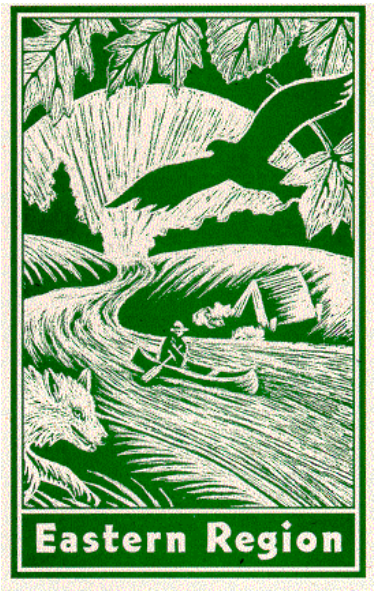
Conservation Assessment
For
American Ginseng (Panax quinquefolius) L.



USDA Forest Service, Eastern Region
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Prepared by:

This Conservation Assessment was prepared to compile the published and unpublished information and serves as a Conservation Assessment for the Eastern Region of the Forest Service. It does not represent a management decision by the U.S. Forest Service. Though the best scientific information available was used and subject experts were consulted in preparation of this document, it is expected that new information will arise. In the spirit of continuous learning and adaptive management, if you have information that will assist in conserving the subject community, please contact the Eastern Region of the Forest Service - Threatened and Endangered Species Program at 310 Wisconsin Avenue, Suite 580 Milwaukee, Wisconsin 53203.

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NOMENCLATURE AND TAXONOMY

SCIENTIFIC NAME: Panax quinquefolius L.

COMMON NAME: American ginseng, wild ginseng, dwarf groundnut, five fingers, five-leafed ginseng, garantogen, garentoquere, gensang, ginseng, grantogen, jinshard, man's health, man root, ninsin, redberry, sang, tartar root, wonder-of-the-world.

FAMILY: Araliaceae

SYNONYMS: Panax quinquefolium L.

USFS REGION 9 STATUS: Sensitive Species

USFW STATUS: None

ILLINOIS STATUS: None

GLOBAL AND STATE RANK: G4

RANGE: In eastern temperate deciduous forest of North America, ranging from Quebec to Minnesota and South Dakota, south to Georgia, Louisiana, and Oklahoma (figure 1). In Illinois, this species can be found in 70 counties: Adams, Alexander, Brown, Calhoun, Carroll, Cass, Champaign, Clark, Coles, Cook, Crawford, DeKalb, DeWitt, Douglas, DuPage, Edgar, Effingham, Fayette, Fulton, Greene, Grundy, Hancock, Hardin, Henderson, Jackson, Jersey, Jo Daviess, Johnson, Kane, Kankakee, Kendall, Knox, Lake, LaSalle, Lawrence, Lee, Logan, McDonough, McHenry, McLean, Macon, Macoupin, Madison, Marion, Massac, Morgan, Ogle, Peoria, Piatt, Pike, Pope, Putman, Randolph, Richland, St. Clair, Saline, Sangamon, Schuyler, Scott, Shelby, Stephenson, Tazewell, Union, Vermilion, Wabash, Wayne, Will, Williamson, Winnebago, and Woodford (figure 2).

PHYSIOGRAPHIC DISTRIBUTION: Panax quinquefolius can be found in the Southwestern Great Lakes Moraines Section, Ozark Highlands Section, Upper Gulf Plain Section, Central Till Plains (Oak-Hickory) Section, North Central U.S. Driftless and Escarpment Section, Interior Low Plateau-Shawnee Hill Section of the Eastern Broadleaf Forest Continental Province, and in the Central Till Plains Section and Central Dissected Till Plains Section of the Prairie Parkland Temperate Province (Key et al., 1995). Based upon the Natural Divisions of Illinois (Schwegman et al., 1973), Panax quinquefolius can be found in all Natural Divisions, but not all sections (Eric Ulaszek per. comm.).

