Zenger 1983; Carpenter and Cottam 1982 in Schlessman 1985). These generalist pollinators do not transfer pollen between distant individuals (Carpenter and Cottam 1982 in Proctor 1987). The effective range of these insects appear to be limited to approximately 50 metres (Robert L. Beyfuss, pers. comm.). A study conducted by a graduate student at the West Virginia University, to test the effects of pollinators on gene flow, found that pollen dispersal was approximately 50 m; but, it may be even farther (Hackney 1999). This result was qualified, however, by the researcher's inability to discount the effects of ineffective field-techniques in flower emasculation, as well as seasonal flowering variation. Studies of this nature are usually carried out over many flowering seasons and this particular study was conducted in only one floral

season (Hackney 1999).

In an experiment with a small number of cultivated ginseng plants, it was found that the success rate of fruit set was greater for plants which were protected from outcrossing (Schluter and Punja 2000). This experiment utilized three and four-year old plants and was conducted in British Columbia. The increase in fruit set was only observed on the four-year old plants and the researchers noted considerable plant-to-plant variation within the subset. In addition, even though there was fruit set, a significant number of berries aborted before they reached maturity. The researchers concluded that under cultivated conditions the species is autogamous, but also has geitonogamous and xenogamous capabilities. In addition, they concluded that individual plant fecundity was based on the plant's ability to allocate stored resources to seed formation — older plants in good condition produced more viable fruit. This research generally agrees with that of others which indicate the older plant is more capable of producing viable seed than the less mature plant (Schlessman 1984; Charron and Gagnon 1991; Hackney 1999). It should also be noted, the ambient summer air temperature in inland British Columbia can be as high as 43 degree C — these are not conditions normally seen in Ontario and Quebec — which tends to induce flower abortion (Jan Schooley, pers. comm.).

Ginseng researchers generally agree the fecundity of the American ginseng plant is relatively low and that in wild populations it is significantly lower than in field-cultivated populations (Schlessman 1985; Charron and Gagnon 1991; Hackney 1999; Schluter and Punja 2000). This relates back to the plant's tendency to allocate more resources to seed production, when it is growing under optimal conditions such as those found in field-cultivated populations.

The seed dispersal routes for the plant have not been studied extensively; however, this too appears to be a limiting factor for the ginseng colony expansion (Charron and Gagnon 1991; Cruse-Sanders and Hamrick 2004b). Usually the ripe berries of the plant — each of which may contain between one and three seeds — simply fall from the plant to the ground below. Unpublished data cited in a MSc thesis postulates that approximately 88 percent of ginseng seed falls with one metre of the parent plant (M. Van der Voort in Hackney 1999). Both the flesh of

the berry and the seed are highly attractive to a large number of small forest dwelling rodents — deer mice (*Peromyscus maniculatus*), eastern chipmunk (*Tamias striatus*), woodland jumping mouse (*Napaeozapus insignus*), and the white-footed mouse (*Peromyscus leucopus*), among others. Generally, these rodents consume and destroy the ginseng seed. The husks of the seeds may be found immediately adjacent the plant (Andrée Nault; Robert L. Beyfuss; pers. comm.; author's pers. obs.). Beyfuss has, however, occasionally observed a number of seedling ginseng plants all sprouting from one cluster which he speculates may be the result of a forest rodent caching ginseng seeds. There is no information concerning the consumption of ginseng seed by avifauna with the exception of wild turkeys (*Meleagris gallopavo*) (Eric Burkhardt; Robert L. Beyfuss, pers. comm.). In the US, the wild turkey regularly feeds on ginseng berries and leaves. It is thought by most observers, the ginseng seed does not survive the digestive system of the turkey. There are, however, anecdotal accounts of whole ginseng seeds being observed in wild turkey scats (Robert L. Beyfuss, pers. comm). There are growing numbers of wild turkeys in southern Ontario and their range is expanding northward into those forested areas of central Ontario and Quebec. There are also apocryphal accounts of the extinct passenger pigeon (*Ectopistes migratorius*), a forest dwelling columbiform, being responsible for the widespread dissemination of ginseng seed in northeastern US (Robert L. Beyfuss, pers. comm.).

White-tailed deer (*Odocoileus virginianus*) also consume the berries of the ginseng plant, as well as browsing on its leaves. The effect of increasing deer populations throughout the range of ginseng is seen as a threat to the species (Nault 2006). It is thought the ginseng seeds do not survive the digestive tract of the deer (Furedi and McGraw 2004).

The high mortality of the seed, low seed producing fecundity, and the relative immobility of the seed all result in the slow growth of a given ginseng population. Even when large areas of suitable habitat are present, the ginseng plant exhibits an inherent inability to colonize widely, or swiftly. The survival of the species is dependent on its ability to self-pollinate and the longevity of the individual — some ginseng plants found in Ontario and Quebec are known to reach 60 years of age (Charron and Gagnon 1991). Age claims in excess of 100 years are made for some individuals within US wild populations (Persons and Davis 2004).

Since the mid 19th century and the precipitous destruction of the forests of northeastern North America, the primary vector for the dissemination of the ginseng plant may well be humans and their attempts, albeit monetary in motive, to maintain the species and reintroduce it into suitable second-growth forest environments.

6.2 Ginseng Genetics

Most plant scientists, who work with American ginseng genetics, do not think it is possible to distinguish wild growing ginseng from cultivated ginseng on an individual plant by plant basis, or even across large populations from one geographic area to another (Dr. Daniel Brown; Dr. John T. A. Proctor; Dr. Zamir Punja, Simon Fraser University, pers. comm.). There is some criticism of this position by others, stating that the actual number of wild populations sampled is insufficient to draw this conclusion (Dr. Andrée Nault, Research Associate Montreal Biodome, pers. comm.) Dr. Richard Reeleder (pers. comm.) is of the opinion that it may be worthwhile to examine some of these reputedly wild populations more extensively, to determine if there are any which are genetically unique.

Some authors have suggested the genetic difference between wild colonies and cultivated populations, is that wild colonies have less genetic diversity within a particular population than do ginseng plants found in a field-cultivated population (Schluter and Punja 2002; Grubbs and Case 2004). Logically, this would appear to be the result of long-term genetic isolation of the few remaining wild ginseng colonies brought about by massive habitat destruction and consequent fragmentation of remnant populations.

In one recent study examining the fine-scale genetic differences between harvested and unharvested wild populations, the authors of the study stated that wild unharvested ginseng populations were genetically more diverse than wild harvested populations (Cruse-Sanders and Hamrick 2004a). In a subsequent paper, they appear to have revised their conclusions and stated

there were no differences in fine-scale genetic structure between unharvested and harvested wild populations (Cruse-Sanders and Hamrick 2004b).

Populations of field-cultivated ginseng show a greater genetic diversity between individuals (Schluter and Punja 2002). This is the result of a number of factors: field-cultivated populations are densely grown, which provides a greater chance of xenogamous gene exchange, the ancestral stock of cultivated populations originated from a variety of remnant sympatric and allopatric wild populations, and these field-cultivated populations have had over a century of outcrossing opportunities under optimal field-cultivated growing conditions. The field-cultivated ginseng populations are in essence still wild and are the repository of most of the various remnant genetic material from southern Ontario and Wisconsin, which was extant approximately 100 years ago. In theory, some individuals in these populations may be closely related to certain remnant wild populations. Practically, this would be impossible to determine, unless all remnant wild populations were located and genetically typed (Zamir Punja, pers. comm.)

In addition, most ginseng researchers and growers acknowledge that within these field-cultivated populations there are a variety of phenotypes. When the seed of cultivated ginseng is planted back into the deciduous forest environment it readapts to the forest environment. In the absence of optimal field-cultivated conditions, the growth of the plant slows and the size, shape, and textural appearance of the root change. Certain phenotypes may become more prominent in the population based on the environmental exigencies of the site. It becomes visually indistinguishable from the wild plant. The size, growth rate, health, and fecundity of an individual plant in the wild are dependent on its microhabitat (Cruse-Sanders and Hamrick 2004b; Schluter and Punja 2000).

Somewhat similar attempts to distinguish between wild and cultivated ginseng populations have been attempted using phytochemistry. In one study, the researchers utilized the levels of various ginsenosides from plants taken from several wild ginseng colonies in Ontario, Quebec, Vermont, Maine and Wisconsin. It was found that there was no statistical significant difference in ginsenoside levels between wild and cultivated ginseng plants (Assinewe *et al.* 2003). A similar project, in the same year, concluded that ginsenoside levels have a direct correlation with sunlight

levels filtering through the forest canopy; the more sunlight the plant receives, the higher the ginsenoside content up to a maximum of 36 % solar exposure at which point the leaves begins to die (Fournier *et al.* 2003). A more recent study conducted in 2006, noted a ginsenoside difference between northern populations — Ontario, Quebec, and upstate New York — and southern populations in Maryland and Tennessee (Schlag and McIntosh 2006).

7.0 Current Wild Ginseng Population Status

According to 2006 figures contained in the *Proposed Ginseng Recovery Strategy*, there are 63 viable wild populations of American ginseng known in Canada —38 in Quebec and 25 in Ontario (Nault 2006; Mr. Guy Jolicoeur, recovery coordinator, Ministère du Développement durable, de l'Environnement et des Parcs, pers. comm.). The entire Ontario and Quebec populations are estimated to be approximately 50,000 plants. Half of these plants are located in nine large colonies (Nault 2006). These 63 populations are deemed to have a minimum viable population (MVP) by virtue of their containing more than 172 individual plants. This figure was derived from a simulated population growth model of four actual Quebec populations, which projected growth trends over 200 years under a variety of harvesting regimes (Nantel *et al.* 1996). The 172 MVP figure has been contested by a number of researchers as either being too high or too low. The theoretical model is based on a number of input values and attempts to predict the results of stochastic extinction events on the modelled populations. Some researchers feel the model is outdated and has not taken into account the climatic effects of global warming, or that it reflects only the conditions of the four Quebec populations upon which it was based. Others believe the population model is theoretical and based on the false premise that these populations exist in isolation from human influence.

