United States Department of the Interior

FISH AND WILDLIFE SERVICE
International Affairs
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To: Chief, Branch of Permits, Division of Management Authority

From: Chief, Branch of Monitoring and Consultation,
Division of Scientific Authority

Subject: General Advice for the export of wild and wild-simulated American ginseng (*Panax quinquefolius*) roots legally harvested during the 2022 harvest season in the 19 States and Tribe with an approved CITES Export Program for American ginseng

Advice: The Division of Scientific Authority (DSA) finds that the export of roots and root parts of wild and wild-simulated American ginseng legally harvested during the 2022 harvest season in: Alabama, Arkansas, Georgia, Illinois, Indiana, Iowa, Kentucky, Maryland, Minnesota, Missouri, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Vermont, Virginia, West Virginia, Wisconsin, and the Menominee Indian Tribe of Wisconsin will not be detrimental to the survival of this species, provided the following CONDITION is implemented:

> All wild and wild-simulated American ginseng roots and root parts for export must be from plants that are 5-years of age or older (i.e., the rhizome attached to the root must have 4 or more visible stem scars).

The age of American ginseng plants can be determined by counting the stem scars present on the rhizome (commonly referred to as "root neck") connected to the root. A stem scar is formed on the rhizome from the abscission of the plant stem. A plant with 3 leaves (3 "prongs") or more, each leaf comprised of 3-5 leaflets, is most likely to be 5-years of age or older.

This General Advice is valid for the export of wild and wild-simulated ginseng roots legally harvested during the 2022 harvest season in the 19 States and Tribe above, unless the DSA receives new or additional information regarding the status of or management this species that indicate this finding should be rescinded.

The American ginseng management programs in the 19 States and Tribe are approved under the U.S. Fish and Wildlife Service (Service) CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) Export Program (CEP) for this species (Service regulation 50 CFR §23.68).

Basis for advice:

This finding is based on our review of the annual State and Tribe harvest reports for American ginseng (hereafter referred to as ginseng), information from State and other Federal agencies, published peer-reviewed literature, and other information on legal and illegal harvest of ginseng, and the status and trade of this species and relevant information.

International Trade and CITES Appendix-II listing

The harvest of wild ginseng roots for international trade began in the early 1700s in North America with exports to China (Carlson 1986); the first shipments from the Colonies was in 1773 (Williams 1957). The harvest of the root kills the ginseng plant. Due to concerns of overharvest of wild ginseng roots for international trade, this species was included in Appendix II of the CITES in 1975. Appendix II includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival. The Appendix-II inclusion of ginseng covers live and dead plants, whole and sliced roots, and parts of roots (including root fibers and hairs), and excludes manufactured parts or derivatives such as powders, pills, extracts, tonics, teas, and confectionary.

The United States is the only exporter of wild ginseng (*P. quinquefolius*) roots, and it is considered one of the most economically important U.S. native medicinal plants harvested for international trade (Robbins 2000; Chamberlain et al. 2013). Exports are mainly to Asia where more than 95% of wild ginseng is consumed (Liu et al. 2021), Asian consumers regard wild ginseng roots more favorable than cultivated ginseng roots (Robbins 2000; Arik et al. 2020; Liu et al. 2021).

Biology, Ecology, and the Conservation Status of American ginseng

Ginseng is a slow-growing, long-lived herbaceous perennial plant that occurs in deciduous forests of eastern United States and Canada (Anderson et al. 1993; McGraw et al. 2013). The species' range extends from southern Ontario and Quebec, west to Minnesota, south to eastern Oklahoma and northern Georgia, and east to Maine (Gleason and Cronquist 1991). Ginseng is considered to be rare or uncommon in most of its range (Anderson et al. 1993; McGraw et al. 2003; Carignan and Branchaud 2018), with less than 1% of the global population of ginseng occurs in Canada (Carignan and Branchaud 2018).

Ginseng is physiologically adapted to low light conditions of mature deciduous forests. The tree canopy is characterized by low levels of diffused sunlight with spatially and temporally heterogeneous patches of more intense sunlight referred to as 'sunflecks' (Fournier et al. 2004; Wagner and McGraw 2013).