HABITAT: Panax quinquefolius can be found in undisturbed mesic upland forest and woodland with greater occurrence on north facing slopes (Anderson et al., 1984; Anderson et al., 1993; Swink and Wilhelm, 1994). Anderson et al. (1993, see references in text) reported that this shade-tolerant species has a light saturation of 10% of full sunlight and that maximum growth will occur with 8 to 30% full sunlight. In Illinois, this species can be found in sandy loam and silt loam to loam soils and is very rare in soils with more than 35% clay

(Anderson et al., 1984; Anderson et al., 1993). Panax quinquefolius can also tolerate a wide range of soil pH (4.4-7.3) and inorganic nutrient conditions (e.g. P, K, Ca, and Mg) (Anderson et al., 1984; Anderson et al., 1993; Charron and Gagnon, 1991). Plants associated with Panax quinquefolius are: Acer saccharum, Actaea pachypoda, Adiantum pedatum, Botrychium virginianum, Bromus pubescens, Carex albursina, Carya cordiformis, Caulophyllum thalictroides, Dentaria laciniata, Dicentra cucullaria, Euonymus obovatus, Hepatica acutiloba, Prunus virginiana, Quercus rubra, Sanguinaria canadensis, Smilacina racemosa, Tilia americana, and Uvularia grandiflora (Swink and Wilhelm, 1994).

SPECIES DESCRIPTION: Long-lived herbaceous perennial (50 + yrs.) with a thick taproot that abruptly narrows into a rhizome (Lewis and Zenger, 1982). Rhizomes have large scars as a consequence of the abscission of the aerial stem. Whorled palmately compound leaves with an oblong to obovate shape, serrate margin, and pinnate venation. Flowers in a terminal umbel with several greenish-white flowers (± 8) (Gleason and Cronquist, 1991). Fruit a red berry with one to four seeds. The juvenile stage of Panax quinquefolius can be confused with individuals of Panax trifolius.

LIFE HISTORY: Sexual and asexual reproduction can be found in Panax quinquefolius. This species blooms from June to July and produces small hermaphroditic flowers, most of them protandrous. The species has a mixed breeding system of autogamy and xenogamy (Schessman, 1985), suggesting self-compatibility (Rebecca Anderson per. comm.). Schessman (1985) found that pollinators of Panax quinquefolius include halictids and syrhids. Fruits mature and seeds are dispersed during autumn. Fruit set can be high, 80-89%, but dry conditions can reduce fruit set to 47% (Lewis and Zenger, 1982). These fruits can have 1-2 seeds or, less frequently 3-4 seeds (Lewis and Zenger, 1982). Asexual reproduction is possible, although rare, via rhizome fragmentation (Lewis, 1984).

Seeds of Panax quinquefolius are dormant for almost 20 months before germination (Lewis and Zenger, 1982). These seeds show deep simple morphophysiological dormancy, meaning that they require warm stratification followed by cold stratification (Baskin and Baskin, 1998). In the case of Panax quinquefolius, cool-warm-cool stratifications (i.e. 5-20-5 °C) are needed for effective germination (Stoltz and Snyder, 1985). Lewis and Zenger (1982) found that Panax quinquefolius has very high seed mortality (99.5%), suggesting that this is a very vulnerable stage in the life cycle of the species.

Fruits of Panax quinquefolius abscise by September or October staying near the maternal plant (i.e. gravity seed dispersal). Evidence of this was found by Anderson et al. in a 1984 study. Seedlings were found to be clustered within a meter or less of the maternal plant and fruits dispersed less than 50 cm from the maternal plant. It has been suggested that because of the bright red fruits long distance dispersal by animals (e.g. birds) is possible (Lewis and Zenger, 1982).

Limited information is available regarding the size of unharvested populations of Panax quinquefolius because of the intense harvesting to which they are subjected. In general, wild populations of Panax quinquefolius are small (Charron and Gagnon, 1991; Lewis and Zenger, 1982). In a study by Anderson et al. (1993), protected populations averaged 35.7 plants/0.05 ha plot and unprotected averaged 12.0 plants/0.05 ha plot. Individuals in a population can start reproducing between the ages of 4-8 years (Anderson et al., 1984; Anderson et al., 1993; Carpenter and Cottam, 1982). In wild populations,

individuals can be as old as 13 years, but older than that is very rare (i.e. 23 years) (Carpenter and Cottam, 1982; Lewis and Zenger, 1982). Most individuals in Illinois, in both protected and unprotected populations, are under three years of age (Anderson et al., 1984; Anderson et al., 1993). Extreme variation among populations can be found annually in seedling and non-reproductive and reproductive individuals (Charron and Gagnon, 1991).

