

ARIZONA GAME AND FISH DEPARTMENT  
HERITAGE DATA MANAGEMENT SYSTEM

Plant Abstract

Element Code: PDFAB0F3M2

Data Sensitivity: No

**CLASSIFICATION, NOMENCLATURE, DESCRIPTION, RANGE**

**NAME:** *Astragalus geyeri* var. *triquetrus* (Gray) Jones

**COMMON NAME:** Beaver Dam milk-vetch, Sand milk-vetch, Threecorner milkvetch, Geyer's milkvetch; Geyer milkvetch

**SYNONYMS:** *Astragalus triquetrus* Gray; *Phaca triquetra* (Gray) Rydberg

**FAMILY:** Fabaceae

**AUTHOR, PLACE OF PUBLICATION:** *Astragalus triquetrus* A. Gray, Proc. Amer. Acad. Arts and Sci. 13: 367. 1878. *Astragalus geyeri* var. *triquetrus* (A. Gray) M.E. Jones, Contributions to Western Botany 8: 7. 1898.

**TYPE LOCALITY:** United States of America, southeastern borders of Nevada: [at the confluences of] Muddy River [with the Virgin], St. Thomas.

**TYPE SPECIMEN:** HT: GH-58996. E. Palmer, 1877.

**TAXONOMIC UNIQUENESS:** *Astragalus* is a species-rich genus, with more than 2500 species currently known worldwide. *Astragalus geyeri* is one of over 350 species in the genus *Astragalus* in North America, and has two varieties. *A. geyeri* var. *triquetrus* is one of the few annuals in the genus.

**DESCRIPTION:** Slender, spreading, fast maturing annual herb, with flexuous stems 10-20 cm (4-8 in) long. Leaves and stems covered by a fine ashy pubescence; leaves 3-5 cm (1.2-2 in) long, bearing about 9 elliptical, retuse leaflets 4-15 mm long. Racemes loosely 2-8 flowered; calyx 2-4 mm long, white or partly fuscous-strigulose, tube 1.5-2.5 mm long. Petals of flower are whitish with faint pink veining, which dries violet. Banner moderately recurved, 5-7.5 mm long; keel 3.8-5 mm long. Ovary is strigulose; ovules number 7-11. Pods are oblong, curved, and triangular in cross section with a prominent groove on the lower side, 1 cm long.

**AIDS TO IDENTIFICATION:** Per Barneby (1990, *in* Knight 1990) "*Astragalus geyeri* var. *triquetrus* ... coincides with the range of the annual *A. sabulorum*, however, *A. sabulorum* differs in a less oblique, thick-textured, villosulous pod and loosely hairy foliage. From typical *A. geyeri*, this variety differs in its pod which is definitely triangular and leaflets which are broadly oblanceolate. Additionally, typical *A. geyeri* of the central Great Basin frequently has populations with pinkish-lilac or bright purple flowers."

**ILLUSTRATIONS:**

Line drawing (Kurzius, *in* Niles et al. 1995: fig. 2)

Line drawing of species (Cronquist et al., 1989: p. 157)

Photos of plant and habitat: [http://heritage.nv.gov/taxon\\_detail/16691](http://heritage.nv.gov/taxon_detail/16691)

Photos of plant and habitat: Basin and Range Watch (BRW) and Western Watersheds Project (WWP). 2019

**TOTAL RANGE:** Southeast Nevada (Clark and Lincoln Counties), and Northwest Arizona (Mohave County). Most occurrences are found in Clark County, and the Sand Hollow Wash population in Lincoln County, Nevada and Arizona is the northeastern most extent of the known range.

**RANGE WITHIN ARIZONA:** Sand Hollow Wash and Beaver Dam Wash, Mohave County. The Beaver Dam Wash site is known only from a single collection made in 1940. The “NW Mohave County Coon Creek” locality mentioned in the 2019 Petition to List (BRW and WWP 2019) is really the Sand Hollow Wash occurrence.

### **SPECIES BIOLOGY AND POPULATION TRENDS**

**GROWTH FORM:** Annual forb.

**PHENOLOGY:** Flowers in April and May, although it does not bloom every year. Fruit sets in 4 to 6 weeks.

**BIOLOGY:** This species is an ephemeral winter annual that is *not seen for years at a time*. It requires sufficient winter rainfall to germinate, which is about 15 to 25 mm in the northern Mojave Desert (TNC 2007). It typically takes five to eight months from seed germination to seed dissemination and plant death. Life span is dictated primarily by moisture and temperature. Wetter and cooler springs provide the ideal conditions for greater reproductive output, which replenishes the seed bank. Seed bank longevity is unknown (TNC 2007).

