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REPORT ON THE CONSERVATION STATUS OF
ASTRAGALUS SCAPHOIDES, A CANDIDATE THREATENED SPECIES.

Taxon name:	<u>Astragalus scaphoides</u> (Jones) Rydb.
Common name:	Bitterroot milkvetch
Family:	Fabaceae (Leguminosae)
States where taxon occurs:	Idaho and Montana
Recommended Federal Status:	U.S. Fish & Wildlife Service Category 2
Author of report:	Peter Lesica
Original date of report:	December 6, 1984
Date of most recent revision:	
Institution, agency or individual to whom further information and comments should be sent:	Peter Lesica The Nature Conservancy Big Sky Field Office P. O. Box 253 Helena, MT 59624

FILED IN 1992

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I. Species Information

1. Classification and Nomenclature

A. Species

1. Scientific name

- a. Binomial--Astragalus scaphoides (Jones) Rydberg.
- b. Full bibliographic citation--Memoirs of the New York Botanical Garden 1:241. 1900. ("scophiodes").
- c. Type specimens--Dry sagebrush areas, 5500' alt., Beaverhead County, Montana, on hills west of Clark's Canyon, July 1888. Frank Tweedy No. 9 in 1888, US. Isotype, NY, POM.

2. Pertinent Synonyms--Astragalus arrectus var. scaphoides M.

E. Jones. Proceedings of the California Academy of Science II 5: 664. 1895. Astragalus scaphoides Jones. Contributions to Western Botany 10:69. 1902. Phacopsis scaphoides Rydberg. Bulletin of the Torrey Botanical Club 40:52. 1913. Hesperomix scaphoides Rydberg. North American Flora 247:439. 1929.

3. Common name--Bitterroot milk vetch.
4. Taxon codes--None known.
5. Size of genus--Approximately 2000 species with a great deal of local endemism.

B. Family classification

1. Family name--Fabaceae
2. Pertinent family synonym--Leguminosae, Papilionaceae
3. Common names for family--Pea Family, Legume Family.

C. Major plant group--Dicot

- D. History of knowledge of taxon--A. scaphoides was first collected by Frank Tweedy in 1888 in Beaverhead Co., Montana in the low mountains north of what is now Clark Canyon Reservoir.
- E. Comments or current alternative taxonomic treatments--There are no recent alternative taxonomic treatments.
2. Present legal or other formal status
- A. International--None.
- B. National--No current federal status.
- C. State
1. Idaho--Listed as proposed Federal Watch List (Steele et al. 1991).
2. Montana--Listed as proposed state threatened (Lesica et al. 1984).
3. Description
- A. General nontechnical description--Astragalus scaphoides is a fairly robust perennial forb about 1-2 feet high. The leaves are pinnate, clustered at the base and scattered along the stem, and 4-8 inches long. The flowers are light yellow, about an inch long, and fairly showy. They are borne in tight clusters of 15-30 on stalks 2-4 inches long originating in the axils of upper leaves. The flowers are spreading or slightly nodding, and as they mature the cluster opens up. The fruits are almost cylindric, sharply pointed, and about an inch long. They are held erect and away from the stem, resembling a candelabra. Their color is light green, often with a deep reddish cast. Most plants bloom in June and mature fruit in the latter part of July.