NATURAL AND HUMAN LAND USE THREATS: The biggest threat to Panax quinquefolius is the intense and destructive root harvesting that the populations endure because of the supposed medicinal properties of the root (Charron and Gagnon, 1991). Other threats associated with Panax quinquefolius are land use practices such as habitat loss (i.e. forest) as a consequence of development, agriculture, and grazing. Herbivory by insects or deer can be a problem. Insects can destroy between 10-43% of the shoots (Anderson et al., 1984). In a study by Rebecca Anderson (per. comm.), up to 1/3 of the flowering plants in one of her populations was destroyed by high rates of deer browsing. Deer browsing can also result in the removal of a single leaflet or removal of all leaves.

VIABILITY: To maintain minimum viable populations of Panax quinquefolius throughout its habitat rang, protection, management, and restoration of habitat should be provided as much as possible. A minimum viable population is defined as a population size likely to give a population a 95% probability of surviving over a 100 year period (Menges, 1992). To insure viability:

1. It is vital that the size of the existing populations of Panax quinquefolius be maintained or increased to insure the persistence of this species in the region. Also, it is necessary that local seed sources are available for future reintroductions of the species to other areas. The only way to accomplish such a task is by protecting the already existing seed sources (i.e. populations) available in the region.

2. The creation and maintenance of a metapopulation for Panax quinquefolius is crucial for the persistence of the species in the region. A metapopulation is as an assemblage of populations existing in a balance between extinction and colonization, the boundaries of which can be a site or a geographical region (Husband and Barrett, 1996; Levins 1969, 1970). The populations that will form this metapopulation should be large because they can have a better opportunity of persistence than small populations (Hanski et al., 1996). Hanski et al. (1996) have suggested, based upon models, that a metapopulation should consist of a minimum of 15-20 well connected populations. However, Hanski et al. (1996) point out that if this cannot be achieved, the few remaining populations and habitats should be protected and other management techniques should be used to allow the persistence of these populations. Also, based upon models, populations should be >200 individuals to avoid demographical and environmental stochasticity (Menges, 1992). This number can be higher or lower depending upon the species. In the case of Panax quinquefolius, Nantel et al. (1996) determined that the minimum viable population for this species is 200 or more individuals.

The existing population of Panax quinquefolius in the region potentially can go extinct as a consequence of illegal harvesting, low recruitment, stochastic event, etc. By developing several populations (i.e. metapopulation) this situation may be prevented. Also, by having a

metapopulation, other interactions that will impact the overall viability of Panax quinquefolius in the region, such as pollinator interactions, genetic structure, gene flow within and between populations, and seed dispersal, can be maintained.

3. Protection of existing and newly discovered populations in the region should be attempted. Protection of these populations also implies protection of their habitat.

MANAGEMENT: To maintain minimum viable populations of Panax quinquefolius throughout its habitat range, specific management practices will be needed to insure the persistence of the species.

1. To maintain and increase the existing population of Panax quinquefolius, specific practices should be followed:

a. To successfully maintain and increase the existing Panax quinquefolius populations, harvesting should not be allowed. Violation of this recommendation should be penalized according to laws such as the Illinois Wild Ginseng Harvest Regulation (Public Act 83-680 in 1983).

b. Management practices such as removal of noxious weeds should be used to avoid encroachment in existing habitat. These management practices should be conducted to provide the conditions for Panax quinquefolius to grow (i.e. shady habitat). Anderson et al. (1993, see references in text) reported that this shade-tolerant species has a light saturation of 10% of full sunlight and that maximum growth will occur with 8 to 30% full sunlight. In addition to these management practices, an Integrated Pest Management Plan such as the one developed by Carroll and White (1997) can be used to control exotic and noxious weeds species.

c. Activities that increase the likelihood of noxious weed introduction or cause trampling (e.g. humans or animals) of the plants should be avoided or minimized.

d. Development of trails in areas where Panax quinquefolius is found should be avoided or minimized to prevent negative impacts to the populations.

e. Collection of Panax quinquefolius should only be allowed for scientific reasons and only by permit.