It is not known whether the small white flowers are apomictic (producing seed from generative tissues without fertilization) or if pollinators are required to produce viable seed. The inflated pods are well suited for wind dispersal (TNC 2007).

The fact that seeds may not germinate for several years if winter rains are not adequate is a major risk factor for this species. Habitat may be lost if extant populations go undetected because the plants are not observed.

**HABITAT:** Threecorner milkvetch locations are closely associated with the Muddy Creek Formation, a Tertiary aged sedimentary rock widely exposed along Lake Mead’s portion of the Colorado River and its tributary valleys. It is found on both deep sand and unconsolidated dunes weathered from this formation and deposited as aeolian or fluvial sand. Threecorner milkvetch

occurs on deep sand habitat including areas of stabilized sand that have a cemented or hardened surface, or a cryptogamic crust, and frequently with sparse gravel on the surface. It also occurs at edges of dunes and in depressions or sand blow-outs. Additional habitat types include sand-clay with scattered gravel, disturbed sandy beaches, and rolling calcareous hills. The most common associated plant community is creosote bush scrub dominated by *Larrea tridentata* and *Ambrosia dumosa* (TNC 2007).

**ELEVATION:** 1200 - 2450 feet (366 – 747 m.) per TNC 2007. Collections in Arizona range from 1930 – 2,395 feet (588 – 730 m.) per Heritage Data Management System unpublished records (AGFD, accessed 2019).

**EXPOSURE:** Typically occur on very slight slopes less than two degrees, but they can be found uncommonly on slopes as great as 21 degrees. Occurs on all exposures with west and southwest exposures the most common, and east and northeast the least common (TNC 2007).

**SUBSTRATE:** More than half of threecorner milkvetch occurrences are mapped on Quaternary alluvial deposits, while much of the remaining occurrences fall on Triassic aged tuffaceous sedimentary rocks. Soil associations most commonly mapped with threecorner milkvetch are fine sands, including Bard gravelly fine sand and fine sandy loam, Arada fine sand and fine sand gravelly substratum, and Mormon Mesa loamy fine sand and fine sandy loam. Sands can be delivered to its habitat by either fluvial or aeolian processes (TNC 2007).

**PLANT COMMUNITY:** Mojave Desert scrub. Creosote bush scrub series dominated by *Larrea tridentata* and *Ambrosia dumosa*. This species is commonly associated with *Allonia incarnata* (windmills), *Camissonia brevipes* ssp. *brevipes* (golden suncup), *Hymenoclea salsola* (white burrow-bush), and *Oryzopsis* (= *Achnatherum*) *hymenoides* (Indian Mountain-ricegrass). Other associated species include: *Amphipappus fremontii* (Fremont's chaffbush), *Astragalus nyensis* (Nye milk-vetch), *A. nuttallianus* var. *imperfectus* (turkey peas), *A. sabulonum* (gravel milkvetch), *Acacia greggii* (catclaw acacia), *Bromus rubens* (red brome), *Chilopsis linearis* (desert-willow), *Eriogonum viscidulum* (sticky buckwheat), *Krameria parvifolia* (= *K. erecta*, littleleaf ratany), *Muhlenbergia porteri* (Porter's muhly), *Opuntia echinocarpa* (straw-top cholla), *Prosopis juliflora* (mesquite), *Psilostrophe cooperi* (white-stem paper-flower), and *Yucca brevifolia* (Joshua tree). Additional species noted in TNC 2007 include *Ephedra torreyana*, *Tiquilia canescens*, *Opuntia basilaris*, *Psoralea fremontii*, *Chamaesyce polycarpa*, *Plantago ovata*, *Palafoxia arida*, *Chorizanthe brevicornu*, *Eriogonum inflatum*, and *Oenothera deltoids*.

**POPULATION HISTORY AND TRENDS:** Trends are essentially unknown for both populations and habitat (TNC 2007). Not only is *A. geyeri* var. *triquetrus* usually found in very small numbers, but the ephemeral habit of this annual to sometimes go for several years without a major germination event makes population monitoring very difficult. Surveys to determine the overall range of this species and more localized inventories have tended to be opportunistic, rather than systematic, because of the ephemeral nature of the plant.

In 2001, a total population of 4,094 individuals at 39 sites was known from Nevada (NNHP 2001). When accessed in 2019, the NNHP fact sheet listed 41 occurrences. More importantly, the total area occupied was given as one hectare. There are two known occurrences in Arizona, but one (Beaver Dam Wash) has not been documented since 1940. At the other, Sand Hollow Wash, about 250 plants were observed in 1995, and 75 counted in 2004 (NatureServe 2018).