- B. Technical description--Sparsely strigilose perennial with a taproot and branched crown; stems several, stout, ascending to erect, 2-6 dm tall; leaves 10-25 cm long; stipules lanceolate, 1-4 mm long, not connate; leaflets 15-21, lance-oblong to elliptic-oblong, 1.5-3.5 cm long, as much as 13 mm broad, glabrous on the upper surface at least; peduncles mostly 10-15 cm long; racemes closely 15-30 flowered but elongating and open in fruit; pedicels 2-5 mm long; flowers spreading to slightly reflexed, white to ochroleucus, about 2 cm long; calyx usually blackish hairy, 8-10 mm long, the narrowly lanceolate lower teeth about 2 mm long; banner erect; wings 2-4 mm longer than the keel; pod erect; lacinous, glabrous, slightly mottled corrugate-wrinkled, oblong-ovoid, inflated and slightly obcompressed, 4-6 mm broad, 6-10 mm thick, with both sutures sulcate, the lower intruded to form a 3/4 complete partition (Hitchcock et al. 1961).
- C. Local field characters--The legumes are large with a pointed attenuated apex and held erect and distant from the axis of the raceme.
Flowering racemes are fairly conspicuous with large slightly declined ochroleucus flowers in a tight cluster which expands with age.
- D. Identifying characteristics of material which is in interstate or international trade or commerce--No interstate or international trade or commerce known.
- E. Photographs and/or line drawings--Line drawing in Hitchcock et al. 1961 p. 261. Color slides available from The Nature Conservancy, Big Sky Field Office, P.O. Box 258, Helena, MT 59624.

4. Significance

A. Natural--Natural significance is unknown.

B. Human--Human significance is unknown.

5. Geographical distribution

A. Geographical range--Known from elevations of 5,000-5,500 feet in southwestern Beaverhead County, MT in a small area north and west of Clark Canyon Reservoir and in the drainage of the Lemhi River in southeastern Lemhi County, ID. A disjunct population occurs along the Salmon River in extreme northern Lemhi County.

B. Precise occurrences (see Appendix II)

- 1) Bon Accord Bench - Beaverhead Co., MT; 6,400'; T8S R11W Sec9; ^{OK} USGS Quad Bannack; ca 200-300 individuals.
- 2) Cold Spring Creek - Beaverhead Co., MT; 5,700'; T8S R11W Sec15; ^{OK} USGS Quad Bannack; ca 100 individuals.
- 3) Sheep Corral Gulch - Beaverhead Co., MT; 6,400'; T8S R12W ^{OK} Sec26; USGS Quad Grant; ca. 2,000 individuals.
- 4) Badger Gulch - Beaverhead Co., MT; 6,300'; T8S R12W Sec28; USGS Quad Grant; 50-100 individuals.
- 5) Bachelor Mtn. - Beaverhead Co., MT; 6,200'; T9S R13W Sec14; ^{OK} USGS Quad Grant, ca 100 individuals.
- 6) Mouth of Grasshopper Creek - Beaverhead Co., MT; ca 5,300'; USGS Quad Dalys; exact location unknown - label of herbarium specimen reads, "12 mi south of Dillon, Hitchcock 15799" NY.
- 7) Agency Creek - Lemhi Co., ID; 5,600'; T19N R25E Sec17; USGS Quad Lemhi; ca 200-400 individuals.
- 8) Lower Agency Creek - Lemhi Co., ID; 5,000-5,300'; T19N R24E sec 25-26, scattered plants above road; USGS Quad Lemhi; less than 50 individuals.

- 9) Agency Creek - F.S. - Lemhi Co., ID; 5,900'; T19N R25E Sec15; USGS Quad Lemhi Pas; ca 10 individuals.
- 10) Napo Bench - Lemhi Co., ID; 5,200'; T18N R24E Sec21; USGS Quad Lemhi; less than 50 plants.
- 11) Lemhi - Lemhi Co., ID; 5,200'; T18N R24E Sec28; USGS Quad Lemhi; less than 50 plants.
- 12) Hayden Basin - Lemhi Co., ID; 6,000'; T18N R23E Sec33; USGS Quad Lemhi; less than 50 plants.
- 13) Leadore - Lemhi Co., ID; ca 6,200'; T16N R25E Sec25-26, exact location is unknown - herbarium label reads "4 mi west of Leadore" NY, fide Rupert Barneby; USGS Quad Leadore.
- 14) Shoup - Lemhi Co., ID; 3,400'; T24N R21W Sec22; USGS Quad Ulysses Mtn.; less than 50 individuals.

C. Status and location of presently cultivated material--No cultivated material known.

D. Biogeographical and phylogentic history--Astragalus scaphoides is related to the widespread and polymorphic A. eremiticus (Barneby pers. com.) which occurs to the south of the range of A. scaphoides. The presence of a depauperate population disjunct to the north of the main range may indicate that the range of this species is contracting.