Seedlings emerge in the spring with a single leaf with three small leaflets (Lewis and Zenger 1982; McGraw et al. 2013). Juvenile plants produce 2-leaves, and adult plants produce 3- to 4-leaves (infrequently 5 leaves) (McGraw et al. 2013); each leaf is palmately compound, with 3 to 5 leaflets. Leaves occur in a whorl at the summit of a single stem that grows from the root (Radford et al. 1968). The colloquial name for a ginseng leaf is "prong" (e.g., 1 prong; 2 prongs;

3 prongs). Plants do not replace the stem and leaves if they are damaged or die during the growing season (i.e., determinate plant growth).

The life cycle of ginseng is typically comprised of distinct morphological stage classes determined by the number of leaves (1-leaf, 2-leaf, 3-leaf, 4 leaves). The life stages of ginseng were originally described as plants increasing in size with age, from a seedling to a 2-leaf plant, to a 3-leaf plant, to a 4-leaf plant (Anderson et al. 1993). Long-term demographic population monitoring has since shown that plants may continue to remain in a leaf stage over several growing seasons or revert to an earlier stage (e.g., from a 3-leaf plant to a 2-leaf plant), in particular as a result of herbivory (Farrington et al. 2009, McGraw et al. 2013). The overall size of a plant (leaf number and leaf area) is a good predictor of its capacity to survive and reproduce and increases as plants age (Carpenter and Cottam 1982; Lewis and Zenger 1982; Anderson et al. 1993; Mooney and McGraw 2009).

When the aboveground stem of the plant dies in autumn, it marks a permanent scar on the underground rhizome (commonly referred to as "root neck") connected to the root. The approximate age of a plant can be determined by counting the number of stem scars on the rhizome (Lewis and Zenger 1982; Anderson et al. 1993). Where the rhizome and the root collar meet indicate the first year of growth, and each subsequent year of growth is marked by a bud-scale scar on the rhizome (Carpenter and Cottam 1982; Lewis and Zenger 1982; Anderson et al. 1993). The minimum age of a plant can be determined by counting the number of bud-scale scars on the rhizome plus one for the first year of growth. Field studies have revealed that ginseng plants, in general, live to 20 to 25 years, and older plants are uncommon (Lewis and Zenger 1982; Lewis 1984; Carpenter and Cottam 1982; Mooney and McGraw 2009; McGraw and Chandler 2018).

Reproduction is by seed. There is a long pre-reproductive period before plants produce flowers, fruits, and seeds (Lewis and Zenger 1982; Charron and Gagnon 1991; McGraw et al. 2013). At the 2-leaf stage, flowering is possible, although seeds are rarely produced (Carpenter and Cottam 1982; Schlessman 1985; McGraw et al. 2013). In general, plants with 3 or 4 leaves are reproductive (Schlessman 1985; McGraw et al. 2005; McGraw et al. 2013). The inflorescence is an umbel with greenish-white flowers that bloom in June and July (Lewis and Zenger 1982; Schlessman 1985). Ginseng is a mixed-mating species, meaning a flower can self-pollinate (selfing) or cross-pollinate (outcrossing). The anthers (male) mature before the stigmas (female) which allows cross-pollination with flowers of nearby plants (Carpenter and Cottam 1982; Lewis and Zenger 1983; Schlessman 1985; Mooney and McGraw 2007). Although flowers are morphologically adapted for mixed mating (Lewis and Zenger 1983; Schlessman 1985), genetic research has shown the species' genetic profile is more consistent with a predominant life-history strategy of a self-pollinating species rather than cross-pollinating species (Cruse-Sanders and Hamrick 2004; Grubbs and Case 2004).

Generalist pollinators that have been observed visiting flowers are syrihid flies (*Syrphidae*) and halictid bees (*Lasioglossum* (*Dialictus*)) (Lewis and Zenger 1983; Schlessman 1985). A field study looking at patches (i.e., "clusters") of plants within populations relative to seed production, found that plants in smaller "clusters" produced less fruits (thus seeds) per plant than plants in larger "clusters" and densities, suggesting that small populations separated by distance from

lager populations can limit pollinator visits, which may have negative consequences on reproduction (i.e., Allee effect) (Hackney and McGraw 2001).

Fruits begin to form in mid-summer, changing from green to red in color and are mature by autumn; fruits generally fall within 2 meters (m.) (6.5 feet (ft.)) of the parent plant (McGraw et al. 2005; Mooney and McGraw 2007). Fruits are susceptible to predation by white-tailed deer (*Odocoileus virginianus*) and small mammals (Furedi and McGraw 2004). Thrushes (*Hylocichla* spp.), in particular the wood thrush (*H. mustelina*), are the primary dispersal vectors for long-distant seed movement (mean distance 15.2-21.7 m. (49.8-71.1 ft.) up to 96.6 m. (316.9 ft.) (Hruska et al. 2014; Elza et al. 2016). Although wood thrushes are still common throughout deciduous forests of eastern North America, populations declined by nearly 2% per year between 1966 and 2015 resulting in a cumulative decline of 62% percent, according to the North American Breeding Bird Survey (Cornell Lab of Ornithology 2019).