The Nature Conservancy (TNC 2007) combined the known occurrences in Nevada into 17 “population groups.” The distribution centers on the confluence of the Muddy and Virgin Rivers (the type locality, now inundated). Populations along Lake Mead’s shoreline on sand dunes and in sandy soils along the banks of the Muddy and Virgin rivers suggest better connectivity of habitat between them at earlier times when the Colorado River flowed freely and episodic floods delivered large amounts of sand to reaches of the rivers. In addition to the regime change from the now “tamed” Colorado River, documented loss of habitat and extirpation of populations occurred at Bark Bay, The Meadows, and Ebony Cove from inundation of habitat by Lake Mead reservoir.

The largest known population of threecorner milkvetch is at Sandy Cove, Lake Mead NRA, where 8,000 plants were estimated in 2005. This population has been monitored annually since 1995, and the highly variable results highlight the difficulty of determining populations for an annual species whose appearance is highly correlated with winter precipitation. Population counts were less than 140 plants during four of the years inventoried, exceeded 1,500 and almost 3,000 in other years, and then 8,000 in 2005, after only 135 in 2003 (TNC 2007). The National Park Service has launched a new research project using a new methodology to monitor several species (including the threecorner milkvetch) at Lake Mead NRA, so better information may be available in the future (NPS 2010).

Viability rankings for the various population groups as determined by TNS (2007) were all judged to be “fair.”

Threecorner milkvetch is listed by the State of Nevada as Critically Endangered/Fully Protected, by the BLM as Sensitive, by the Nevada Natural Heritage Project as At-Risk, and by the Nevada Native Plant Society (NNPS) as Threatened (TNC 2007). NatureServe (2018) considers the plant to be imperiled in Nevada, and critically imperiled in Arizona.

## **SPECIES PROTECTION AND CONSERVATION**

### **ENDANGERED SPECIES ACT STATUS:**

None (USDI, FWS 1996)

[C2 *A. geyeri* var. *triquetrus* USDI, FWS 1990, 1993]

[C2 USDI, FWS 1983, 1985]

[C1 USDI, FWS 1980]

[PTN-T *A. geyeri* var. *triquetrus* USDI, FWS 1975]

**STATE STATUS:**

State of Nevada – Critically Endangered, Fully Protected

**OTHER STATUS:**

Bureau of Land Management Sensitive (USDI, BLM AZ 2005, 2008, 2010, 2017)

**MANAGEMENT FACTORS:** Threecorner milkvetch populations and habitats have a high number of identified threats. In order, they include urban development and sprawl, casual vehicle use and trail development, energy development, surface water development, invasive plant species, utility corridor construction and maintenance, agriculture practices, inundation and shoreline fluctuation, Federal land disposal, commercial development, livestock grazing management, sand and gravel mining, wild horse and burro management, legal recreation use, and legal off-highway use (TNC 2007).

These threats have reduced size and extent of populations and habitats by both direct mortality of individuals and loss or fragmentation of habitats. They have altered composition of its plant communities by reducing native plants and introducing invasive exotic plants, which can alter the wildfire and/or soil moisture regimes. They have altered the condition of substrates through soil erosion, stabilization (more density/cover by invasive species), or destruction of soil crusts. These threats have also resulted in the interruption of sand deposition by wind and loss of sand deposition by fluvial processes (TNC 2007).

Considerable effort has been made in recent years to fight the aggressive Sahara mustard (*Brassica tournefortii*) infestation. Lake Mead is a major vector for weed dispersal to shoreline habitats. Two other exotic weedy species, Mediterranean grass and Russian thistle (*Schismus barbata* and *Salsola iberica*) were identified in the area in 1997. Exotic species of annual grasses are a major factor in stabilizing sand sheets and dune habitats throughout the range of threecorner milkvetch (TNC 2007).

The larger populations (Mud Lake, Muddy River, and Logandale) and some other smaller populations that are managed on multiple-use public lands have high and very high threat concerns related to rural sprawl, casual OHV use, exotic species invasions, utility corridor development and maintenance, and potential energy development. Populations at Lake Mead NRA have many fewer and more moderate current threats (burros, trespass grazing, shoreline exotic species, sand and gravel mining, and recreation). Overall, the threats to all populations except at Sand Hollow Wash are considered to be very high. The Sand Hollow Wash population threats are considered to be more moderate, primarily from increased fire frequency and intensity, utility corridor construction and maintenance, and livestock grazing.