6. General environment and habitat description

A. Concise statement of general environment and habitat--Silty soils with moderate to large amounts of coarse fragments derived from limestone, basalt, or diabase. Sites are dominated by sagebrush-bunch grass association and occur between 5,000 and 6,500' on lower slopes. Sites are often in an ecotonal area

between rocky steep upper slopes and nearly level benches along drainageways.

B. Physical characteristics

1. Climate

- a. Koppen Climate Classification--Unknown.
- b. Regional macroclimate--Climate of the area in which A. scaphoides occurs (Artemisia-Agropyron shrubland) is described by Weaver (1980, Amer. Midl. Nat. 103:392). July mean is 66°F. January mean is 19°F. Mean annual precipitation is 13 inches, with an average drought period of 2.0 months.
- c. Local microclimate--No information available. Populations usually occur on warm aspects.

2. Air and water quality requirements--Not known.

3. Physiographic province--Northern Rocky Mountain Province (Hunt 1967).

4. Physiographic and topographic characteristic--Astragalus scaphoides occurs between 5,000 and 6,500' at all locations except the Shoup site. Populations generally occur on lower slopes at the base of fairly steep hills. A. scaphoides seems to be most abundant on warmer aspects - south and southwest being most common.

5. Edaphic factors--Soils are generally silty in texture with moderate to large amounts of coarse fragments. Parent materials are basalt, diabase, and limestone.

6. Dependence on dynamic factors--Unknown.

7. Other unusual physical features of environment and habitat--None.

C. Biological characteristics

1. Vegetation physiognomy and community structure--Sagebrush grassland, generally with relatively dense cover of sagebrush. There is usually much bare ground and occasionally other shrub species are dominant. Before the advent of grazing sagebrush was probably less common and the bunchgrasses were dominant.
2. Regional vegetation type--Sagebrush steppe (Kuchler 1964).
3. Frequently associated species--Sagebrush (Artemisia tridentata) is present at all sites. Rabbitbrush (Chrysothamnus nauseosus) is common at the Agency Creek site. Black sagebrush (Artemisia nova) is common at the Bon Accord site. Bluebunch wheatgrass (Agropyron spicatum), western wheatgrass (Agropyron smithii), needle-and-thread (Stipa comata), and Indian ricegrass (Oryzopsis hymenoides) are common associated grasses. Pricklypear (Opuntia polyacantha), snakeweed (Gutierrezia sarothrae), phlox (Phlox hoodii), and fringed sage (Artemisia frigida) are common associated forbs.
4. Dominance and frequency--Astragalus scaphoides is generally not dominant, but at the Sheep Corral Gulch site it might be considered a codominant forb.
5. Successional phenomena--Unknown.
6. Dependence on dynamic factors--None evident. A. scaphoides seems to be a member of stable communities.
7. Other endangered species--Penstemon lemhiensis, a candidate for federal status, occurs in the same general area but was never observed near populations of A. scaphoides.

7. Population biology

A. General summary--Populations of Astragalus scaphoides are generally sparse to moderately dense. The Sheep Corral Gulch population might be considered dense. In 1984 approximately half of the individuals in five populations studied were non-reproductive. Non-reproductive plants are not necessarily immature as some non-reproductive plants had dried flower stalks of the previous season still attached to their rootcrown. Five populations were studied (Lesica in review).

B. Demography

1. Known populations--14 sites for A. scaphoides are known or have been reported (see Precise occurrences).
2. Demographic details of populations studied--Demographic details of populations studied: Bon Accord Site - 1500 plants/acre; 54% of plants are reproductive; average # fruits per fruiting plant is 20 ± 25 ; average # seeds per fruit is 8.5 ± 6.7 . Cold Spring Creek - 1500 plants/acre; 57% of plants are reproductive; average # fruits per fruiting plant is 20; average # seeds per fruit is 7.3 ± 4.9 . Sheep Corral Gulch Site - 7,450 plants/acre; 41% of plants are reproductive; average # fruits per fruiting plant is 8 ± 4 ; average # seeds per fruit is 3.1 ± 3.7 . Badger Gulch Site - 1,250 plants/acre; 52% of plants are reproductive; average # fruits per fruiting is unknown; average number of seeds per fruit is unknown. Agency Creek Site - 560 plants/acre, 63% of plants are reproductive, average # fruits per fruiting plant is 3; average number of seeds per fruit is unknown. (See Lesica 1985 for additional information.)