In addition to the 63 MVP populations identified in the recovery strategy, there are many more known occurrences of ginseng in Ontario. According to the Ontario Ministry of Natural Resource's (OMNR), Natural Heritage Information Centre (NHIC), there are approximately 291

known occurrences of the plant in Ontario (Dr. William Crins, senior ecologist, OMNR, Planning and Research Department; Mr. Michael Oldham, botanist/herpetologist NHIC, pers. comm.). NHIC occurrence records relate to any reported occurrence of a species, whether or not that population is still extant. There have been no comprehensive efforts in Ontario to census ginseng populations on Crown Land and budgetary/staffing constraints make it unlikely this will be a priority in the province (Mr. Shaun Thompson, regional ecologist, OMNR Kemptville District; Michael Oldham, pers. comm.). Those reported occurrences are often the result of incidental observations on the part of OMNR staff or members of the public. The number of occurrences of ginseng on privately owned forested land is also largely unknown. In Quebec, there are 138 occurrences with populations below the number of 172, 25 are historic or extirpated; 75 are still extant. (Guy Jolicoeur, pers. comm.).

8.0 Biological Factors Predisposing Ginseng to Extirpation or Extinction

There are a number of biological factors that predispose American ginseng to extirpation and extinction events. These are:

- a relatively low rate of reproduction and limited seed dispersal capabilities,
- very specific deciduous forest habitat niche requirements,
- inability to survive direct sunlight conditions — solar radiation above 36% causes photo-toxicity,
- and a short seed life-span and inability to form a persistent seed bank.

Normally, ginseng seed only lives for between 18 and 20 months in the soil (Charron 1989 in Gagnon 1999). Under artificially induced conditions of drying and chilling ginseng seed to just above the freezing point, the seed has remained viable for between 5 and 7 years (Jan Schooley, pers. comm.). In essence, unlike many other botanical species, the ephemeral nature of ginseng's seed prevents it from forming a persistent forest floor seed-bank. Seed longevity in other botanical species is part of a survival strategy that allows the species to persist through times of

environmental adversity and to re-colonize a habitat after a local extirpation event. For example, the seed of the pin cherry tree (*Prunus pennsylvanica*) — a shade intolerant species — may live for as long as 60 years in the forest soil (Tierney and Fahey 1998). Ginseng is also subject to photo-toxicity and cannot tolerate long periods of direct exposure to sunlight. Photo-toxicity and leaf death begins to occur at approximately 36% exposure to solar radiation (Fournier *et al.* 2003).

9.0 What Are the Origins of the Remnant Wild Ginseng Populations?

Consideration of the aforementioned limiting biological factors, pose some questions concerning the current assumptions made about the remnant wild ginseng populations in Ontario and Quebec. In aggregate, these limiting factors preclude the survival of any ginseng population in the event of significant forest clearance. In addition, since it does not develop a seed-bank beyond 20 months, it cannot persist in the soil until the forest begins to regrow. Even in the instances of isolated populations surviving in small old-growth deciduous stands, the expansion of a ginseng colony is very slow and its seed is incapable of dispersion across large areas of non-forested landscape. In order to explore the provenience of the existing wild ginseng populations, it is necessary to examine the history of Ontario and Quebec forests.

9.1 A Short History of Forest Clearance and Landscape Conversion

The popular view of southern Ontario as a verdant primordial forest until the time of significant European colonization — circa 19th century — is essentially a myth (Cronon W. 1992). As early as AD 500 proto-Iroquoian cultural groups, such as the Princess Point, Glen Meyer, Uren, Pickering, and St. Lawrence Iroquoian, began clearing the forests from southern Ontario to grow corn as a supplement to their hunting and gathering economy (Trigger 1976). In order to plant their fields of corn, beans, squash, and sunflowers, the evolving agricultural practices of these people involved slash and burn forest clearance (Tooker 1964; Heidenreich 1971; Trigger1976). These Iroquoian agriculturalists lived in villages numbering between 1,000 and 2,000 people.

They grew their crops until the soil was exhausted or they had run out of trees for fuelwood. This usually occurred in 8 to 12 years time (Tooker 1964; Heidenreich 1971). At this point, they moved their village to a new location and began the process of slash and burn forest clearing again. Other first nations groups are thought to have manipulated forest environments by the use of fire. This was done to maintain open, park like, oak savannahs, or encourage the growth of forest mast crops, in an effort to improve hunting opportunities (Riley and Mohr 1994).

By the beginning of the 17th century significant portions of south-central and southwestern Ontario were occupied by the Huron (Wendat), Petun (Tionontaté), Neutral (Attiwandaronk), Erieehronons, Onondaga, and Wenrohonon. There are good estimates for the population densities of the Huron resulting from early 17th century Jesuit population censuses — approximately 20,000 to 40,000 people — (Heidenreich 1971; Trigger 1976). Using the conservative figure of 21,000 persons, Heidenreich (1971) estimated they would require at any one time 50,000 acres of cleared land — in various stages of active cultivation and fallow — to sustain themselves. There would be few stands of trees on any of the arable land of the Huron and the Tionontaté nations — approximately 1,078 sq. km (415 sq. miles) — which would have been allowed to mature beyond 15 years of age (Heidenreich 1971).

Epidemics of European diseases, beginning in the early 17th century, in combination with warfare with the Iroquois of the Five Nations, resulted in the destruction and dispersal of these non-allied Iroquoian farmers. The forest returned to these agricultural clearings, covering the land for 200 years until a major influx of European settlers occurred between 1780 and 1850 (Heidenreich 1971).

The first European settlers saw the forest as a malignant force to be conquered in the effort to convert the land to an agricultural purpose. They clear-cut and burned the deciduous forests of Ontario and Quebec, especially those forests located along the north shore of the lower Great Lakes and St. Lawrence River. Only areas of rocky soil or very steep slopes, which were untillable, would have been spared the onslaught of 19th century European colonization. These remnant forests and those farther north were subject to logging for timber, fuelwood, and in the

early 20th century, for pulp. By the late 19th century the government of Ontario, in the form of the Ontario Agricultural Commission, had become concerned over the reckless waste of this property "of fabulous value." Woodlots and windbreaks were gone, streams had dried up and fuelwood was becoming scarce (Glazebrook 1971). By 1986 only 5.5 % of the agricultural lands of southern Ontario were in any type of forest. Since that time, the decline of livestock-based agriculture has resulted in certain pasturelands being abandoned and returning to early-successional forest growth (Riley and Mohr1994).

10.0 Lack of Consistency Between Wild Harvest Figures and the Blurring Effect of Wild-Simulated Production

One of the major areas of contention between those who support and those who oppose the export of wild and wild-simulated ginseng in the US, is the apparent disconnect between the estimated numbers of wild populations and the annual export harvest figures. The State of Kentucky provides a prime example of this confusion. Kentucky is estimated to export more wild ginseng than any of the other 18 States that permit its harvest and export (Gabel 2005). The Kentucky Heritage Program has, however, estimated the wild populations of ginseng to be "vulnerable" and in need of protection. At the same time, the US Fish and Wildlife Service reports that 25,000 pounds of dried wild ginseng root —approximately 7 million plants — are exported annually (Beyfuss 2005).

The Kentucky Heritage Program frequently revises its population status for ginseng, but has difficulty assessing the species' population statistics in the face of inadequate information. It bases its conservation status for ginseng on the information provided by the conservation status reports of NatureServe, a North American not-for-profit conservation agency. Currently, the state's status for wild American ginseng is that it has an S3 to S4 ranking — rare to uncommon and uncommon to apparently secure. Although wild-harvesting in Kentucky is thought to be a stressor on the ginseng populations, an increase in logging activity is the primary threat (Ms.

Deborah White, Kentucky Heritage Program, botanist, pers. comm.).

The US Fish and Wildlife Service speculates the lack of consistency between putatively wild populations and the wild harvest figure is the result of the skewing effect wild-simulated ginseng production has on the export figures (Gabel 2005). All ginseng that appears to be wild is sold and exported as such. In fact, the wild-harvesting and the wild-simulated cultivation are so intertwined many ginseng harvesters in the US do not differentiate between the two (Robert L. Beyfuss; Eric Burkhart, pers. comm.).

There has never been an official or accurate accounting of either the export of wild ginseng from Canada, or its domestic market structure within the country's borders. When it was legal, wild ginseng was simply lumped in with the export of field-cultivated root. However, a similar inconsistency in estimated populations as compared to wild-harvest figures, exists in Ontario, but on a much smaller scale. Currently, the estimated total population for wild ginseng in Ontario and Quebec is approximately 50,000 plants (Nault, 2006). When this figure is compared with the recent and historical wild-harvest figures there is a wide discrepancy.

To obtain information regarding the wild ginseng market in Ontario, it was necessary to interview a number of persons who were associated with the ginseng trade. Although these men represent some of the oldest, multi-generational ginseng trading families in Canada, they were not the only traders in the market. Mr. Walter Hellyer, Mr. John Race, and Mr. Keith Rainey were all field-cultivated ginseng growers in Norfolk County. They also dealt in wild ginseng. All are now retired from the trade.

These buyers of wild-ginseng estimated that during an average year they purchased, in aggregate, approximately 75 lbs. (34 kg) of dried wild ginseng root, (John Race; Walter Hellyer; Keith Rainey, pers. comm.). This would represent about approximately 11,322 plants — the average 10 -14-year old dried wild ginseng root weighs between 2.0 g and 3.0 g and there would be about 333 ginseng roots per kg using the conservative 3.0 g value (Robert L. Beyfuss, pers. comm.).