Ginseng fruits typically contain two seeds (Carpenter and Cottam 1982; Lewis and Zenger 1983; Anderson et al. 1993), although three-seeded fruit have been reported (Schlessman 1985). Seeds have a morphophysiological dormancy, in that the embryo is not fully developed and requires a period of moist, warm stratification to continue to develop, followed by winter chilling conditions to break the physiological dormancy (Baskin and Baskin 1998). Seeds typically germinate after 18-21 months of cool-warm-cool temperature sequence (Anderson et al. 1993; Lewis and Zenger 1982; Stoltz and Snyder 1985; Hackney and McGraw 2001). Seeds planted from mature red fruits are more likely to germinate than seeds of green fruits (McGraw et al. 2005). Ginseng harvesters that plant the seeds of harvested plants 2 centimeters (ca. 1 inch) deep in the soil can increase the germination success over seeds that naturally fall to the ground (McGraw et al. 2005). Seeds have been determined to be viable up to four years in the soil (Souther and McGraw 2010).

Population growth is affected by low fecundity and high seed mortality (Carpenter and Cottam 1982; Lewis and Zenger 1982; Schlessman 1985). Populations are small and widely distributed; occurrence varies from frequent to uncommon to rare (Anderson et al. 1993; McGraw et al. 2003; Albrecht and McCarthy 2009). Populations range in size from a few dozen plants (less than 1 acre in size) to up to fewer than 200 plants (covering nearly 10 acres) (McGraw et al. 2013). Within populations, smaller groups (i.e., "clusters") of plants can range from 1 plant to more than 100 plants within 1 m^2 (10.7 ft^2) area (McGraw et al. 2010).

In forests (e.g., State and Federal lands, private conservation lands) where harvest is prohibited, researchers have reported that populations tend to have more adult plants (3- and 4-leaf plants) compared to populations where harvest is allowed, which tend to have higher proportions of seedlings and juvenile plants (1- and 2-leaf plants) (Cruse-Sanders and Hamrick 2004; McGraw et al. 2013). The observed higher ratio of seedlings and juvenile plants to adult plants in populations has been described as the "fingerprint" of harvest pressure (Mooney and McGraw 2009).

High densities of white-tailed deer throughout eastern United States are affecting forest understory plants, including ginseng. The U.S. Forest Service reported that 59% of the 182.4 million acres of forest land inventoried in the Midwest and Northeast (comprised of 24 States)

was estimated to have moderate or high browse impacts, and that the Mid-Atlantic region had the highest proportion of forest land with moderate or high browse impacts (79%) (McWilliams et al. 2018). In particular, oak/hickory (*Quercus*/*Carya*) and maple/beech/birch (*Acer*/*Fagus*/*Betula*) forests were estimated to have moderate or high browse impacts above the regional average, 69% and 65%, respectively (McWilliams et al. 2018).

Although ginseng is not considered a 'preferred' food plant for white-tailed deer (Hruska et al. 2014), deer consume both leaves and fruits, and tend to browse larger plants over smaller plants (Furedi and McGraw 2004; McGraw and Furedi 2005; Farrington et al. 2009; McGraw and Chandler 2018). Repeated browsing by white-tailed deer can over time, cause decline in population growth by loss of reproductive output including seed production, and reduce plant size as browsed leaves and flowers are not replaced during the growing season, and can cause mortality of plants (McGraw and Furedi 2005; Farrington et al. 2009; McGraw et al. 2013; McGraw and Chandler 2018). Fruits and seeds are also consumed by small rodents (McGraw et al. 2013); however, the overall impact of such predators on seedling recruitment are unknown.