C. Phenology

1. Patterns--Astragalus scaphoides generally blooms in June. Fruit is matured in mid to late July. An occasional plant may bloom as late as mid-July.
2. Relation to climate and microclimate--Unknown.

D. Reproductive ecology

1. Types of reproduction--Details of the breeding system are unknown. A. scaphoides does not reproduce vegetatively, and I suspect that flowers are mainly outcrossed.
2. Pollination
 - a. Mechanisms--Unknown, probably by insects.
 - b. Specific known pollinators--Only chance observations of pollination were made. Bumblebees (Bombies spp.) were the only pollinators observed at the flowers of A. scaphoides.
 - c. Suspected pollinators--Perhaps moths.
 - d. Vulnerability of pollinators--Unknown.
3. Seed dispersal
 - a. General mechanisms--Although not directly observed, the seeds of A. scaphoides are presumably shaken from the legume which dries and opens at the tip while still on the plant.
 - b. Specific agents--Unknown.
 - c. Responses of mechanisms--Unknown.
 - d. Dispersal patterns--Unknown.
4. Seed
 - a. Amount of seed production--Plants with fruit had an average of 3-20 legumes per plant with a mean seed number of 3-9 (see Lesica in review).

- b. Seed viability and longevity--Unknown.
 - c. Dormancy--Unknown.
 - d. Germination requirements--Unknown.
 - e. Percent germination--Unknown.
5. Seedling Ecology--Only a small number of seedlings were observed during field work. Their ecology is unknown.
 6. Survival and mortality--Unknown.
 7. Overall assessment of reproduction success--Reproductive success is minimal in most populations due to herbivory and flower/fruit abortion (see section on negative interactions). Reproduction may be inadequate to maintain some populations.

8. Population Ecology

- A. General summary--Astragalus scaphoides is a member of stable, climax, shrubland communities. It is apparently able to compete successfully with the vegetation of these communities. There is evidence that herbivores, both insect and mammalian, are severely restricting the reproductive ability of this species.
- B. Positive and neutral interactions--Astragalus scaphoides is, in all likelihood, mycorrhizal with an endophytic fungi in the Family Endogonaceae. A. scaphoides may also have nitrogen-fixing nodules - a symbiotic relationship with bacteria of the genus Rhizobium.
- C. Negative interactions
 1. Herbivores, predators, pests, parasites and diseases--In the five populations of A. scaphoides studied 45-89% of the reproductive individuals had their inflorescence destroyed in the flowering stage. Part of this damage is thought to be caused by mammalian herbivores such as deer, antelope, or

livestock. A large part of the damage appears to be due to stem-girdling insects. Both beetles (Order Coleoptera, Families Buprestidae and Cerambycidae) and sawflies (Order Hymenoptera, Family Cephidae) are known to exhibit stem-girdling behavior. Conclusive evidence linking any particular herbivore to the destruction of the inflorescences of A. scaphoides is not currently available. In addition to the inflorescence destruction, leaf damage was observed on many A. scaphoides plants. This damage appears to be caused by biting and chewing insects (probably Orders Orthoptera and Lepidoptera) (see Lesica in review).

2. Competition

- a. Intraspecific--Unknown.
- b. Interspecific--Species does not seem to suffer any adverse effects in dense stands of sagebrush. Competition with grasses and forbs may occur.