2. To develop and maintain a metapopulation of Panax quinquefolius, attempts should be made to restore or reintroduce this species in areas that were historically mesic upland forest and mesic woodland. This includes the improvement of areas that have mesic upland forest and mesic woodland. Part of this restoration will include the reintroduction of Panax quinquefolius in the appropriate habitat.

To maintain and increase these populations of Panax quinquefolius, the following practices should be considered in addition to those measures outlined under 1 of this section:

a. To enhance the genetic diversity of the populations, seeds should be collected from nearby populations (e.g. 50-100 miles from the site) to develop seedlings and rootstock.

b. Seed sowing and hand plantings of individuals with more than 2 leaves (Gagnon, 1999) should be used to develop populations in the proper areas.

c. Monitoring and evaluation should be conducted for any restored or reintroduced populations. In the event that a restored or reintroduced population is unsuccessful, a site's potential for a second reintroduction or restoration attempt should be reevaluated. This may require additional research.

3. In the case that additional populations of Panax quinquefolius are found in the region, they should be marked and protected from any potential damage and the above practices for maintenance and enhancement of these populations should be followed. Their habitat should also be protected.

MONITORING: In natural populations, regular counts of individuals (i.e. seedlings, juveniles, flowering adults, and non-flowering adults) should be done to determine population status. Transects and quadrats should be used to determine the size of a population in a large area. Hand counts can be done if a population is small (less than 100 individuals). In restored areas, sampling should be done as above to detect increases or decreases in the population. If no significant changes are detected, reevaluation of seeding techniques and management practices should be done to enhance the population. For a detail monitoring protocol (i.e. demographic and reproductive information) for Panax quinquefolius see Anderson (1996) and Gagnon (1999).

RESEARCH NEEDS: Immediate research needs for Panax quinquefolius that will help in the establishment and management of the species are:

1. Collect demographic, fruit and seed set, movement of pollen and seeds, and population size information. This information is needed to determine the population structure and population changes (i.e. increases or decreases) of the species. With this information, specific recommendations can be made if the population is declining or only seedlings are found.

2. Determine the genetic diversity, genetic population structure, and gene flow of Panax quinquefolius. This information can be used, for example, to avoid inbreeding depression in small populations.

3. Determine the impact of different management (e.g. grazing, fire) and recreational activities. It is important to determine the best management practice(s) to improve the habitat for the species. Also, it is important to determine which recreational activities are compatible with the species. This will prevent any risks to the species and its habitat.

4. Determine the impact of deer browsing on the species, for example, how deer browsing affects the reproductive output of the species. This information can be used to determine the proper management practice to avoid deer browsing.

5. Determine the impact of a harvesting program if harvesting is allowed in the future. It is important to determine if populations can be harvested or how a supplemental growing program can be used to avoid the harvesting of natural populations.

REFERENCE LIST

Literature cited

Anderson, R.C. 1996. Monitoring harvested wild Ginseng populations. Report to U.S. Fish and Wildlife Services. Department of Biological Sciences. Illinois State University. Normal, Illinois 61790-4120.

Anderson, R. C., J. S. Fralish, J. Armstrong, and P. Benjamin. 1984. Biology of Ginseng (Panax quinquefolius) in Illinois. Department of Conservation, Division of Forest Resources and Natural Heritage, Springfield, IL.

Anderson, R. C., J. S. Fralish, J. Armstrong, and P. Benjamin. 1993. The ecology and biology of Panax quinquefolius L. (Araliaceae) in Illinois. American Midland Naturalist 129: 357-372.

Baskin, C. C. and J. M. Baskin. 1998. Seeds: ecology, biogeography, and evolution of dormancy and germination. Academic Press, San Diego, CA.