Genetic diversity allows a population to adapt to a changing environment and to buffer against stochastic events. Research of ginseng populations have shown there is significantly greater genetic diversity among populations than within populations indicating restricted gene flow and spatial distance between populations (Cruse-Sanders and Hamrick 2004). Populations on lands where harvest is prohibited have higher levels of genetic diversity than populations where harvest is allowed, suggesting that populations subject to harvest pressure have experienced restriction of gene flow and genetic drift (Cruse-Sanders and Hamrick 2004; Cruse-Sanders et al. 2005). The conservation concern is that genetic diversity is gradually lost in ginseng populations that are isolated by distance, resulting in higher rates of selfing and mating of related plants (inbreeding) and reduction of fitness (Cruse-Sanders and Hamrick 2004; Grubbs and Case 2004; Mooney and McGraw 2007; Schlag and McIntosh 2012). Inbreeding depression is the reduction of fitness among offspring of closely related individuals. Studies have shown plants within 2 m. (6.5 ft.) of each other tend to be genetically related, and that adult plants maintain more genetic diversity than juvenile plants (Cruse-Sanders and Hamrick 2004). Ginseng populations may be at risk of inbreeding depression and the subsequent loss of fitness among offspring of closely related plants as populations become smaller and distant from other populations (Cruse-Sanders and Hamrick 2004; Souther and McGraw 2014).

Researchers have documented higher levels of genetic diversity in field-cultivated plants than wild populations, largely due to the practice of mixing different seed lots, resulting in plants that are genetically more similar to each other than to wild plants (Boehm et al. 1999; Schluter and Punja 2002; Grubbs and Case 2004). Genetic studies have revealed plants grown from field-cultivated seeds growing among wild plants (Boehm et al. 1999; Schlag and McIntosh 2012; Young et al. 2012), indicating the intentional planting of cultivated sourced seeds (Grubbs and Case 2004; Young et al. 2012; McGraw et al. 2013). The conservation concern is wild plants cross-pollinated with non-wild plants (grown from cultivated seeds) may produce offspring with traits more similar to cultivated plants than to wild plants, and may introduce non-local genotypes (i.e., maladaptive) into wild populations (Mooney and McGraw 2007). As noted above regarding inbreeding depression, hybridization between wild plants and plants grown from non-local seeds could lead to an outbreeding depression and reduce fitness among offspring.

The conservation concern of planting cultivated seeds/non-local seeds in forest habitats is the introduction of non-local genotypes into wild populations that may disrupt co-adapted gene complexes, and reduce the ability of the species or populations to adapt to changing environmental conditions (Cruse-Sanders and Hamrick 2004; Mooney and McGraw 2007; Souther and McGraw 2014).

The main threats to ginseng are illegal harvest of roots (McGraw et al. 2010); unsustainable harvest (Van der Voort and McGraw 2006; Mooney and McGraw 2009); and browse by white-tailed deer (Furedi and McGraw 2004; McGraw and Furedi 2005; Farrington et al. 2009). Populations are also impacted by invasive non-native plant species (Wixted and McGraw 2009), habitat loss (McGraw et al. 2013), and timber harvest (Chandler and McGraw 2015).

A serious threat to forest ecosystems is climate change (Huber and Gulledge 2011; Iverson et al. 2019). Ginseng populations are adapted to local climatic conditions (Souther and McGraw 2010, 2014; Souther et al. 2012). Research has shown changing climatic conditions such as severe rainfall, drought, spring cold snaps, impact ginseng plants and populations over multiple years (Souther and McGraw 2010, 2014), and can have long-lasting effects when the habitat is affected (Carignan and Branchaud 2018). More research is needed to fully assess potential impacts of climate on the species' potential resilience and adaptation in response to changing climate and forest habitat, particularly given ginseng life history traits and ongoing threats to the species.

NatureServe classifies the national conservation status of ginseng in the United States as vulnerable/apparently secure (N3N4); last reviewed in June 2005 (NatureServe 2022). Vulnerable (N3) is defined as a species at moderate risk of extinction or elimination due to a restricted range, relatively few populations, recent and widespread declines, or other factors; and apparently secure (N4) is defined as a species uncommon but not rare; some cause for long-term concern due to declines or other factors (NatureServe 2022).

CITES Export Program - States and Tribe management of ginseng

The CEP States and Tribe have codified regulations to ensure legal harvest and to protect ginseng populations from overharvest within their respective jurisdictions (50 CFR §23.68). Regulations include designated harvest and buying seasons; minimum plant harvest size (i.e., 3–leaf or 4–leaf plants) and/or plant age requirement (i.e., plants must be 5-years or 10-years of age) depending on the State or Tribe; require seeds of harvested plants to be planted at or near harvested roots; require ginseng dealers (buyers) to be licensed; and other related requirements. With the exception of Illinois that require plants to have 4 compound leaves (4 prongs) at the time of harvest, all States require plants to have a minimum of 3 compound leaves (3 prongs); plants with 3 or 4 leaves produce seeds necessary for regeneration. Many States also require plants to have red (mature) fruits. Illinois, Vermont, and the Tribe require harvested plants to be 10-years of age or older.