3. Toxic and allelopathic interactions--None known.

D. Hybridization

1. Naturally occurring--At a number of the sites in Idaho A. scaphoides co-occurs with A. atropubescens. These two species are closely related and are very similar vegetatively. No obvious hybrids were observed.
2. Artificially induced--Unknown.
3. Potential in cultivation--Unknown.

E. Other factors of population ecology--None known.

9. Current land ownership and management responsibility

- A. General nature of ownership--All known viable populations are on public land owned by the U.S. Government.
- B. Specific landowners--All sites with more than 50 plants of Astragalus scaphoides are on public land administered by the Bureau of Land Management - specifically Dillon, MT and Salmon, ID area offices. Part or all of the Bachelor Mtn., Mouth of Grasshopper Creek, Lower Agency Creek, Lemhi, Hayden Basin, Leadore, and Shoup sites are in private ownership. The Agency Creek --F.S. site is on public land administered by Salmon National Forest.
- C. Management responsibility--See above.
- D. Easements, conservation restrictions, etc.--None known.

10. Management practices and experience

A. Habitat management

- 1. Review of past management and land use experiences--No experience.
- 2. Performance under changed conditions--Unknown.
- 3. Current management policies and actions--With the exception of the Shoup site, all A. scaphoides populations are on land which is currently managed for livestock grazing. Of the five sites studied, the Bon Accord site appears to have little or no recent livestock usage; the Cold Spring Creek site appears to have light livestock usage, although the presence of exotic plant species may indicate heavier past use; the Sheep Corral Gulch, Badger Gulch, and Agency Creek sites all appear to have moderate to heavy use by livestock.

4. Future land use--The areas will probably continue to be used for livestock grazing. The Shoup site which is privately owned is currently being subdivided for residential and/or recreational use.

B. Cultivation

1. Controlled propagation techniques--None known.
2. Ease of transplanting--Not known.
3. Pertinent horticultural knowledge--Unknown.
4. Status and location of presently cultivated material--None known.

11. Evidence of threats of survival

A. Present of threatened destruction, modification, or curtailment of habitat or range

1. Past threats--Judging from the proximity of populations of Astragalus scaphoides to existing roads at the Bon Accord, Agency Creek, Lower Agency Creek, Lemhi, Hayden Basin, and Shoup sites, construction of these roads probably destroyed parts of these populations. Intense, unregulated livestock grazing carried out in past years may also have reduced populations.
2. Existing threats--In the populations studied 45-89% of the reproductive individuals had their inflorescences removed by herbivores. This severe curtailment of reproductive capacity would seem to be the most serious threat to the persistence of Astragalus scaphoides. It is currently not known to what extent this damage is caused by insects, wildlife, or livestock, although livestock grazing does not appear to be the

major cause (see Lesica in review). Damage to the foliage A. scaphoides by insects is probably reducing the vigor of the affected plants.

3. Potential threats--The paucity of large populations makes this species more vulnerable to extirpations or loss of genetic variability if environmental fluctuations should result in the destruction of one of the few important populations. Since A. scaphoides often occurs on lower slopes above drainages - topographic positions which are frequently favorable to road construction, future road construction may threaten populations of this species.

B. Overutilization for commercial, sporting, scientific, or educational use--No threats known.

C. Disease predation or grazing--See existing threats and Lesica (1985).

D. Inadequacy of existing regulatory mechanisms

1. Past threats--None known.

2. Existing threats--Allowing grazing in early spring may be adversely affecting A. scaphoides by causing some predation and trampling.

3. Potential threats--None unknown.

E. Other natural or man-made factors--None known.

II. Summary and Recommendations

12. General assessment of vigor, trends and status--Based on previous collecting records and five days of field searching, it appears that [Astragalus scaphoides is generally limited to a small area of southwestern Beaverhead Co., MT and the Lemhi River drainage between Leadore and Tendoy in Lemhi Co., ID.] Furthermore, populations of more

than 50 individuals are uncommon within this range. In five populations studied only a small percent (0-30%) of the reproductive individuals were able to mature fruit. In light of its very limited distribution, this severe curtailment of reproductive capacity may be a serious threat to the continued existence of A. scaphoides.