In a good year, they might purchase as much as 215 lbs (97.5 kg) of dried wild ginseng root. This would be the equivalent to approximately 32,475 plants purchased in a given year. These buyers' purchases were made every year for as many as 30 years and only ceased with the retirement of the individuals involved. Mr. Rainey was the largest, by volume, dealer of the three and he retired from the trade four years ago. All of this root was sold on the legal, domestic wild-ginseng market.

Another buyer of ginseng estimated that in the early 1990s his company annually purchased, on average approximately 600+lbs (272+ kg) of dried wild ginseng root (Mr. Lawrence Cheng, Sun Ming Hong Canada Ltd, pers. comm.). Using the same conservative assumptions of 3g for the average 10-14 year-old root, this latter figure would indicate a trade in approximately 90,576 individual ginseng roots per year in the early to mid-1990s. The combined annual purchases of ginseng by Sun Ming Hong Canada and the three Norfolk buyers in an average year would be approximately 101,898 plants — more than double the estimated entire wild-ginseng population of Ontario and Quebec.

At this same time, there were also other buyers in the wild ginseng market from the US and Asia. Cheng believes these annual harvest figures are still valid today; however, the increased number of foreign buyers has obscured the traditional market structure.

Cheng also noted a decline in the quantity and quality of wild ginseng root being offered for sale by wild harvesters in the mid-to-late 1990s. It would seem initially logical to assume this represented a decline in the wild populations. However, upon further examination Cheng determined that some of his traditional ginseng sellers were being approached by Asian buyers, who were paying cash at the dried-root price for small amounts of top-quality "green" wild ginseng roots, but leaving lesser quality roots for the traditional buyers such as himself. He believes these roots were being moved out of the country illegally, for sale in the high-end Asian market.

Clearly these anecdotal wild-harvest figures are far in excess of the estimated wild ginseng

populations. This might be explained by one, or a combination of the following scenarios:

- The wild harvest figures indicate a gross underestimation of the wild ginseng populations, which are being rapidly extirpated from their Ontario and Quebec ranges.

- The wild harvest figures indicate a gross underestimation of the wild ginseng populations, which seems to have the ability to sustain this level of harvest.

- The wild harvest figures are, similar to the US situation, skewed because they include a large component of wild-simulated ginseng root, which the various buyers are unable to distinguish from wild ginseng plants.

The latter scenario would seem to be the most logical given the biological, socioeconomic, and historical factors examined in this report. This lack of distinction between wild-harvested and wild-simulated ginseng root within the ginseng market structure, further complicates the issue of wild-ginseng conservation and necessitates an examination of the wild-harvest traditions in Ontario and whether or not they include an element of wild-simulated horticultural practice.

In its initial COSEWIC status report on American ginseng, the report's author, Mr. David J. White, reports a similar situation using a similar set of wild-harvesting figures. White estimated the average dried root weight to be 3.4 g using a combination of CITES export permits from 1979-1980 — it was at this time legal to export wild-harvested ginseng to China — and figures obtained from a 1980 survey of 29 ginseng harvesters. White concluded that in the year 1979-1980, between 296 and 302 pounds of dried wild ginseng root was harvested in Ontario representing approximately 40,468 ginseng plants (White 1988). White then details a series of three different methods of interpreting these harvest figures and comes to the conclusion that here seems to be a very large discrepancy between existing population estimates and the harvest figures. He then concludes that the harvesting figures are unsustainable given the estimated populations (White 1988).

White draws this conclusion based on the assumption that these harvest figure come from totally wild populations and that humans have no hand in perpetuating the species. He does this despite the results of his 1980 Ontario ginseng digger survey which indicates that at least 72 % of the survey respondents stated that they planted new ginseng colonies in new areas of suitable forest habitat as part of their harvesting cycles and that 78 % said that there was more ginseng present in their harvesting areas over an average of the 23 years that they had been harvesting (White 1988). One survey respondent even replied that he purchased field-grown seed and planted it in the forest.

11.0 The Wild-Harvest and Wild-Simulated Traditions in the US and Canada

11.1 The American Situation

The American experience with the wild ginseng trade has arisen out of a rural subsistence economy linked to the fur trade. This linkage to the fur trade continues today, however, there are now also buyers who deal solely in herbal products (Persons and Davis 2005). This traditional rural subsistence economy included both aboriginal peoples and European settlers. The first indications of an element of wild-simulated practice in the wild-harvesting tradition is noted among the Ojibway "... the Ojibway made no use of ginseng, but gathered it for traders, always planting new seeds for what they had dug up" (Huron Smith 1933 in Vogel 1970). A similar opinion is held by Dr. Valerie Assinewe (pers. comm.) regarding First Nation's utilization and maintenance of medicinal plants.

In the 1975 Appalachian oral history Foxfire series, there appears the following description of the ethics of good sang hunters ..."they dig the roots in the spring only if they intend to transplant them into their own beds. Aside from that, they dig only in the fall when the berries are ripe. The bigger roots they sell. The smaller ones they move" (Wigginton 1975).

Elements of this rural subsistence economy survived into the 20th and 21st centuries. This is particularly true in the rural areas of the United States where the wild harvesting of ginseng root is still allowed, as is its export. Some authors have written that the American wild-harvest ginseng trade is unsustainable given the limited number of wild ginseng populations that are extant. They postulate there would be no significant loss of rural incomes from a prohibition of the wild harvest, since no one could actually make a living from the wild harvest of ginseng (Gagnon 1999). One author says that in the State of West Virginia, the majority of ginseng digger's primary income comes from social welfare payments (Bailey *et al.* 1996 in Gagnon 1999). These authors appear to be solely referring to the conservation agencies' statistics regarding known wild populations and are unaware of the intermingling of the wild-harvest and wild-simulated ginseng roots at the primary market level. Gagnon also proposed a theoretic, but economically unviable harvesting quota system (Gagnon 1999). This quota system was based on the US conservation agencies known population estimates and did not take into consideration the blurring effects of wild-simulated ginseng root on wild population figures at the annual reported harvest level.

Conversely those persons involved in the wild-simulated and wild-harvesting industries disagree with this position concerning the economic significance of the trade. In a response to recent US Fish and Wildlife Service's regulatory changes in ginseng harvesting protocols, Robert L. Beyfuss (2005) estimates that wild-harvesting and wild-simulated growing annually contributes approximately $30 million to the rural economies of the 19 states where the wild harvesting and export of wild ginseng are allowed. Indeed, US export trade figures for wild-ginseng, which tacitly includes wild-simulated root, acknowledge a $25.1 million trade in 2006 (USDA FAS 2007).

With regard to the socioeconomic status of those persons who harvest wild, or wild-simulated ginseng, Eric Burkhart differentiates between two distinct types of wild ginseng harvesters. The first is the recreational "sang hunter," who may come from any socioeconomic strata, but for whom the occasional harvest of wild ginseng provides a small amount of money and an opportunity to engage in an atavistic activity similar to sport hunting or trapping. The professional "sang hunter," on the other hand, is in the trade for a significant portion of their

annual income. This latter group are the most likely to be engaged in wild-simulated growing practices, or at the very least replanting all of the sites they harvest (Eric Burkhart, pers. comm.).

In addition, there is a significant difference in the manner in which these two groups of ginseng harvesters actually harvest and deliver their wild ginseng to market. The recreational ginseng harvester will harvest by taking the occasional foray into the forest to find a wild ginseng colony. Their actual harvest success is fairly low and their annual harvest is usually less than ½ pound (0.22 kg) of ginseng per year. Recreational harvesters often retain their annual root harvest for several years until they accumulate enough root to make it worthwhile to approach a ginseng buyer. The professional ginseng harvester, on the other hand, knows exactly where they will be harvesting since, for the most part, they have actually planted some, or all, of the ginseng they will be harvesting. They harvest on a cycle taking only the mature plants. They harvest more than the recreational sang hunters and they bring it to market annually since it is a significant part of their annual incomes (Eric Burkhart, pers. comm.).

This situation is illustrated in a recent survey conducted by Burkhart between 2002 and 2006 of 369 wild ginseng harvesters.

- 95 harvesters (28.2 %) planted less than 50% of the ginseng populations they harvested
- 54 harvesters (16.0%) planted more than 50% of the ginseng populations they harvested
- and 37 harvesters (11.0%) thought they had planted at least some of the ginseng they had harvested, but could not recall how much.

These figures indicate that 55.2% of the ginseng harvesters had, to some degree, planted the ginseng they were harvesting. On five separate occasions between 2002 and 2006, Burkhart was shown “wild” ginseng colonies by wild harvesters — presumably recreational harvesters —only to be later shown the same population by another wild harvester, who claimed to have planted it (Eric Burkhart, pers. comm.).

In 1980, David J. White and Dr. George Argus of the National Museum of Natural Sciences conducted a similar survey of the known “ginseng diggers” in Ontario. This survey was centred

around eastern Ontario and did not include harvesting activities around central and southwestern Ontario. In total, 58 wild ginseng harvesters were requested to a complete a five-page survey which was designed to shed some light on their harvesting practices and attitudes to proposed regulations aimed at protecting wild ginseng populations. Of the initial group queried, 50% (N=29) responded. The results with regard to the planting of new ginseng colonies were remarkably similar to those of Burkhart's 2002 to 2006 survey of American "sang hunters". Argus and White found that of the 25 ginseng diggers, who responded to this particular question, that 52% were always planting ginseng beds in forests other than where they gathered their seeds and ginseng roots. A further 20% stated that they did this on occasion (White 1988).

It is interesting to note that Argus and White concluded from their survey that the ginseng diggers "...appear to be responsible harvesters interested in the long-term survival of the plant and hence their industry." They also noted that in over an average of 23 years, in which they had been harvesting the species, 78% of the survey respondents reported finding the same or more ginseng in their harvest areas (White 1988). In their summary, the authors concluded... "little would gained by instituting harvest regulation, permit systems, or digger education programs"; and "...none of these measures would address the more significant problem of habitat loss, or destruction by development, agriculture, or logging"(White 1988).