State and Tribe officials inspected and certified harvested roots. The certification of roots ensure that they were harvested according to State or Tribe harvest regulations. All roots intended for international export must have the original issued State or Tribe certificate and a valid CITES export permit, which must be presented to the USDA Animal and Plant Health Inspection

Service - Plant Protection and Quarantine officers at the port of export.

With the exception of Illinois, which starts the first Saturday in September, the harvest season start date is September 1 in 18 States and the Tribe. The harmonized start date helps to discourage illegal harvest and transport of ginseng roots across neighboring borders. The harvest of ginseng on State-owned lands (e.g., State parks, forests, natural areas, wildlife management areas) is prohibited in 17 States, thereby providing necessary refuge for this species. Only two States (Minnesota and Tennessee) allow harvest in certain State lands with a State-issued harvest permit.

Most States require harvesters to obtain landowners' permission to harvest ginseng on land not one's own, and six States (Alabama, Illinois, Iowa, Maryland, Vermont, and Wisconsin) and the Tribe require harvesters to obtain a license or permit to harvest ginseng within its jurisdictions. The Tribe further prohibits planting seeds from sources outside the reservation in order to prevent non-local genotypes into populations on their land.

State agency websites provide information on the respective States' laws and regulations to harvest, sell, and buy ginseng, and general information about the species, as well as the Service's role in the international export of ginseng (including a link to the Service's webpage). Most States' websites also provide a link to the American Herbal Products Association's "Good Stewardship Harvesting of Wild American ginseng" webpage. A pamphlet for each of the 19 States can be downloaded with State specific information on its regulations, stewardship harvest guidelines, and related information.

As reported in our 2020 and 2021 findings, the Kentucky Department of Agriculture (KDA) and the Office of Kentucky Nature Preserves (OKNP) have a Memorandum of Understanding to complete a State-wide assessment of ginseng populations, including habitat conditions and ecological threats to the species. In 2021, 32 ginseng populations were surveyed, of which the majority were determined to be "Poor" to "Fair" (Element Occurrence rankings of C and D, respectively) estimated viability, and are threatened by logging activities and non-native invasive species (OKNP 2022). The Statewide assessment is on track to be completed in 2023.

The North Carolina Department of Agriculture & Consumer Services (NCDA&CS), Plant Conservation Program is partnering with the U.S. Forest Service in the State to expand studies on simulated harvest and population monitoring to help elucidate sustainable harvest rates for populations in the State.

In 2021, the North Carolina Friends of Plant Conservation (supporters of the NCDA&CS) funded a grant to researchers at the University of North Carolina-Asheville and Warren Wilson College to conduct a 2-year study on the genetic diversity of wild ginseng populations in the State. The study will also compare demographic data from years past to present to provide an update on the status of several populations throughout the State, and populations with and without known poaching pressure.

U.S. Forest Service management and conservation of ginseng

The U.S. Forest Service (USFS) is responsible for the conservation and management of ginseng and its habitat in the National Forests where the species occurs, and is required to set sustainable harvest levels for ginseng by its regulations (36 CFR 223.219; FSH 2409.18 87.1). There are National Forests in 17 of the 19 CEP States; there are no National Forests in Iowa and Maryland.

Within the USFS Eastern Region, ginseng occurs on 12 National Forests in 12 States (Illinois, Indiana, Maine, Michigan, Missouri, New Hampshire, New York, Ohio, Pennsylvania, Vermont, West Virginia, and Wisconsin). Two National Forests located in northern Minnesota (Superior and Chippewa) and one in northern Michigan (Hiawatha) are considered outside of ginseng's range (Kauffman 2006). Since 2000, the species has been included on the USFS Region's Sensitive Species List in 10 of the 12 National Forests due to population viability concerns, and harvest is prohibited except under special conditions authorized by the USFS. Ginseng harvest is allowed through a permit system on the Monongahela National Forest (West Virginia) and the Wayne National Forest (Ohio). Both National Forests limit the number of permits issued and the harvest amount based on the estimated population size within the respective Forest.