13. Priority of listing or status change

A. Recommendations to U.S. Fish and Wildlife Service--On the basis of the evidence presented here and in Lesica (1985) I recommend to the U.S. Fish and Wildlife Service that the plant species Astragalus scaphoides be listed as category 2 under the provisions of the Endangered Species Act of 1973.

B. Recommendations to other U.S. Federal Agencies

1. Bureau of Land Management--Should Astragalus scaphoides receive status under the Endangered Species Act, in areas determined to be critical habitat for A. scaphoides (see next page) livestock grazing should be restricted from May 15 through July 15 to minimize compaction of soil and damage to reproductive plants. Construction of new roads and improvement of existing roads that occur in potential A. scaphoides habitat should be carried out in a manner which will protect populations of this species.

C. Other status recommendations

1. State

a. Montana--No change is recommended at this time.

b. Idaho--Should be listed as state threatened.

2. Other nations--Not pertinent.

3. International--Not pertinent.

14. Recommended critical habitat

- A. Concise statement--Although I feel that all individuals of Astragalus scaphoides should be protected, at this time there are only three known sites which constitute viable, long-term populations. These are: Bon Accord Site - all of the gently sloping sagebrush-grassland which currently supports individuals of A. scaphoides as well as adjacent appropriate habitat. A buffer zone should include land north of Grasshopper Creek and south of steep slopes. East and west boundaries must be determined by inspection. Sheep Corral Gulch Site - all of the gently sloping sagebrush-grassland on the south, east, and west sides of the large unnamed butte north of Sheep Corral Gulch down to Sheep Corral Gulch. Agency Creek Site - all of the gently sloping sagebrush-grassland on the north side of Agency Creek from the creek north ca 1/4 mile and between Eckersell Draw in section 18 and the largest tributary of Agency Creek in section 19. The above boundaries are preliminary and may need to be revised based on future research. More detailed information can be obtained from The Nature Conservancy--Big Sky Field Office.
- B. Legal description of boundaries--Not developed.
- C. Latitude and longitude--Not developed.
- D. Publicity-sensitivity of critical habitat area--It is a very small possibility that parties now leasing grazing rights the areas of critical habitat may try to vandalize populations of A. scaphoides.

15. Conservation/Recovery recommendations

- A. General conservation recommendations
1. Recommendations regarding present or future activities--see section 12-3.

2. Areas recommended for protection--all areas of critical habitat; see 14-A.
 3. Habitat management recommendations--See sections 12-B and 15-B.
 4. Public sensitivity--See Section 14-D.
- B. Monitoring activities and further studies recommended--Studies should be initiated to determine the identity and ecology of the insect(s) responsible for the destruction of the inflorescences of Astragalus scaphoides. The degree to which grazing by livestock and wildlife are responsible for inflorescence removal should also be determined. Population monitoring studies should be initiated to determine if current reproductive output is sufficient to maintain population levels. Continue searching for large viable populations of A. scaphoides, particularly in the following areas: southeast of Bannack, MT, southeast of Tendoy, ID, and the area around Shoup, ID. Pollination ecology should be examined to determine dependence, if any, on specific species of insects.

16. Interested parties:

Attn: John Spinks
Office of Endangered Species
U.S. Fish and Wildlife Service
Washington, D.C. 20240

Mr. Rupert Barneby
The New York Botanical Garden
Bronx, New York 10458

Attn: Jim Miller
Office of Endangered Species
U.S. Fish and Wildlife Service
P.O. Box 25437
Denver, CO 8225

Steve Caicco
Idaho Natural Heritage Prgm.
Idaho Dept. Fish & Game
4696 Overland Road, Suite 518
Boise, ID 83705

John Crawford
Chief, Wildlife Division
Div. of Wildlife & Endg. Species
Bureau of Land Management
1725 I NW St. - Rm. 903
Washington, D.C. 20240

Dr. Douglas Henderson
Herbarium
Dept. of Biological Sciences
University of Idaho
Moscow, ID 83843