**PROTECTIVE MEASURES TAKEN:** Nominally, there are several mechanisms in place that should offer protection to *Astragalus geyeri* var. *triquetrus*, especially in Nevada. The state has declared the plant “critically endangered/ fully protected.” The BLM has designated the threecorner milkvetch as a Sensitive species (BLM 2005-2017). Several major populations lie within the USNPS Lake Mead National Recreation Area. Four population groups overlap with designated ACECs on BLM lands (Mormon Mesa, Mud Wash, Toquop Wash, and Weiser Wash) and two overlap with Wilderness Areas at Lake Mead NRA (Ebony Cove and Sandy Cove). The threecorner milkvetch is also a covered species under the Clark County Multi-Species Habitat Conservation Plan (TNC 2007). Lime Cove, Bark Bay, and Middle Point (Ebony Cove) were recommended for establishment of special botanical areas because of their population and habitat significance by Knight (1992, in TNC 2007), but this designation never happened.

However, it appears as though these present mechanisms to conserve this taxon and its habitat are not effective. Although threecorner milkvetch is listed as critically endangered under Nevada State law, there are concerns that the effectiveness of the State’s permit process yields inadequate protection and mitigation. Threecorner milkvetch is a covered species under the Clark County Multiple Species Habitat Conservation Plan, but large-scale solar projects that would devastate populations of this species are planned in the county despite this Conservation Plan. Trespass cattle from the Bundy Ranch are trampling plants despite closure of BLM allotments to conserve sensitive species (BRW & WWP 2019).

These apparent management failures were cited as one of the primary reasons to petition the US Department of the Interior and the Fish and Wildlife Service for an emergency listing of *Astragalus geyeri* var. *triquetrus* as endangered under the Endangered Species Act (ESA).

**SUGGESTED PROJECTS:** *Astragalus geyeri* var. *triquetrus* is not a well understood plant. TNC (2007) provides a lengthy list of research and management needs. Among the priorities are additional species range distribution information, more detailed soil and vegetation maps for predictive distribution mapping (this may be especially important because this ephemeral annual species can be easily overlooked if not present during a year with insufficient rainfall), population genetics, reproductive biology, pollination ecology (if relevant), seed bank research, effectiveness and status of monitoring techniques, a comprehensive conservation report, effects of fire and invasive species interactions, effective restoration techniques, and others.

The Beaver Dam locality in Arizona has not been documented since the original 1940 collection. This area should be re-surveyed during a year with sufficient winter rainfall to determine if this population is still extant.

**LAND MANAGEMENT/OWNERSHIP:** In Arizona: BLM - Arizona Strip Field Office; NPS – Lake Mead National Recreation Area. For its range in both Nevada and Arizona: Bureau of Land Management (BLM), Bureau of Reclamation, National Park Service, State of Nevada, and private land holdings.

## SOURCES OF FURTHER INFORMATION

### REFERENCES:

- Bangle, Dianne. 2009. Report on *Astragalus geyeri* var. *triquetrus* (threecorner milkvetch) and *Eriogonum viscidulum* (sticky buckwheat) within Lake Mead National Recreation Area. Lower Colorado River Multi-species Conservation Program. US National Park Service. Basin and Range Watch (BRW) and Western Watersheds Project (WWP). 2019. Petition to list the Threecorner Milkvetch (*Astragalus geyeri* var. *triquetrus*) as Endangered under the Endangered Species Act. Notice of Petition, April 25, 2019.
- Cronquist, A., et al. 1989. Intermountain Flora: Vascular Plants of the Intermountain West, U.S.A. Volume Three, Part B. The New York Botanical Gardens. Bronx, New York. Pp. 155-157.
- Harvard University Herbaria (HUH). 2001. Index of Botanical Specimens. Accessed: 4/14/2004. Integrated Taxonomic Information System (ITIS). Retrieved 7/21/2004 from ITIS, <http://www.itis.usda.gov>.
- Kearney, T.H., and R.H. Peebles with collaborators. 1951. Arizona flora. Second edition with supplement by J.T. Howell, E. McClintock and collaborators. 1960. University of California Press. Berkeley, California. Pp. 463.
- Knight, T. 1990. Status Report: *Astragalus geyeri* A. Gray *triquetrus* (A. Gray) M.E. Jones. University of Nevada, Las Vegas, NV, report prepared for U.S. Fish and Wildlife Service, Great Basin Field Office, Reno, NV. 21pp.
- McDougall, W.B. 1973. Seed Plants of Northern Arizona. The Museum of Northern Arizona. Flagstaff, Arizona. Pp. 252-253.
- Missouri Botanical Garden – TROPICOS, Nomenclatural Data Base. *Astragalus geyeri* var. *triquetrus* (A. Gray) M.E. Jones. <http://www.tropicos.org/Name/13063453>. Accessed: April 30, 2019.
- National Park Service (NPS). 2010. Inventory, Research and Monitoring for Covered Plant Species Project Report, 2008-2010. National Park Service, Lake Mead National Recreation Area. Project Number 2005-NPS-535-P. May 17, 2010.
- NatureServe Explorer: An online encyclopedia of life [web application]. 2001. Version 1.6. Arlington, Virginia, USA: NatureServe. Available: <http://www.natureserve.org/explorer>. (Accessed: July 31, 2002).
- NatureServe. 2004. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.0. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: July 21, 2004).
- NatureServe. 2018. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available <http://explorer.natureserve.org>. (Accessed: May 1, 2019).
- Nevada Natural Heritage Program (NNHP). Accessed 2019. Rare Plant Fact Sheet: *Astragalus geyeri* A. Gray var. *triquetrus* (A. Gray) M.E. Jones.