The USFS Southern Region includes National Forests in 10 States (Alabama, Arkansas, Georgia, Kentucky, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, and Virginia). Ginseng is not designated as a sensitive species in the Region. For the second consecutive harvest season, the National Forests in Georgia (Chattahoochee-Oconee NFs; USFS 2022a), Kentucky (Daniel Boone NF; USFS 2022b), North Carolina (Nantahala and Pisgah NFs; USFS 2022c.), and Tennessee (Cherokee NF; USFS 2022d) have suspended the issuance of ginseng harvest permits due to concerns of declining wild ginseng populations on those National Forests. According to Forest Service officials, suspending ginseng harvest helps ensure wild ginseng on the national forests can rebuild populations. Prior to the suspension, from 2013 to 2020, the four National Forests had reduced the number of permits issued, the harvest amounts allowed, and shortened the harvest season due to concerns about the status of the species. From 2009 to 2013, the National Forests in Georgia, Kentucky, North Carolina, and Tennessee accounted for 31-35% of the total value of ginseng harvest reported from those states (Chamberlain et al. 2018). The reported volumes of ginseng for those National Forests in the four States were the permitted amounts over the five harvest seasons. Harvest is prohibited in the National Forests in Alabama, Arkansas, South Carolina, and Virginia due to concerns about the status of the species (Kauffman 2006).

Research funded by the USFS Southern Region, analyzed ginseng harvest data reported by 18 of the 19 States (1978–2014), current and historic ginseng populations (1,200 sites), the quality and extent of habitat by county, socioeconomic data (population, poverty, unemployment), and road densities by county. The research showed that the four States with the largest reported harvests (Kentucky, Tennessee, Virginia, and West Virginia) have the largest statewide habitat indices, and the geographic regions with the largest harvests were the Southern Appalachians and the Ozarks (Schmidt et al. 2019). The researchers found that while there is sufficient habitat for ginseng, the socioeconomic conditions are more critical drivers of harvest intensities, and that county-level harvest rates increased with available habitat, road density, poverty, and unemployment, but decreased when public land formed a large proportion of county area

(Schmidt et al. 2019).

Refuge on State, Federal, and other forest lands

Ginseng harvest is prohibited on National Park Service and Department of Defense lands, most USFS National Forests and State forest lands, and private conservation lands (e.g., The Nature Conservancy), as well as many private owned forest lands. Maintaining healthy ginseng populations in forests where harvest is prohibited is essential to ensure long-term genetic diversity and population growth of ginseng (Cruse-Sanders and Hamrick 2004).

Law enforcement efforts to combat illegal harvest and trade of wild American ginseng

State, Tribe, and Federal law enforcement officials enforce laws and regulations to protect wild ginseng, and provide a critical role in the conservation and management of this species. The Service relies on these entities, as well as other sources, for information on illegal ginseng activities. Reported activities include illegal root harvest, trespassing on private, State, and Federal lands, harvest out-of-season, harvest of underaged roots, harvest without a license or permit, and other violations of State and Federal regulations and laws.

The National Park Service, the NCDA&CS, and the non-government-organization Friends of the Smokies continue their collaboration marking individual ginseng roots in the Great Smoky Mountains National Park (GSMNP) to combat illegal harvest of roots in the National Park in North Carolina. The roots are marked with a fluorescence dye, which is visible under a UV light, or embedded with microscopic silicone chips. Marked roots enable law enforcement officials to identify and trace roots illegally harvested from the GSMNP. Since implementing the marking program, thousands of seized roots have been successfully replanted in the National Park (GSMNP 2015).

Illegal harvest directly undermines the efforts of the State and Federal agencies and the Tribe to manage and conserve populations through reproductive potential, genetic diversity and viability of populations, and affects the livelihoods of law-abiding harvesters and landowners who depend on ginseng for a source of monetary revenue. Illegal harvest of roots of underaged or undersized plants reduces population growth below replacement levels (Van der Voort and McGraw 2006). Ginseng theft on State and Federal lands, and private conservation lands that prohibit harvest, is of particular concern as these lands provide critical refuge for long-term genetic diversity and viability of this species.

Wild-simulated American ginseng

Wild-simulated ginseng is planting cultivated-sourced ginseng seeds in suitable deciduous forest habitat and then allowing the plants to grow with little to no cultivation under natural conditions, resulting in roots that are similar in appearance to wild roots (Beyfuss 1999; Davis and Persons 2014; Chittum et al. 2019). The majority of field-cultivated ginseng seed is produced from commercial ginseng farms in Wisconsin (Davis and Persons 2014; Burkhart et al. 2021), where 95% of field cultivated ginseng is produced in the United States (Ginseng Board of Wisconsin 2022).