Robert Jenkins
Science & Heritage Dept.
The Nature Conservancy
1800 North Kent St.
Arlington, VA 22209

Dr. Roger Rosentreter
Bureau of Land Management
Idaho State Office
P.O. Box 2237
Boise, ID 83701

Bob Lund, Wildlife Division
Bureau of Land Management
Montana State Office
222 N. 32nd Street
Billings, MT 59107

Cindi McAllister
The Nature Conservancy
Big Sky Field Office
P.O. Box 258
Helena, MT 59624

Dr. Kathleen M. Peterson
Department of Botany
Missoula, MT 59312
University of Montana

Dr. John H. Rumely
Department of Biology
Bozeman, MT 59717
Montana State University

J. Scott Peterson
Rocky Mtn. Natural Heritage Program
1370 Pennsylvania St., Suite 190
Denver, CO 80203

III. Information Sources

17. Sources of Information

- A. Publications--see Literature Cited
- B. Museum collections consulted--Label data from specimens at the New York Botanical Garden (NY) was sent to the author by R. C. Barneby. Recent collections by the author are housed at the University of Montana (MONTU), the New York Botanical Garden (NY), and the University of Idaho (ID).
- C. Fieldwork--Populations were searched for and located July 9-10, 1983, June 8, 11-12, and July 11, 1984. Population studies were carried out July 10-11, 1984 (see Lesica in review).
- D. Knowledgeable individuals--

Mr. Rupert Barneby
The New York Botanical Garden
Bronx, NY 10458

Dr. Douglas Henderson
Department of Biological
Sciences
University of Idaho
Moscow, ID 83843

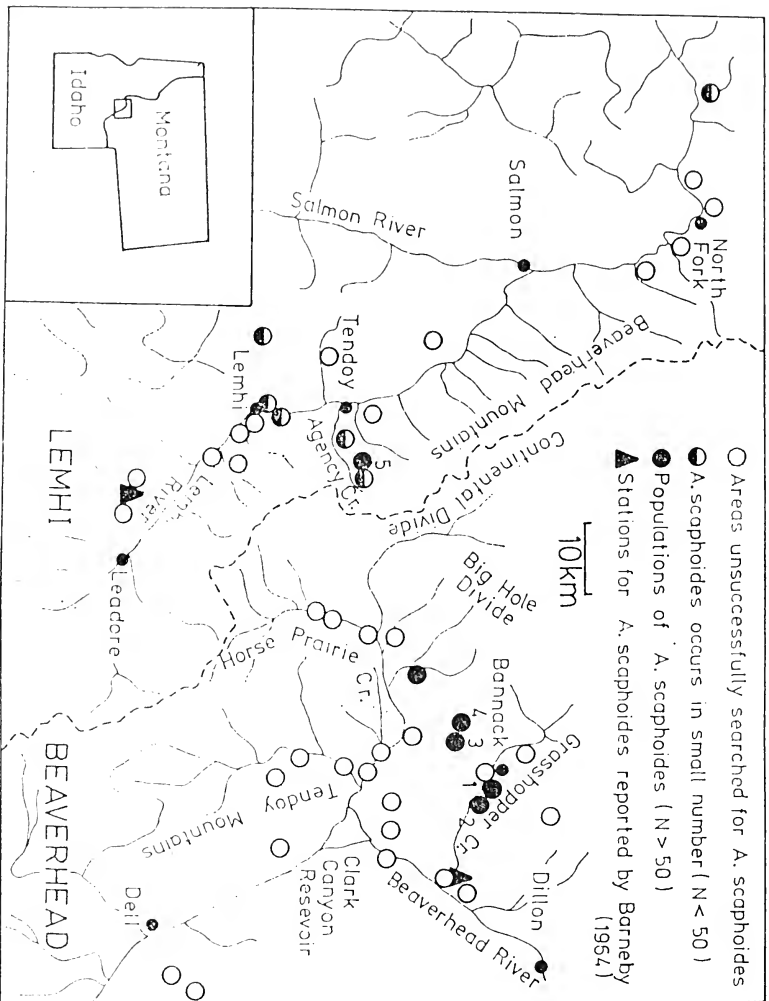
E. Other information sources--A collection of color slides of A. scaphoides and many of the population sites as well as detailed information on these sites is on file at the Big Sky Field Office of The Nature Conservancy, P.O. Box 258, Helena, MT 59624.