11.2 The Ontario and Quebec Situation

Although Canada has been the primary supplier of the world's field-cultivated American ginseng for over a century, the harvest of wild ginseng in Ontario and Quebec has not been widely studied or understood. This is probably the result of the scarcity of wild ginseng in Ontario and Quebec relative to those areas of its range in the northeastern United States, where it has a more favourable growing climate and the mountainous terrain is heavily forested. In Ontario and Quebec most of the prime historical ginseng range is located in the southern portions of the provinces, in areas which have undergone a massive land use conversion rendering the habitat unsuitable for ginseng (Charron and Gagnon 1991; Riley and Mohr 1994).

There is, however, a variety of evidence that the wild harvest of ginseng was taking place in the remaining forested areas of Ontario during the 19th century and that it involved elements of wild-simulated horticultural practice. The decline in both forested environments and the ginseng plant itself, prompted the Ontario government to impose ginseng harvesting regulations in 1890 which provided a closed season for ginseng harvesting from January to September (McRae 1921). These regulations were repealed in the 1960s (Jan Schooley, pers. comm.). This in itself would indicate a significant tradition of ginseng harvesting in Ontario.

In 1921 the Ontario Department of Agriculture published a circular for Ontario farmers encouraging them to plant ginseng both in the field and in the forest. This circular was written by F.C. McRae, the agricultural representative for Norwood. It is interesting to note, the small town of Norwood is located in that area of eastern Ontario which has now been identified as a primary locus of wild ginseng populations.

Similar publications were available from the United States in the 1890's, which promoted the wild-simulated growing of ginseng. In particular, the American magazine *Special Crops* which published from 1900 to 1925 featured many articles on ginseng cultivation. In its 1902-1903 edition, it published an essay on the moral and ethical correctness of reintroducing ginseng into the forest by means of wild-simulated and woods-growing techniques. In the 1940's, the USDA was promoting the wild-cultivation of ginseng as the industry standard (Eric Burkhart, pers. comm.).

This tradition of government agencies encouraging the growing of ginseng on privately owned forested lands continues today. In 2002, the Ontario Woodlot Association (OWA), published in its official newsletter, the *S&W Report*, an article encouraging woodlot owners to consider growing ginseng in their forests (Ontario Woodlot Association 2002). The article outlined the basics of wild-simulated site selection and provided a source of ginseng seed. The OWA is a not-for-profit organization partially funded by OMNR.

There is a small and fairly secretive industry of wild ginseng harvesting in Ontario in those more

remote rural townships where the mature deciduous forest is still extant. This tradition is particularly strong in the Lanark, Renfrew, Arnprior, Peterborough, Napanee, and Kingston areas, which is where most of the reputedly wild colonies of ginseng are located (Mr. Shaun Thompson, regional ecologist, OMNR., pers. comm.). Other reported areas of wild ginseng harvest are: north of Sarnia, south of St. Thomas, Orangeville, Grey County, Simcoe County, and the Cambridge area (John Race; Walter Hellyer; Keith Rainey; Lawrence Cheng, pers. comm.). The relatively small amount of harvested wild ginseng root from Ontario is usually marketed through the large field-cultivated ginseng market distribution structure (Keith Rainey; Lawrence Cheng, pers. comm.).

During the 1980's, Mr. David J. White, a noted Ontario botanist, conducted a census of rare plants in Ontario. When he was working in eastern Ontario near Sharbot Lake, where wild ginseng is known to occur, he accompanied two elderly brothers to a number of wild ginseng colonies which they had been harvesting. They told him that they had been replanting these sites and only harvested the mature plants. Several years later, they complained to him that the ethics of wild-harvesting, which they had been taught by their parents, were not being followed by other persons who were destroying their ginseng colonies by simply digging all of the roots and not replanting (Mr. David J. White, botanist, co-author of the *Atlas of the Rare Vascular Plants of Ontario,* pers. comm.).

White also recounted discovering approximately 1,000 mature ginseng plants in a small woodlot near a rural village, in eastern Ontario. He speculates this colony was planted by someone, but that it had never been harvested. To the best of his knowledge this population is still extant, although the area is now subject to development pressures. White assumes at least some of the colonies found in Ontario are of anthropogenic origin and that he was aware that a number of persons in Lanark County had been planting and harvesting “wild “ ginseng for years.

Similarly, Shaun Thompson (pers. comm.) is aware of certain families in the Lanark, Renfrew, and Arnprior areas who have been involved in wild harvesting of ginseng over several generations. He did not know how much of this wild harvesting also involved replanting and/or

the establishment of new ginseng plantings with harvested seed. He also noted some of the harvesting of wild ginseng in the 1970s and 1980s was being done by OMNR timber technicians, who would periodically discover ginseng populations during tree-marking and timber-cruising operations on Crown Land forests. He speculates some of these individuals, now retired from the OMNR, may still be involved in this activity. It is Thompson's opinion there may have been a wild-harvesting conservation ethic on the part of some of the older rural farm community members, but that the most recent generation, who have left the farm, did not retain this conservation ethic. This generation now resides in urban areas and may only return to the rural areas to harvest ginseng for short-term profit.

Dr. Valerie Assinewe (pers. comm.), the author of several papers on ginseng, recounts a story of spending an afternoon with her father on the Sagamok First Nation territory — on the north shore of Lake Huron, well north of the known natural range of ginseng — hunting for a ginseng colony which he had known to be planted there many years before. Dr. Daniel Brown (pers. comm.) recounts a similar story of going with his grandfather to look for a long lost ginseng field in Bruce County where, as a boy, his grandfather had been paid to dig ginseng. In both these instances, there were no surviving ginseng plants.

In 1978, Mr. Martin Parker, a former OMNR park naturalist for MacGregor Point Provincial Park in Bruce County, reported finding a colony of ginseng within the park's boundary. The find was reported to David J. White, who was at the time conducting a survey of rare plants in Ontario, and who collected a sample for a herbarium specimen. To the best of his knowledge Parker believes the forest within the park had been previously clear-cut and burned. In a more recent botanical survey of the park, the ginseng population had disappeared (Martin Parker, pers. comm.). It is interesting to note, the Chippewas of Saugeen First Nation, who have a tradition of wild ginseng harvesting, are located approximately 15 km north of this provincial park.

The author of this report has personal knowledge of five populations of ginseng which were planted in the mid-1990s in the Parry Sound District and Haliburton County — well north of the known ginseng range. At least three of these populations are extant.

Every year in the areas of Lanark, Renfrew, and Arnprior advertisements are run in the local papers offering to buy wild ginseng (Shaun Thompson; David J. White; Lawrence Cheng, pers. comm.). Mr. Cheng states that his company traditionally purchased from three middlemen buyers in these areas and that there were US buyers who came there to purchase wild ginseng and transport it back to the US. The combined collections of these three buyers were purchased by Cheng and would make up a significant portion of his company's annual 600+ lb. (272 kg) purchases of wild ginseng. Most of these middlemen are now deceased, however, the wild ginseng trade continues and there are more foreign buyers involved in the Ontario wild ginseng market.

Clearly, historical records from pre-confederation Quebec indicate a significant wild-harvesting tradition on the part of the various First Nations peoples. In particular, it seems hard to imagine an agricultural people such as the Iroquois, whose settlements were focused around Montreal, would not also have engaged in some form of wild-cultivation of American ginseng as part of their subsistence agricultural economy. The existence of modern wild-harvesting in Quebec is less clear, but there does not appear to be the same traditions of wild-harvesting as in Ontario (Andrée Nault; Ms. Isabelle Nadeau, pers. comm). Ms. Nadeau, however, has noted that there is some interest in wild-simulated ginseng growing among landowners in Quebec. As part of Ginseng Boreal's consulting service she has sold stratified field-cultivated ginseng seed to approximately 650 individuals over the past 10 years. At least 150 of these individuals have standing wild-simulated ginseng plantations (Isabelle Nadeau, pers. comm.).

11.3 The Wild Ginseng Provenience Issue

Given the well documented evidence of almost total forest clearance in Ontario combined with the continuing logging of mature second-growth deciduous forests, the wide-spread occurrences of wild ginseng would indicate that some, if not most, of these populations are the result of human initiatives. Although much of the evidence is anecdotal and circumstantial, it would appear much of the wild ginseng that is being harvested in Ontario may originate from an early wild-simulated

tradition, similar to that which has been more throughly documented and studied in the US. The annual wild ginseng harvest figures cited by the ginseng buyers in Ontario far exceeds the officially acknowledged ginseng populations. It is highly unlikely there exists, in the second-growth deciduous forests of Ontario, sufficient remnant ginseng populations which could sustain this level of annual harvest. The populations of wild ginseng in Ontario have been, and continue to be, augmented by human hands.

12.0 Wild American Ginseng as an Endangered Species

The tendency of man to place a high value on the medicinal properties of American ginseng has contributed to its extirpation and or extinction from portions of its former range. This, however, is not the primary reason for it precipitous decline. The overwhelming reason there are few wild American ginseng colonies extant in Ontario and Quebec is the loss of mature deciduous forest habitat. Setting aside the provenience issue of these remaining wild colonies, these forested environments — especially those adjacent to urban areas — are under constant threat from development. The natural range for ginseng in Ontario and Quebec is located in those portions of the provinces where there are numerous urban areas (Charron and Gagnon1991). In addition, any mature deciduous forest has been and is still prone, to clear-cut logging. Forested lands are viewed as having little value except for the timber resources and their potential to be converted into some other land uses — predominantly suburban residential housing developments. Any ginseng recovery program will have to effectively and realistically deal with the political and economic pressures brought to bear by the residential development and logging industries.