Genetic research has shown wild populations are genetically different from cultivated ginseng (Schluter and Punja 2002). McGraw et al. (2013) estimated that ginseng pollen travels less than 100 m (328 ft) from a flowering adult wild ginseng plant. Due to concerns of introducing non local genes into wild populations discussed above, planting of cultivated sourced seeds in forest habitat on privately owned forest lands should always be separated from wild populations, and is prohibited on State and Federal lands, and on private lands otherwise posted.

Wild-simulated ginseng is described as low-intensity type of forest farming that is widely promoted as a means of providing a source of revenue to forest landowners/tenants while conserving forest lands (Burkhart and Jacobson 2008; Vaughn et al. 2011; Davis and Persons 2014; ASAP 2017; Burkhart and Jacobson 2017; Smith et al. 2017; Chittum et al. 2019; Liu et al. 2021). There are approximately 6,000 to 8,000 ginseng seeds per pound (Greenfield and Davis 2004; Vaughn et al. 2011). Wild-simulated ginseng roots are harvested between 7-11 years of age (Davis and Persons 2014; Ha et al. 2017; Burkhart and Jacobson 2017). A half-acre of wild-simulated ginseng plants can reportedly yield 60-80 pounds of dried roots (Davis and Persons 2014; Burkhart and Jacobson 2017).

Wild-simulated ginseng roots can be morphological indistinguishable from wild roots, which are preferred by the Asian market (Liu et al. 2021). With the exception of West Virginia, that regulates forest-grown ginseng, there is little incentive for sellers offering wild-simulated roots to inform buyers/dealers that such roots are not wild for fear of receiving a lower price per pound (Burkhart and Jacobson 2008; Burkhart et al. 2021).

Responses to annual surveys of ginseng root sellers in Pennsylvania conducted over eight years, Burkhart et al. (2021) found that nearly three in ten sellers reported “wild” roots were a mixture of “wild” and “wild-simulated roots (roots harvested from plants grown from cultivated-sourced seeds planted in forest habitat), and forest “farmed” roots. According to the researchers, survey respondents are hesitant to report roots not as “wild” on state dealer reporting forms for a various reasons including fear of price devaluation of roots, theft of roots from their property, taxation concerns, as well as understanding of what constitutes a “wild” plant/root (Burkhart et al. 2021).

Research by Schmidt et al. (2019) found that the harvest levels in Illinois, Iowa, Wisconsin, and in particular Indiana, were quite large relative to the estimated forest habitat in those States. Based on their work, the researchers suggested the possibility that roots grown from cultivated-sourced seeds planted in the woodlands are likely reported as wild roots (Schmidt et al. 2019).

It is likely that wild-simulated ginseng, which is often planted at higher densities than wild plants occur, is harvested and sold as wild roots, which is then reported as wild to the State agencies. While we recognize that wild-simulated ginseng grown on private forest lands can reduce harvest pressure on wild populations and provide a source of revenue for landowners/tenants, currently only seven States (Indiana, Iowa, Kentucky, Maryland, North Carolina, Vermont, and West Virginia) report wild-simulated roots separate from wild roots in their annual reports to the Service. Moreover, the amount of wild-simulated roots reported is significant less than the amount of wild root reported in those States. We continue to encourage all States to report wild-simulated harvest data in their annual report to the Service.

2021 annual harvest of wild and wild-simulated American ginseng roots

According to the State and Tribe harvest data reported for the 2021 ginseng harvest season, 29,908 lbs. (dry) of wild ginseng roots were harvested; representing approximately 6,522,934 plants with 3 leaves or more (based on an average of 218 dry roots per pound). The 2021 harvest was a 10% decrease from the 2020 harvest. The top five States with the largest harvest amounts reported of total 2021 harvest were Kentucky (20.9%), Tennessee (20.3%), West Virginia (14.9%), North Carolina (11.3%), and Indiana (7.1%). Of the 19 States, only Arkansas (10.4%) reported an increase in the total amount of ginseng harvested in 2021 compared to the State's 10-year average (2011-2020). A total of 125 lbs. (dried) roots of wild-simulated ginseng was reported from five States (Kentucky, Maryland, North Carolina, Vermont, and West Virginia).

Several States reported the average age of harvested ginseng roots were 5-10 year; Kentucky reported 12.8 years, Vermont reported 18.7 years, whereas Alabama reported the average age of harvested ginseng roots was 3-5 years of age. Several States reported population levels to be stable overall or no change, whereas two States reported populations on private and public lands were declining.