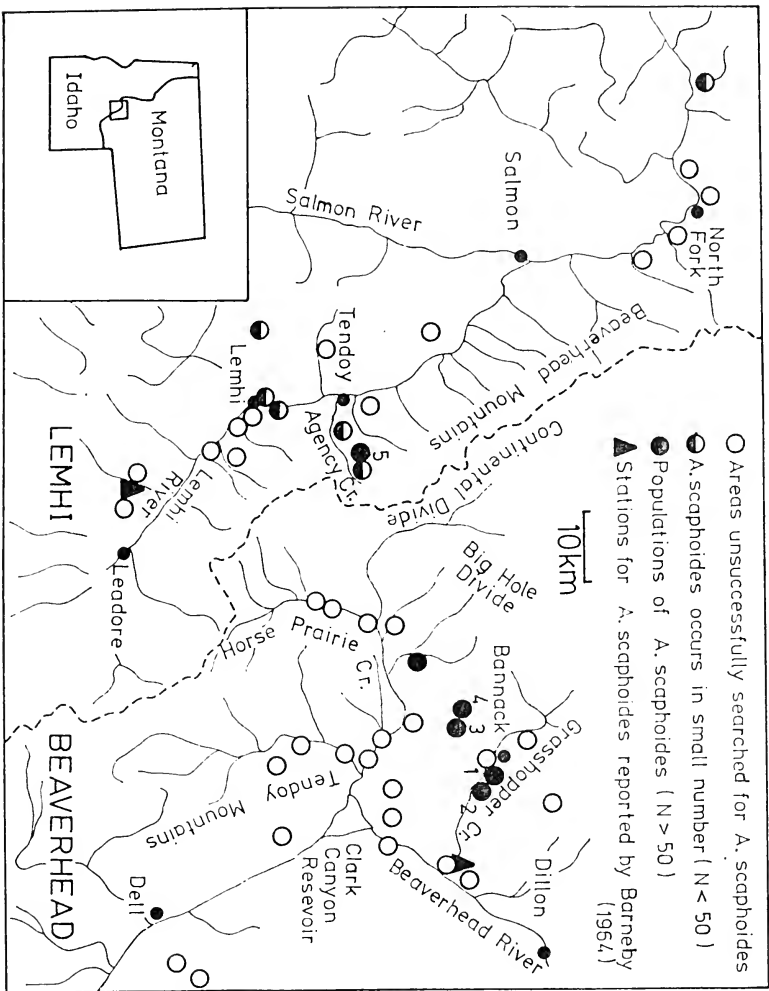
IV. Authorship

19. Initial Authorship--Peter Lesica.

LITERATURE CITED

- Barneby, R. C. 1964. Atlas of the North American Astragalus Parts 1 and 2
Mem. N. Y. Bot. Gard. 13:1-1188.
- Hitchcock, C. L., A. Cronquist, M. Owenby, and J. W. Thompson. 1961. Vascular
Plants of the Pacific Northwest Part 3. University of Washington Press,
Seattle.
- Hunt, C. B. 1967. Physiography of the United States. Freeman, San Francisco.
- Lesica, P. 1985. The distribution and reproduction effort of the rare plant
Astragalus scaphoides in Montana and Idaho. Submitted to Northwest Science.
- Kuchler, A. W. 1964. The potential natural vegetation of the conterminous
United States. Am. Geog. Soc. Spec. Publ. 36:122-147.
- Steele, R., S. J. Brunsfeld, D. M. Henderson, K. E. Holte, F. D. Johnson, and
P. L. Packard. 1981. Vascular Plants of Concern in Idaho. University of
Idaho Forest, Wildlife and Range Experiment Station Bulletin No. 34.





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