Other significant threats to the continued existence of the remaining wild populations of ginseng include:

- persistent and ongoing habitat fragmentation, which isolates small populations and eliminates any exchange of genes between populations nodes,

- accelerated climate change and the resultant increases in catastrophic weather events, which may impair the survival of some mature deciduous forests and associated ginseng populations,

- increased forest canopy closure, a natural forest maturation process that results in less sunlight reaching the forest floor and consequent impairment of ginseng growth and fecundity,

- introduced forest insect pests such as the Asian longhorn beetle, emerald ash borer, and gypsy moth, which may impair the survival of some mature deciduous forests and associated ginseng populations,

- herbivory by increased white-tailed deer populations resulting from the decline in hunting pressure and decreased incidence of winter-kill brought about accelerated climate change,

- and increased wild-harvesting pressure brought about by well intentioned, but ineffective prohibition measures and the concomitant increase in the prices paid by the domestic and international market for wild ginseng.

12.1 History Of Legislation to Protect American Ginseng in Canada

- 1890 Ontario prohibits the wild harvest of ginseng between January and September
- 1975 American ginseng was listed in Appendix II of CITES — requires export permits for American ginseng root — the export of wild ginseng from Quebec is prohibited
- 1988 American ginseng was listed as threatened by the federal Committee on the Status of Endangered Wildlife in Canada (COSEWIC)
- 1989 the OMNR no longer issue CITES export permits for wild ginseng including wild-cultivated ginseng — this includes wild-simulated and woods-grown ginseng — wild harvesting and selling of wild ginseng from Ontario is still allowed within Canada's

borders

- 1999 American ginseng was listed as endangered by (COSEWIC)
- 2001 the Quebec Endangered Species Act prohibits all harvest and trade of wild ginseng
- 2003 American ginseng is listed as "Endangered" under the federal *Species at Risk Act*
- 2004 American ginseng is listed as "Endangered Unregulated" on Ontario's Species at Risk list
- 2007 Ontario promulgates its own *Endangered Species Act2007* which includes American ginseng — the Act has not yet come into full effect and regulations to regulate or prohibit the wild-harvest have not been formulated
- October 2007 the Canadian CITES Scientific Authority — Environment Canada, Canadian Wildlife Service — released a qualified "non-detriment finding" for the export of the two categories of wild-cultivated ginseng — wild-simulated and woods-grown produced. The qualification is based on a case by case consideration of the production methods and current provincial policy in the province where the ginseng root was grown.
- June 30, 2008 the growing, possession, selling, and trade in all *Panax quinquefolius* in Ontario will be prohibited unless an exemption regulation is passed.

13.0 Potential Threats to Wild Ginseng from Wild-Cultivation of Ginseng

Currently, it is still legal to grow a wild-simulated or a woods-grown crop of American ginseng in Ontario and Quebec, but illegal to export it. The wild and wild-simulated ginseng root may be sold in Canada — including Quebec. As previously stated, this situation may soon change in Ontario with the implementation of the *Ontario Endangered Species* Act, 2007. At present, there is a very good market for the wild-simulated root, which is usually represented to the ginseng buyer as "wild" ginseng.

The wild-simulated root is included with whatever actual wild ginseng a buyer has also purchased and would be ultimately sold as wild. This type of ginseng root is destined for wealthy consumers, who for a variety of reasons, are willing to pay approximately 20 times the price of the

field-cultivated root. There is a sufficiently, large wealthy Asian community in the major cities of Canada to create a domestic demand for the wild-simulated ginseng root (Keith Rainey; Lawrence Cheng; John Race, pers. comm.). Additionally, it is very likely that a portion of this crop finds its way out of the country either in small quantities smuggled out by the primary purchaser — usually a tourist from an Asian country — or in larger amounts by commercial ginseng buyers, (Keith Rainey; John Race, pers. comm.).

The primary reason for the prohibition on the export of wild-simulated ginseng is that the resultant ginseng root is indistinguishable from wild ginseng roots. This, of course, was the intent of the grower and for all intent and purpose the plant is wild, excepting that its seed was placed in the forest by human hands. The inability to distinguish it from a wild root is held by the federal and provincial CITES Scientific Authorities — OMNR and Ministère du Dévelopement durable, de l'Environnement et des Parcs (MDDEP) — to constitute a threat to the wild populations of ginseng, since wild ginseng root might be claimed to be wild-simulated ginseng.

The inclusion of woods-grown ginseng in the same category as wild-simulated ginseng illustrates a fundamental confusion on the part of the two provincial CITES Scientific Authorities regarding the two cultivation techniques, and the market criteria for wild ginseng. Woods-grown ginseng is, in essence, field-cultivated ginseng grown under the same management system in the forest. The forest floor is tilled and the crop is planted in rows under an unnaturally dense spatial regime. It is fertilized, sprayed with fungicides, and ultimately produces a larger, heavier, younger root, which is readily discernible from wild ginseng by a professional ginseng buyer (Keith Rainey; Lawrence Cheng; John Race; Jan Schooley, pers. comm.).

The intensive nature of woods-grown ginseng cultivation is also cited as a threat to wild ginseng populations (Nault, 2006). This potential threat seems to be predicated on the possibility that a woods-grown ginseng crop might be planted on top of a wild ginseng colony, or that an area of forest suitable for wild ginseng habitat would be tilled.

The most recent version of Environment Canada's, *Proposed Recovery Strategy for American*

Ginseng (Panax quinquefolius L.) In Canada, lists a number of other reasons why wild-simulated and woods-grown production of ginseng should be viewed as a threat to wild ginseng populations (Nault 2006). Paradoxically, none of the reasons listed relate to the original concerns of wild-simulated and woods-grown ginseng being indistinguishable from wild ginseng. The stated threats posed by wild-cultivation, which includes both wild-simulated and woods-grown production methods, are :

- wild ginseng habitat conversion and fragmentation,
- the potential for wild-cultivation ginseng to exchange genes with the "true" wild populations to the detriment of its genetic fitness,
- and the spreading of fungal pathogens into the wild ginseng populations.

The following subsections of this report explore each of these potential threats and proposes a series of best management practices to alleviate the threat.

13.1 Habitat Conversion and Fragmentation

It would seem the first concern is related solely to the woods-grown production technique, which does involve alteration of the forest floor understory. Wild-simulated growing techniques require no habitat alteration, with the exception of some occasional minor removal of small tree saplings to improve light levels. It would also appear the author of the recovery strategy presumes that a woods-grown ginseng plantation might be placed in an existing wild colony, or directly adjacent it.

The mature deciduous forest habitat of those portions of Ontario and Quebec, which are within American ginseng's historical range, is already rare and badly fragmented. Considering the ginseng plant's naturally low levels of fecundity and seed immobility; it is impossible for most colonies to increase and spread with any degree of certainty. It is unlikely that planting a woods-grown ginseng crop in an isolated woodlot — which did not sustain an existing wild ginseng

colony — could worsen the current state of habitat fragmentation, or in any way threaten the slow expansion of an existing ginseng colonies located in other isolated woodlots.

In reality the forested environments capable of sustaining a woods-grown ginseng plantation are plentiful. Unlike the habitat requirements for wild ginseng or wild-simulated ginseng, all that is needed is a woodlot with sufficient canopy closure to provide the optimal light levels and a relatively flat terrain to facilitate tillage. Forest soils are amended to provide optimal pH and nutrient requirements. It would be possible to develop a woods-grown ginseng crop under the shade of a polewood stage aspen plantation.

The resultant crop receives extensive management intervention to protect it from fungal pathogens and other threats. For these reasons and the relatively low price paid for woods-grown ginseng root, the woods-grown cultivation techniques have become economically unviable (John Race; Jan Schooley, pers. comm.). Currently there is an over-supply of field-cultivated ginseng, which has depressed the price for this type of ginseng root. This price decline has also affected the woods-grown ginseng root since it is similar to field-cultivated roots. In addition, the CITES prohibition presents legal complications when it is necessary to market such a low-quality/priced root. Finally, it is unlikely that a woods-grown plantation of this type and magnitude would be located near any significant wild ginseng colony.

Proposed Best Management Practices for Site Selection

- To ensure the continuance and integrity of the existing 63 MVP wild ginseng populations identified in Ontario (25), and Quebec (38) by the proposed ginseng recovery strategy, it is proposed to establish a 100 m (328 foot) buffer zone around each of these locations, where no form of wild-cultivation techniques would be allowed.

- It may be possible to provide some sort of site inspection for proposed woods-grown sites, to determine the presence, or absence, of wild ginseng prior to the operations

commencement. This inspection process would, however, have to provide a level of confidentiality and security for the grower. In addition, it should be realized that this sort of provision may give impetus to some persons to remove any wild populations growing on their woodlot prior to an inspection.

13.2 Genetic Contamination of Wild Ginseng Colonies

There is a perception on the part of some conservation biologists that the known existing, reportedly wild ginseng populations, are the only genetically viable populations for a given eco-region (Grubbs and Case 2004; Nault 2006). There are, however, no studies that indicate field-cultivated ginseng and wild ginseng are genetically distinct (Grubbs and Case 2004; Schluter and Punja 2002). Similarly, those plant scientists interviewed for this report, who work with American ginseng genetics, do not think it is possible to genetically distinguish populations even from one North American geographic area to another (Daniel Brown; John T. A. Proctor; Zamir Punja; Richard Reeleder, pers. comm.).

Despite this, field-cultivated ginseng stocks — containing a diverse genetic mix of ancestral wild stocks — are perceived as inferior and having the potential to pollute the wild ginseng population to their genetic detriment, or diminution. This would seem to fly in the face of all biological maxims, related to the survival advantages of genetic species diversity. Indeed, this lack of genetic diversity in wild populations and the inability of gene flow to cross fragmented landscapes is a concern on the part of several researchers (Charron and Gagnon 1991; Hackney 1999; Schluter and Punja 2000).

American ginseng, when grown in its natural, mature, deciduous forest environment tends to spatially stratify in clumps related to microhabitat preference (Cruse-Sanders and Hamrick 2004b). In this natural setting, the species is strongly autogamous (Schlessman 1985; Schluter and Punja 2000). It has some limited capabilities to outcross, but the only suspected pollinators are hoverflies and halictid bees neither of which are thought capable of pollinating between distant

individuals (Carpenter and Cottam in Proctor 1987).