- Niles, W.E., et al. 1995. Occurrence and distribution of *Astragalus geyeri* var. *triquetrus* (Three-cornered milk-vetch) and *Eriogonum viscidulum* (Sticky Buckwheat) in Lake Mead National Recreation Area and adjacent regions of Nevada and Arizona. The University of Nevada, Las Vegas, NV, prepared for U.S. National Park Service, Boulder City, NV. 20pp.
- The Nature Conservancy. 2007. A Conservation Management Strategy for Nine Low Elevation Rare Plants in Clark County, Nevada. The Nature Conservancy Nevada Field Office, Reno, NV. Final Report. 17 April 2007.  
[http://www.clarkcountynv.gov/airquality/dcp/Documents/Library/dcp%20reports/2007/LERPlantsCMS\\_Final\\_32007\\_updated1.pdf](http://www.clarkcountynv.gov/airquality/dcp/Documents/Library/dcp%20reports/2007/LERPlantsCMS_Final_32007_updated1.pdf).
- USDA, NRCS. 2004. The PLANTS Database, Version 3.5 (<http://plants.usda.gov>). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.
- USDI, Bureau of Land Management. 2005. Arizona BLM Sensitive Species List.
- USDI, Bureau of Land Management. 2008. Arizona BLM Sensitive Species List.
- USDI, Bureau of Land Management. 2010. Arizona BLM Sensitive Species List.
- USDI, Bureau of Land Management. 2017. Arizona BLM Sensitive Species List.
- USDI, Fish and Wildlife Service. 1975. Threatened or Endangered Fauna or Flora; Review of Status of Vascular Plants and Determination of "Critical Habitat". Federal Register 40(127): 27830.
- USDI, Fish and Wildlife Service. 1980. Endangered and Threatened Wildlife and Plants: Review of Plant Taxa for Listing as Endangered or Threatened Species; Notice of Review. Federal Register 45(242): 82490.
- USDI, Fish and Wildlife Service. 1983. Endangered and Threatened Wildlife and Plants; Supplement to Review of Plant Taxa for Listing; Proposed Rule. Federal Register 48(229): 53645.
- USDI, Fish and Wildlife Service. 1990. Endangered and Threatened Wildlife and Plants; Review of Plant Taxa for Listing as Endangered or Threatened Species; Notice of Review. Federal Register 55(35): 6190-6191.
- USDI, Fish and Wildlife Service. 1993. Endangered and Threatened Wildlife and Plants; Review of Plant Taxa for Listing as Endangered or Threatened Species; Notice of Review. Federal Register 58(188): 51151.
- USDI, Fish and Wildlife Service. 1996. Endangered and Threatened Wildlife and Plants; Review of Plant and Animal Taxa that are Candidates for Listing as Endangered or Threatened Species; Notice of Review; Proposed Rule. Federal Register 61(40): 7596-7613.

**MAJOR KNOWLEDGEABLE INDIVIDUALS:**

**ADDITIONAL INFORMATION:** The varietal name "*triquetrus*" refers to the three-sided inflated seedpods of the variety.

**Revised:** 2002-08-01 (SMS)  
2004-08-20 (SMS)  
2019-05-03 (BDT)

To the user of this abstract: you may use the entire abstract or any part of it. We do request, however, that if you make use of this abstract in plans, reports, publications, etc. that you credit the Arizona Game and Fish Department. Please use the following citation:

Arizona Game and Fish Department. 20XX (= **year of last revision as indicated at end of abstract**). X...X (= **taxon of animal or plant**). Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. X pp.