Carpenter, S. G. and G. Cottam. 1982. Growth and reproduction of American ginseng (Panax quinquefolius) in Wisconsin, U.S.A. Canadian Journal of Botany 60: 2692-2696.

Carroll, C. J. and J. White. 1997. Integrated Pest Management Methods for Control of Invasive Exotic Plant Species at Midewin National Tallgrass Prairie. Unpublished report by Ecological Services for the Illinois Department of Natural Resources, Springfield, IL.

Charron, D. and D. Gagnon. 1991. The demography of northern populations of Panax quinquefolium (American ginseng). Journal of Ecology 79: 431-445.

Gagnon, D. 1999. An analysis of the sustainability of American ginseng harvesting from the wild: the problem and possible solutions. First draft of a report to the Office of Scientific Authority of the U.S. Fish and Wildlife Service.

Gleason, H. A. and A. Cronquist. 1991. Manual of Vascular Plants of Northeastern United States and Adjacent Canada. 2nd ed. New York Botanical Garden, Bronx, NY.

Hanski, I., A. Moilanen, and M. Gyllenbergl. 1996. Minimum viable metapopulation size. The American Naturalist 147: 527-541.

Husband, B. C. and S. C. H. Barrett. 1996. A metapopulation perspective in plant population

biology. Journal of Ecology 84: 461-469.

Key, J. Jr., C. Carpenter, S. Hooks, F. Koenig, W. H. McNab, W. Russell, and M. L. Smith. 1995. Ecological Units of the Eastern United States-First Approximation (map and booklet of map unit tables). U.S. Department of Agriculture-Forest Service, Atlanta, GA.

Levins, R. 1969. Some demographical and genetic consequences of environmental heterogeneity for biological control. Bulletin of the Entomological Society of America 15: 237-240.

Levins, R. 1970. Extinction. In Lectures on Mathematics in the Life Sciences, 2. ed. M. Gerstenhaber. Pp. 77-107. American Mathematical Society, Providence, RI.

Lewis, W. H. 1984. Population structure and environmental corollaries of Panax quinquefolium (Araliaceae) in Delaware County, New York. Rhodora 86: 431-438.

Lewis, W. H. and V. E. Zenger. 1982. Population dynamics of the American ginseng Panax quinquefolium (Araliaceae). American Journal of Botany 69: 1483-1490.

Menges, E. S. 1992. Stochastic modeling of extinction in plant populations. In Conservation Biology: The Theory and Practice of Nature Conservation, Preservation, and Management. eds. P. L. Fiedler and S. Jain. Pp. 253-275. Chapman and Hall, New York, NY.

Mohlenbrock, R. H. and D. M. Ladd. 1978. Distribution of Illinois Vascular Plants. Southern Illinois University Press, Carbondale, IL.

Nantel, P., D. Gagnon, and A. Nault. 1996. Population viability analysis of American ginseng and Wild leek harvested in stochastic environments. Conservation Biology 10: 608-621.

Public Act 83-680. 1983. Illinois Wild Ginseng Harvest Regulations.

Schessman, M. A. 1985. Floral biology of American ginseng (Panax quinquefolium). Bulletin of the Torrey Botanical Club 112: 129-133.

Schwegman, J. E., G. D. Fell, J. Hutchinson, G. Paulson, W. M. Shepard, and J. White. 1973. Comprehensive Plan for the Illinois Nature Preserve Commission. Part II - The Natural Divisions of Illinois. Illinois Nature Preserve Commission, Springfield, IL.

Stoltz, L. P. and J. C. Snyder. 1985. Embryo growth and germination of American ginseng seed in response to stratification temperatures. HortScience 20: 261-262.

Swink, F. and G. Wilhelm. 1994. Plants of the Chicago Region. 4th ed. Indiana Academy of Science, Indianapolis, IN.

Web pages cited

www.fs.fed.us/ne/delaware/ilpin/P.htm

www.itis.usda.gov/plantproj/plants/cgi_bin/fr_enter.cgi?earl=fr_qurymenu

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