Proposed Best Management Practices for Genetic Containment

- To allay these concerns and to ensure the genetic integrity of the existing 63 wild ginseng populations identified in Ontario (25), and Quebec (38), it is proposed to establish a 100 m (328 foot) buffer zone around these locations, where no new plantations of any type of wild-cultivated ginseng would be allowed.

- In response to the criticisms of previous genetic studies, regarding the lack of sufficient sample size from the existing reputedly wild ginseng colonies, it is proposed to initiate a comprehensive study of the genetic composition of various wild populations. The populations sampled would be selected on the basis of good evidence of the site containing, at least a partial, old-growth forest component. The study would be geared to determine whether there are any genetically unique extant populations. However, the conducting of these studies should not be used as an excuse to further delay the permitting of the export of wild-simulated ginseng, since most evidence available would lead us to conclude that genetic pollution caused by introducing ginseng into the forest is a negligible threat to existing wild populations.

- If genetically unique populations are found, a program of micro-propagation — vegetative cloning — could be implemented to aid in the recovery of these genetically distinct stocks and ultimately reintroduce them into suitable, mature, deciduous forest environments for conservation purposes.

13.3 Fungal Disease Contamination of Wild Ginseng Colonies

American ginseng is subject to a number of fungal pathogens. These are *Alternaria panax*, *Botritys cinerea*, *Phytophtora cactorum*, *Cylindrocarpon destructans*, *Pythium irregulare*,

Pythium ultimum, Fusarium spp. and *Rhizoctonia solani* (Persons and Davis 2005; Jan Schooley, pers. comm.). All of these fungal pathogens occur naturally in the forest environment; however, they are particularly pathogenic in field-cultivated populations where the spatial density of the plants results in rapid disease transmission during times of increased humidity and cool temperatures (Jan Schooley, pers. comm.). Ginseng populations growing in a mature deciduous forest with natural densities and clumped spatial stratification, relating to preferred microhabitats, are less prone to fungal pathogens. This would also apply to the plant spatial distribution found in a wild-simulated plantation. In addition, other bacteria and fungi that exist naturally in the forest soil are somewhat antagonistic to a variety of ginseng fungal pathogens (Persons and Davis 2005; Jan Schooley, pers. comm.). The most commonly observed fungal pathogen on wild ginseng is *Alternaria panax* (Nault 1998; Jan Schooley, pers. comm.; author's pers. obs.). *Alternaria panax* is known to infect members of the *Araliaceae* family and is particularly prevalent on the common forest plant, wild sarsaparilla (*Aralia nudicaulis*). This disease occurs during periods of prolonged cool, wet weather. It is usually non-lethal, but will cause the defoliation of ginseng plants and its premature senescence (Persons and Davis 2005; Jan Schooley, pers. comm.; author's pers. obs.)

Many of these pathogenic fungi can be transmitted to the surface of the ginseng seed and several may be incorporated within the seed's internal tissues. Field-cultivated ginseng growers surface treat their seed with a variety of fungicides and several new products are currently being developed as ginseng seed sterilants (Jan Schooley, pers. comm.). Other ginseng seed producers have their seed examined by a phyto-pathologist and certified as disease free prior to sale (Isabelle Nadeau, pers. comm.).

Proposed Best Management Practices for Disease Control

- To ensure the health of the existing 63 MVP wild ginseng populations identified in Ontario (25), and Quebec (38), it is proposed to establish a 100 m (328 foot) buffer zone around these locations where no forms of wild-cultivation ginseng plantations would be allowed.

- In addition, only ginseng seed originating from Canadian sources of field-cultivated stocks will be permitted for use by wild-simulated and woods-growers. This seed must be surface-treated with a fungicide registered for use on ginseng.

- Initiate the development of a ginseng, disease-free seed certification program in conjunction with OMAFRA and the Ontario Ginseng Growers Association.

- Alternatively, allow wild-simulated growers to produce and use their own seed, subject to examination and certification by a phyto-pathologist on sale and transport from the plantation of origin.

14.0 Traceability of Wild-Simulated Ginseng Root

14.1 The Paradox of Wild-Simulated Ginseng Growing and Ginseng Conservation Efforts

Although not specifically mentioned in the proposed recovery strategy as a threat to the remaining wild ginseng populations, the issue of wild-harvested ginseng being exported as wild-simulated, or woods-grown ginseng, is still a concern on the part of all provincial and federal regulatory agencies. It is ironic that the intent of the wild-simulated ginseng grower is the absolute reverse of these agencies' concern regarding the substitution of wild ginseng root for wild-simulated ginseng root. The grower intends to sell wild-simulated ginseng root as wild. Unfortunately, woods-grown ginseng has been lumped together with the wild-simulated product, even though it does not resemble, nor could it be substituted for, wild ginseng.

Those persons who are most likely to be involved in the harvesting of authentically wild ginseng are, for the most, part recreational ginseng harvesters. They randomly search for ginseng patches with varying degrees of expertise. They may, or may not, find any ginseng; in all likelihood they won't find very much. The wild patches they seek are sparsely populated and widely separated by geography and terrain. Small patches of ginseng are very hard to discern in a forest floor

environment of ferns and other herbaceous species. It is not a particularly lucrative hobby. The wild-simulated growers on the other hand, know exactly where they have planted their ginseng patches, how old they are, and when it is appropriate to harvest them. They will be concerned with the security of their ginseng patches and will have put into place various measures to prevent theft by recreational harvesters. Recreational harvesters are not usually capable of discerning a wild-simulated plantation from an authentically wild one. This situation has fostered the level of secrecy and circumspection found among those persons engaged in the wild-simulated ginseng trade.

14.2 Barriers to Traceability Protocols for Wild-Simulated Ginseng Root

To implement a system of protocols to ensure wild ginseng is not sold, or exported, as wild-simulated ginseng will be a difficult task for the following reasons.

- The wild-simulated growers want their product to be indistinguishable from wild ginseng. They want the buyers to believe it is wild ginseng, anything less than this may result in a reduction in the price they receive for their efforts.

- Any system of grower registration, or certification, will require assurance of confidentiality for the grower registrants or permit applicants. This is especially true, if the confidentiality of the registration system has the potential to be compromised and results in the impairment of the wild-simulated grower's ability to sell their crop as "wild," or threatens the security of the grower's ginseng plantations from theft.

- The existing trade in wild and wild-simulated ginseng is highly lucrative, secretive, and involves elements of smuggling. It is an old, well-established system of international commerce. It functions effectively and can quickly adapt itself to whatever regulatory prohibitions are implemented. The current domestic demand for high-quality wild/wild-simulated ginseng far exceeds the supply — portions of those domestic sales will be

smuggled out of Canada by a variety of means. It is relatively easy to move ginseng root from Canada across the US border, where it can be easily included with the legally exported, US wild ginseng root shipments to China. In the current market regime, wild-simulated growers may feel compelled to circumvent whatever traceability protocol is instituted, particularly, if it is felt to be too onerous, or to disadvantage them in the marketplace. It is unlikely, the pending *Ontario Endangered Species Act, 2007* prohibitions on ginseng will have a negative impact on this market other than the new Act's potential to increase the price of wild ginseng and its indistinguishable counterpart wild-simulated ginseng.

- Current levels of enforcement with regard to the export of wild ginseng are ineffective and result in few seizures, or prosecutions. Increases in enforcement, or prohibitions on the practice of wild-simulated growing, which may occur with the implementation of the *Ontario Endangered Species Act, 2007*, may serve to increase the market price for the wild ginseng root, and consequently increase the level of effort expended by recreational wild-harvesters to search out and extirpate those few wild populations which are extant. It will also provide a disincentive for those law-abiding woodlot owners who are currently growing ginseng, or those who may wish to plant it in their forested properties.

- Some wild-simulated growers may be planting forested lands they do not own. These could be Crown lands, or private lands with, or without, the knowledge of the landowner. From what little is known of the traditional "ginseng digger"/wild-cultivation practices in eastern Ontario — as described in sections 10 and 11 of this report — , this may be the most common type of long-standing wild-simulated activity in Ontario. The results of these activities will continue to obscure the status of many putatively wild ginseng populations. For obvious reasons, these particular growers may be unwilling to disclose the locations of their wild-simulated growing plantations.

14.3 Certification of Wild-Simulated Seed Sources

It may be possible to use a system of ginseng seed certification to provide an element of traceability for the growers of wild-simulated ginseng. In the US, traditional wild ginseng harvesting and its associated replanting/reintroduction practices, involves the harvesting of "green" ginseng seed from wild populations — or longstanding wild-simulated patches — and either replanting at the site of origin, or moving some or all of the "green" seed to another suitable forested habitat. In 16 of the 19 states, which allow the harvest and export of wild ginseng, replanting is mandated by law (Gabel 2005). A similar replanting tradition exists in parts of eastern Ontario. This is slow, inefficient, and haphazard by modern standards. Green ginseng seed must remain buried in the forest's partially decomposed leaf litter for 18 months prior to germination. This predisposes it to a variety of threats such as death from dessication or freezing and herbivory by numerous small forest rodents. The ginseng seed's inordinate vulnerability is one of the major contributing factors to the plant's low natural fecundity.

The modern wild-simulated grower plants stratified ginseng seeds obtained from field-cultivated growers. This provides the grower with an abundant source of relatively cheap seed. They may apply it liberally to a particular planting site in the knowledge that the vagaries of forest rodents, deer browsing, slugs, insects, disease, and site specific limiting factors will winnow out a good portion of the ginseng plants over the merchantable cycle. One pound of stratified seeds contains approximately 6,000 to 8,000 seeds, and costs $35.00 to $120.00 depending on its availability and the amount purchased (pers. comm. Isabelle Nadeau). Availability is dependent on the quality of the growing season for the field crop. For example, in years of drought much of the seed "shatters" from the field-grown plants and cannot be harvested.