We continue to request that the States and Tribe report the number of dry roots per pound as the data is used to calculate the number of plants annually harvested, and it provides trend information that we monitor in order to be aware of any irregularities that would be of conservation concern. We strongly encourage States to find a means to track and report wild-simulated roots separately from wild roots.

As reported in previous findings, the amounts of harvested and certified fresh (green) roots reported by the States continues to increase compared to dried roots, as the U.S. ginseng trade shifts from traditional dry root trade to fresh roots. The weight of a fresh root is approximately 70% moisture (Jones and Szymanski, n.d.). The amount of moisture in a harvested root is variable due to the size of the root, environmental factors (e.g., temperature, humidity, soil moisture), the post-harvest handling of roots, the length of time from harvest to when the roots are weighed, and other related factors. Roots harvested at the start of the open season in September have higher moisture content (higher root weight) than roots harvested later in the season (lower root weight). The weight of a properly dried root is approximately one third of the fresh/green weight.

The States and Tribe implement a range of conversion factors (e.g., 0.3, 3.03, 3.2) to convert the fresh weight of roots to dry weight. Because there is variability in fresh root dry down ratios, and to ensure consistency and to monitor trends over time, we continue to ask that the States and Tribe report the total weight of dry and fresh (green) roots separately in their annual reports to the Service. By doing so, we can apply the same conversion factor to the harvest amounts submitted by the States and Tribe. Accordingly, we also ask that the States and Tribe calculate the average number of roots per pound based on dried roots not fresh roots, in particular as we use the data to monitor trends over time.

In Summary

The 2021 harvest was a 10% decrease from the 2021 harvest, and is the smallest total harvest reported since the inception of the CITES Export Program. Since 2016, the total annual harvest amounts have decreased. The 2021 harvest was a 23% decrease from the 5-year average of 38,915 lbs. (2016-2020). In effect for the 2021 season, the suspension of the issuance of harvest permits in the USFS National Forests in Georgia, Kentucky, North Carolina, and Tennessee due to concerns of declining wild ginseng populations on those National Forests, which will continue through the 2022 harvest season.

The decrease in the total annual harvest amounts reported over the past five years, is likely due to multiple extrinsic (harvest pressure, deer browse, invasive plants, climate change) and intrinsic factors (life history traits, population structure, genetic diversity) affecting ginseng populations across the 19 States. While the annual harvest amounts in several States, including the top five harvest volume States, remains relatively high, this might be offset by harvest of forest-farming "wild-simulated" ginseng, particularly given the increasing popularity of growing ginseng on private forest lands. We will continue to monitor annual harvest levels as well as other factors to ensure that international trade does not negatively impact the long-term sustainability of wild ginseng.

The CEP States and the Tribe have regulations that restrict the harvest size of plants and/or age of plants, require harvesters to plant the seeds of harvested plants at the site, and require dealers to report all roots obtained, and the inspection of and certification of harvested roots. The harvest season in all States and the Tribe starts in September to ensure that ginseng fruits are ripe at the time of harvest, which research has shown can increase germination success of the planted seeds. Population monitoring data has shown that 3-leaf plants are reproductive and are often older than 5 years of age.

Harvest is prohibited on National Park Service lands, State-owned lands in 17 States, and most U.S. Forest Service lands, as well as private nature reserves and forest lands. State and Federal forest lands provide critical refuge for population growth and persistence and provide relief from harvest pressure.

Therefore, we find that the export of wild and wild-simulated ginseng roots legally harvested from plants that are 5-year of age or older during the 2022 harvest season will not be detrimental to the survival of this species. The 5-year of age requirement for roots intended for export supports the existing harvest regulations of the CEP States and Tribe and discourages the harvest of younger plants.

Future actions

We will continue to monitor harvest and export levels, and work closely with the States, Tribe, and other Federal agencies, as well as the ginseng industry, to ensure the long-term sustainability of American ginseng. We will seek up-to-date information on the status of the species, including the results of any field surveys and additional protections afforded to it. We will continue to:

Monitor the status of wild ginseng and assess further progress relating to the harvest and management of ginseng at the State and Federal level in our finding for 2023.

Consult with the States strategies to track and report wild-simulated roots separately from wild roots.

Engage with the ginseng industry concerning additional education and outreach opportunities to ensure that all harvesters know and follow harvest stewardship practices that contribute to the long-term sustainability of ginseng and the livelihoods of law-abiding harvesters who depend on this native plant.

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