The quality of the seed available is also variable. Isabelle Nadeau of Ginseng Boreale requires a phyto-pathologist's examination certificate for all the ginseng seed she purchases. She believes the Quebec wild-simulated ginseng producers may soon be in a position to supply their own seed source (Isabelle Nadeau, pers. comm.).

14.4 Proposed Alternative Traceability Protocols

The following alternative traceability measures are presented here in ascending order of their complexity and difficulty to implement. Given the nature of the wild ginseng trade, none of these alternatives will provide an ironclad guarantee that no wild ginseng will find its way into the international market. It may be possible to combine portions of the various alternatives to satisfy the concerns of wild ginseng conservation. Traceability solutions must also satisfy the provisions of the *Ontario Endangered Species Act, 2007*, which has the potential to prohibit all growing, harvest, possession, and trade in ginseng.

Alternative 1. Canada Field-Cultivated Ginseng Seed Provenience Forms

If a wild-simulated grower wishes to obtain an export permit for his crop, he or she must present a ginseng seed provenience form which states:

- the date the ginseng seed was purchased —either "green" or stratified seed — from which his or her export crop originated,
- the signature of the seller of the field-cultivated, or wild-simulated ginseng seed,
- the amount of seed purchased,
- and the seed source which originates from field-cultivated, or wild-simulated ginseng grown in Canada — preferably inspected by a phyto-pathologist and from a certified seed program.

Since wild-simulated ginseng root is always sold with the rhizomatous root structure — the "neck" — intact and attached, the root's age may be approximated, and provides a secondary proof that the ginseng root originated from the seed described in the provenience form. This structure exhibits the annual abscissa —stem scars — of the plant which can be counted to age the roots. The uniform average approximate age of the roots should correlate to the date on the bill of sale for the seeds. Indeed, the fact that all the roots in a shipment exhibit the same approximate

age should also be an indication that the roots are not from a randomly growing, multi-aged wild population.

Advantages

- This is the most likely form of ginseng root verification acceptable to wild-simulated growers since it assures anonymity.

- It is inexpensive and simple to implement. A standardized bill of sale form could be developed by OMAFRA, or AAFC.

- The requirements to certify that the field-cultivated or wild-simulated seed is treated with fungicides can be easily added to the standardized form to satisfy the issue of disease transmission.

- The seed provenience form could be transferable with the particular batch of ginseng root. This would allow a secondary, or tertiary level buyer, to later apply for an export permit for a shipment of ginseng root which contained batches from more than one grower.

- As wild-simulated growers begin to develop their own seed sources this would aid in the long-term development of wild-cultivated eco-regional landraces, which might be of value in conservation efforts to re-establish ginseng on protected lands.

Disadvantages

- It requires expertise on the part of the persons issuing the export permits to be able to assess and correlate the approximate age of the root with seed provenience forms. The annual abscissa are not easily ascertained and aging a large shipment of root would be onerous.

- This system requires an expenditure of money and time on the part of the permitting authority, unless inspection cost are passed on to the growers which would probably serve as a disincentive to compliance. In addition the permitting authority must retain or train personnel who are able to assess and correlate the approximate age of the root with the letter of affidavit information.

- It would be possible to forge the information on the form, but this would be easily detected since authentic wild root would be multi-aged as exhibited by the root neck abscissa.

- Small amounts of wild ginseng root could be slipped into a large batch of wild-simulated roots if they were the same "neck" age as the shipment..

Alternative 2. Notarized Letter of Affidavit Attesting to Provenience of Ginseng Root

This particular method of proof of ginseng root provenience would involve the wild-simulated grower creating a sworn notarized affidavit, at the time of planting a wild-simulated ginseng plantation, or series of plantations on a particular piece of property. This would create a "paper trail" for the ginseng root dating it to the time of its planting. In the case of wild-simulated ginseng, this would occur between 8 to 12 years prior to the crop being harvested and export permit being sought. The letter of affidavit would state:

- the property's legal description including: township, lot number, concession number and in the situation of multiple ginseng beds throughout a property — which would usually be the case for a wild-simulated grower — a Global Positioning System (GPS) location for each bed,

- the Canadian field-cultivated, or wild-simulated seed source utilized and contain the attached bill of sale for the seed,

- and be signed by the wild-cultivated grower and be notarized by a Notary Public or other legal professional.

The letter of affidavit would be sealed and held by a third-party individual, or organization — this could be a grower's association — and could only be accessed by the grower once, when he chose to apply for an export permit for his crop. Alternatively, the grower could simply request the letter of affidavit be forwarded to the permitting authority subsequent to his application for an export permit. The information contained in the letter would then be used by the export permitting authority to validate the approximate "neck" age of the ginseng root presented for permitting.

Advantages

- This form of verification would be acceptable to the wild-simulated growers since it assures anonymity of the grower and his crops location prior to harvest.

- It would also allow the grower to plant on lands which were not his own but which he had the legal owner's permission to utilize.

- The letter of affidavit and its chain of custody features would virtually eliminate any chances of forgery.

- A standardized letter of affidavit form could be developed to simplify the process.

- The system could be combined with Alternative 1 and would also guarantee the acceptable Canadian field-cultivated, or wild-simulated ginseng seed source was utilized.

- In instances of dispute between the permitting authority and the grower, the identified

growing site could be examined by an authorized third party to determine if a crop had been recently dug from that location.

Disadvantages

- This system requires an expenditure of money and time on the part of the permitting authority, unless inspection cost are passed on to the growers which would probably serve as a disincentive to compliance. In addition the permitting authority must retain or train personnel who are able to assess and correlate the approximate age of the root with the letter of affidavit information.

- The system contains a degree of complexity that would involve the Canadian legal system and carry with it some cost to the wild-simulated grower — these costs would be similar to those incurred in drafting a will. The provision of third-party site inspection in the event of dispute over a crop's provenience would incur some costs to the disputants.

- Those individuals involved in small, wild-simulated ginseng production may not be inclined to use this process. There is no clear incentive for them to comply since they have no problem marketing all of the ginseng they produce through the current market structure, which may involve the illegal movement of ginseng into the US or Asia. The current market does not dictate the need for an export permit and growers can readily sell their ginseng root on the domestic market; however, the implementation of the *Ontario Endangered Species Act, 2007* on June 30, 2008 will make this sale illegal. Whether the implementation of this act will provide sufficient incentive to bring their ginseng growing activities into compliance remains to be seen.

Alternative 3. Annual Single Export Permit Issuance to a Wild-Cultivation Association

Field-cultivated ginseng roots are currently exported under the authority of a multi-use export

permit issued to the Ontario Ginseng Growers Association (OGGA). This blanket permit is issued annually to the OGGA by the CITES Management Authority for the export of field-cultivated ginseng root. When a grower wishes to export a portion of their crop, the association provides them with a copy of the valid export permit and records the amount of root the grower is exporting. This sort of system may make it possible to establish a wild-simulated and woods-growers association (s), or it may be possible for them to affiliate themselves with the OGGA or some other provincially recognized organization. It should be noted, however, that some field-cultivated ginseng growers apply and are granted field-cultivated ginseng export permits as individuals.

Advantages

- An association provides the wild-simulated growers with a unified voice to deal with the various regulatory authorities and an organization which could disseminate information concerning growing practices, marketing, etc.

- An affiliation with the already established OGGA would link wild-simulated and woods-growers with those field-cultivated growers who are the primary source of their ginseng seeds.

- An association may be able to recruit more woodlot owners and other interested persons into the wild-simulated and woods-growing business.

Disadvantages

- Woods-growers and particularly wild-simulated growers are, by necessity, secretive. They may not be inclined to join an association. There is no clear incentive for them to join an association since they have no problem marketing all of the ginseng they produce through the current market structure which may involve elements of smuggling. The current

market does not dictate the need for an export permit and growers can readily sell their ginseng root on the domestic market; however, the implementation of the *Ontario Endangered Species Act, 2007* on June 30, 2008 will make this sale illegal. Whether the implementation of this act will provide sufficient incentive to bring their ginseng growing activities into compliance remains to be seen.

- Currently, the number of persons engaged in woods-growing and wild-simulations are unknown, but they are probably few in number. Ginseng growing is not their primary occupations and they may be unwilling , or unable, to expend the amount of time and money it would take to organize an association.

Alternative 4. Third Party, Individual Grower Certification

Each grower who wishes to export wild-cultivated ginseng roots would be certified by a third party organization. They would supply the third party organization with a certain set of proofs to demonstrate they were engaged in the wild-cultivation of ginseng. The individual grower would be provided a certification number with which to apply to the CITES Management Authority for an export permit. These proofs could include:

- locations of ginseng plots,
- site inspection verification by the third party organization,
- photographs of planting activities,
- bills of sale for Canadian field-cultivated, or wild-simulated ginseng seed,
- and demonstration that roots they bring for export were homogenous in age structure.

A list of certified growers would be held by the third party organization, but it would be maintained in strict secrecy. The CITES Management Authority would provide export permits when requested by the third party organization for a particular grower. It has been suggested in some publications that organizations modelled on Smartwood, the Forest Stewardship Council (FSC), or International Standards Organization (ISO) might serve as a model for certification (Jain

2004). Currently, a similar grower certification and traceability protocol is being developed by the Canadian Herb, Spice, and Natural Health Product Coalition. When this is finalized, elements of the protocol may be applicable to issues of ginseng traceability, although there are significant differences in ginseng relating to the highly lucrative nature of the trade and its current status as an endangered species in Canada.

Advantages

- Certification confers on the wild-cultivation grower a legal status and eliminates the possibility that they will be accused of illegally possessing wild ginseng roots, or plants by the various provincial regulatory authorities. This is particularly relevant in light of the pending implementation of the *Ontario Endangered Species Act, 2007*.

Disadvantages

- Any form of secure wild-cultivation grower registration would be complex and expensive to implement and maintain.

- Persons involved in the wild-cultivation of ginseng, particularly wild-simulated growers, are, by necessity, secretive about their activities. Some individuals may be planting ginseng seeds on land they do not own or might not even have permission to use. There is no clear incentive for them to certify themselves or register since they have no problem marketing all of the ginseng they produce through the current market structure. They have no need for an export permit; however, the implementation of the *Ontario Endangered Species Act, 2007* on June 30, 2008 will make this sale illegal. Whether the implementation of this act will provide sufficient incentive to bring their ginseng growing activities into compliance remains to be seen.

15.0 Wild-Simulated Growers Preferences for a Traceability Protocol

In March 2008, prior to the completion of this report, a concerted effort was made to census the opinions of those persons involved in the wild-simulated ginseng industry regarding the feasability and acceptability of the foregoing traceability alternatives. In Quebec, a meeting was held with 12 individuals who represented the views of 51 Quebec-based wild-simulated ginseng growers (Isabelle Nadeau, pers. comm.). In Ontario, the report's author spoke with three growers, who wish to remain anonymous. In both cases, the individuals censussed were presented with the foregoing traceability alternatives. The preferred traceability solution for both groups was the same.

As was predicted, the preferred solution is an amalgam of the various traceability alternatives. It was the general consensus of the wild-simulated ginseng growers that they are very willing to work with the various federal and provincial CITES authorities and that the solutions to the conservation concerns raised by their industry, in relation to the continued survival of the American ginseng in the wild, need to be simple and realistic. The following are the points of consensus.

Seed Source Provenience

The wild-simulated ginseng industry recognizes the importance of being able to prove to the federal CITES authority and its Quebec and Ontario counterparts that their wild-simulated ginseng crops are only grown from artificially propagated, field-cultivated materials (seeds or roots) or from artificially propagated wild-simulated ginseng. To this end, it should be obligatory for the growers to be able to demonstrate proof of seed purchase which would include:

- the name and address of the ginseng seed supplier,
- the amount of seed purchased,
- and the date of the purchase.

Since the usual merchantable cycle for wild simulated ginseng root production ranges from 8 to 12 years, all wild-simulated ginseng growers are eventually able to harvest seeds from their own crops. It is critical that established wild-simulated ginseng growers be allowed to use and even sell their own seed to defray the costs of wild-simulated ginseng production.

Ginseng Root Age as Proof of Wild-Simulated Cultivation

The wild-simulated ginseng industry recognizes the importance of being able to assure the federal CITES authority and its Quebec and Ontario counterparts that export shipments of wild-simulated ginseng root do not contain any wild-grown ginseng. To achieve this objective, the grower's agree that ginseng root export shipments may be checked for the uniformity of root age as a test of its artificially propagated origins. As previously described, this would involve aging the rhizomatous ginseng root neck structure and its abscissa scars. Further to this end, the wild-simulated ginseng industry would suggest that CITES export permits be only issued for batches of wild-simulated ginseng root in quantities greater than or equal to 150 roots. This root-age test is based on the assumption that it would be very difficult to assemble a collection of wild ginseng roots of this size which would all have the same root age.

To account for the within plantation variations in growth habit, and the occasional dormancy response to environmental stress, it is recommended that the ginseng root-batch age test have plus or minus tolerance level of 1 to 2 years. This plus or minus tolerance level would account for root-batch abscissa scar variation which results from different light, nutrient, moisture levels, as well as phenotypical variation which might occur within a single planting of ginseng.

Wild-Simulated Plantation Location Information

The disclosure of the location of a wild-simulated ginseng grower's plantation was the most sensitive and controversial issue addressed during the consultation with the wild-simulated

ginseng industry. This concern for strict confidentiality of this information mirrors the concerns of the various federal and provincial conservation agencies with regard to the locations of known wild ginseng colonies. Theft of all types of ginseng grown in the forest is a common occurrence.

For this reason, the wild-simulated ginseng growers are open to the idea of providing location information, if it can be guaranteed this information will be kept in the strictest confidence. Although the wild-simulated ginseng growers realize that they must identify themselves and provide their addresses and other contact information to the CITES permitting authority, the disclosure of detailed information concerning the location of their various wild-ginseng plantations is more problematic. The wild-simulated growers would prefer that in the first instance, the requirements for the locations of ginseng plantations be kept fairly general requiring only the name of the municipality, or the geographic township in which the ginseng plantation is located. The requirements for more specific location details of a ginseng plantation should be reserved for instances where the first two sets of proofs — seed provenience and ginseng root age — are in some way questioned by the various CITES authorities.

15.1 Wild-Simulated Growers Preferences for Best Management Practices

The wild-simulated ginseng growers agree there needs to be a code of best management practices for the industry, but it is their collective opinion that this should not be included as part of the ginseng export permit requirements. These best management practices should be under the supervision of a wild-simulated ginseng grower's association or some other collective body which represents the majority of the industry producers. These best management practices would include:

- the use of ginseng seed inspected and approved by a certified phyto-pathologist,
- the establishment of a 100 metre buffer between any wild ginseng colony and a grower's plantation,
- and other best management practices which might be added as the industry develops over

time.

16.0 Wild-Simulation as Part of the American Ginseng Recovery Strategy

Many of the wild ginseng populations in Ontario, and potentially Quebec, have their genesis in past efforts at wild-simulated ginseng cultivation, either by aboriginal peoples, or early European settlers as part of a subsistence fur trade economy. Other populations were planted in the early 20th century as part of a general mixed farm economy with the encouragement of the Ontario Department of Agriculture. The ginseng plant is long-lived and might indeed outlive the person who initially planted its seed. If left in a suitable deciduous forest environment over a long period of time, a small ginseng plantation may naturally reproduce itself and come to have the multi-aged characteristics of a natural population.

Still more recently, persons owning forested property have been able to obtain ginseng seed and plant it in suitable forested environments. In Quebec in the past 10 years, approximately 650 people have purchased ginseng seed from Ginseng Boreal (Isabelle Nadeau, pers. comm.). Similarly, an unknown number of persons have been engaged in wild-simulated cultivation in Ontario for many years as is demonstrated by the amount of "wild" ginseng brought to market each year.

The most obvious advantage to these past and recent efforts at wild-simulated ginseng planting is that humans have been, in a large measure, responsible for disseminating the species and maintaining it in the face of large-scale landscape conversion over the past 150 years. To prohibit this activity by legislation in a well-intentioned, but ill-informed attempt to save the species from extirpation, might well hasten that exact result. The primary reason for the demise of American ginseng throughout its range is from the loss of deciduous forest habitat. These losses resulted from society's tendency to undervalue natural, mature, deciduous forest landscapes in favour of residential subdivisions and other similar developments. In addition, the price of hardwood timber from those areas of Ontario and Quebec, which were part of ginseng's historical range, provide an

ongoing monetary incentive to aggressively manage mature deciduous forests for timber production.

There is a stable international market for wild/wild-simulated ginseng, which is perpetually in a state of under-supply. If the CITES Administrative Authority allows the export of wild-simulated ginseng this may result in an increase in the number of persons who choose to engage in wild-simulated ginseng cultivation. This would provide some monetary incentive to preserve mature deciduous forest landscapes.

There are many conservation benefits to be gained from the encouragement of an expanded wild-simulated ginseng industry. Rather than being seen as a detriment to American ginseng conservation, wild-simulated ginseng cultivation could be used to support the efforts of conservationists who wish to see the species continue in a natural setting. If for no other reason than, the more wild-simulated ginseng root there is for sale, the less the market demand for wild ginseng root.

In addition, wild-simulated ginseng cultivation:

- assures a continuance of the ginseng populations in many diverse locations throughout its historical range,
- may be used to expand the range of ginseng beyond its historical known range by introducing it into suitable deciduous forest habitats on the Precambrian Shield — this may become an absolute necessity, if climate change renders southern Ontario and Quebec unsuitable habitat,
- provides security for planted ginseng populations and the genetic material they contain,
- assures a wide diversity of genetic materials will be maintained across a large range,
- may be used, in the long-term, to foster the development of new eco-region landraces which may be used to repopulate areas of suitable ginseng habitat where the plant is now absent,
- and if encouraged, may allow wild-simulated growers to develop gene plasma banks taken from existing wild ginseng populations, if genetically distinct natural regional populations

were ultimately identified.

17.0 Summary

For the past 150 years, during which time most of the forests of northeastern North America were cleared for agriculture and timber production, it would appear that humans have been the primary vector for the dissemination and protection of American ginseng. In Ontario, the efforts of a handful of farmers in Norfolk County, over a century ago, have to some degree preserved the indigenous stocks of American ginseng. In parts of eastern Ontario rural peoples have been engaged in planting and moving ginseng within the remnant hardwood forests as part of a wild harvesting tradition.

Periodically, various Ontario governments have encouraged the growing of ginseng in the forests and in the fields as part of an economic strategy for rural regions of Ontario. Within the past 10 to 20 years hundreds of people in Ontario and Quebec have purchased ginseng seed in an effort to establish American ginseng in mature deciduous forests. American ginseng is not a difficult plant to grow in a suitable forested environment. The difficulty arises, however, in finding such suitable habitats in a largely deforested landscape.

It would seem that in the face of overwhelming habitat loss, human intervention is the only means by which ginseng will survive and expand within its former range. This is consistent with the genus's 4000 + year old history and its longstanding relationship with humankind. Any attempts at preservation of American ginseng in the wild must recognize the positive role humans have played in its survival. It is equally true that humans have contributed to American ginseng's decline through forest clearance and over-harvesting of remnant wild populations.

If American ginseng is to survive in Ontario and Quebec, wild-cultivation and more specifically wild-simulated cultivation should be encouraged, not discouraged. The positive benefits of planting more American ginseng in more forested landscapes vastly outweighs the perceived threats it poses to those few remaining wild ginseng colonies.

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