

GEOCARPON MINIMUM (CARYOPHYLLACEAE), NEW TO OKLAHOMA, U.S.A.

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ABSTRACT

The federally threatened species *Geocarpon minimum* is documented for the flora of Oklahoma for the first time. Approximately 500 individuals were found at four sandstone glade sites near Skiatook Lake in Osage County, Oklahoma. This manuscript describes *G. minimum* habitat and distribution in Oklahoma and throughout the rest of its range.

RESUMEN

Geocarpon minimum, una especie de la lista federal de plantas amenazadas de extinción se documenta para la flora de Oklahoma por primera vez. Se encontraron aproximadamente 500 individuos en cuatro sitios claros de arenisca cerca de Skiatook Lake en el condado de Osage, Oklahoma. Este manuscrito describe el hábitat y la distribución de *G. minimum* en Oklahoma y en el resto de su área de distribución.

Federal protection for *Geocarpon minimum* (earth fruit, tiny Tim) began in 1987 when it was determined to be a threatened species based on its limited distribution, the destruction of its habitat, succession, and forestry activities (U.S. Fish and Wildlife Service 1987). At that time, the species was only known from 13 populations in Missouri and four populations in Arkansas. Since the initial listing, populations have been found in Louisiana in 1990 (McInnis et al. 1993) and in Texas in 2004 (Keith et al. 2004). Forty populations with an estimate of 48,000 individuals are currently known (Baker 2016). Twenty of these sites are protected, and seventeen of these are considered viable (Baker 2016). *Geocarpon minimum* has a Global Conservation Status Rank of G2 or imperiled and is “at high risk of extinction or collapse due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors” (NatureServe 2023). Arkansas, Missouri, and Louisiana have all assigned the species a Subnational rank of S2, while it is considered an S1—critically imperiled or “at very high risk of extirpation in the jurisdiction due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors”—in Texas (NatureServe 2023). The state of Texas lists *G. minimum* as threatened at the state level, while Missouri considers it endangered (Missouri Department of Conservation 2023; Texas Parks and Wildlife 2023).

In Arkansas and Louisiana, all populations of *Geocarpon minimum* are found in undisturbed, sparsely vegetated saline soil barrens on so-called “slick spots” ranging from about 1–30 m² in size (Rettig 1983; Orzell & Bridges 1987; McInnis et al. 1993; Keith et al. 2004; Baker 2016). However, in Missouri and Texas, *G. minimum* is found in shallow depressions in Upper Mississippian-age sandstone outcrops or glades (Palmer & Steyermark 1950; Steyermark et al. 1959; Singhurst, personal communication, Apr 4, 2019). The soil is thin, with pebbles, and the areas fluctuate between very wet and very dry (Palmer & Steyermark 1950; Steyermark et al. 1959; Smith & Ely 2006). These microhabitats are sparsely vegetated, but sometimes include dense mats of mosses (Smith & Ely 2006). According to Smith and Ely (2006), some of these areas are maintained by flowing water, which deposits soil into the depression or removes it, preventing deeper accumulations. In Missouri, *G. minimum* is only found on sandstone outcrops or glades, while Texas populations are found on both slicks and sandstone glades (Keith et al. 2004; Singhurst, pers. comm., 11 Apr 2019).

In March of 2023, *Geocarpon minimum* was discovered by the second author at two sandstone glade sites at Skiatook Lake in Osage County, Oklahoma (Figs. 1, 2). The first author was able to confirm the finding in April, when two additional sites were found. These glade sites range from approximately 270 m² to over



FIG. 1. *Geocarpon minimum* at Skiatook Lake in Osage County, Oklahoma. 26 Mar 2023. Photo by Lisa Miller.



FIG. 2. *Geocarpon minimum* habitat at Skiatook Lake in Osage County, Oklahoma. 26 Mar 2023. Photo by Lisa Miller.



Fig. 3. *Geocarpon minimum* habitat that can be under water depending on lake levels. 25 May 2023. Photo by Lisa Miller.

3,800 m² in size. The soil types in these areas are mapped as Niotaze-Bigheart-Rock outcrop complex, Bartlesville-Bigheart complex, and Bigheart-Niotaze-Rock outcrop complex (Soil Survey Staff 2023). Soil pH at the sites ranges between 6.5 and 7, and *G. minimum* was found growing in soil depths of 10 to 55 mm. Associated species included *Allium canadense*, *Arenaria serpyllifolia*, *Cardamine hirsuta*, *Cerastium glomeratum*, *C. pumilum*, *Chaerophyllum tainturieri*, *Claytonia virginica*, *Draba brachycarpa*, *Hedeoma hispida*, *Houstonia pusilla*, *Micranthes texana*, *Nostoc* sp., *Phemeranthus parviflorus*, *Plantago elongata*, *P. virginica*, *Rumex hastatulus*, *Sedum nuttallii*, *Selenia aurea*, *Veronica arvensis*, *Vicia minutiflora*, *Viola bicolor*, lichens, and mosses. Steyermark et al. (1959) postulated that *Micranthes texana* and *Selenia aurea* had a possible indicator significance for *G. minimum*, and the authors noted a similar association at the Oklahoma sites. Vegetation types associated with the sites include Crosstimbers sandyland post oak/blackjack oak forest and woodland and Crosstimbers pasture and prairie (Diamond & Elliott 2015). One site is a lake shoreline and it can be under water depending on lake levels (Fig. 3). Dominant woody species adjacent to the glade sites included *Carya cordiformis*, *Fraxinus americana*, *Quercus marilandica*, *Q. stellata*, *Parthenocissus quinquefolia*, *Rhus copallinum*, and *Symphoricarpos orbiculatus*. Adjacent associated herbaceous species include *Ambrosia artemisifolia*, *Asclepias viridis*, *Castilleja indivisa*, *Dichanthelium linearifolium*, *D. polyanthes*, *Erigeron strigosus*, *Nothoscordum bivalve*, *Oxalis violacea*, *Schizachyrium scoparium*, *Solidago ulmifolia*, *Symphyotrichum patens*, and *Triodanis perfoliata*.

Geocarpon minimum has been assigned a Conservation Status Rank of S1 in Oklahoma (ONHI 2015). In addition to the threats outlined in the species' initial listing, *G. minimum* populations may be impacted by hydrology changes, alteration of natural fire regimes, overgrazing, encroachment of invasive exotic species, and feral hogs (Baker 2016; Edwards et al. 2017; NatureServe 2023). No herbarium voucher was taken due to the plant's Threatened status. However, iNaturalist observations and photos were obtained by the authors and positively identified by other experts (amybutthod 2023, llm3629 2023).

Voucher Observation: U.S.A. Oklahoma. Osage Co.: Twin Points Recreation Area, 0.5 mi NE of the jct. of HWY 20 and Twin Points Road, sandstone glade, 26 Mar 2023, L. Miller (<https://www.inaturalist.org/observations/153800576>)

TAXONOMIC DESCRIPTION

Slightly succulent, hairless winter annual, purplish to gray-green in color. **Stems** erect, can be single or branched at the base, and are 1–4 cm in length. **Leaves** opposite, entire, sessile, connate, linear-elliptic to ovate in shape and 3–4 mm in length. **Flowers** sessile and usually axillary; sepals 5, funnelform-campanulate in shape, 3–4 mm; petals absent; stigmas and staminodes 5; ovary superior, around 3 mm in length. **Fruit** an ovoid capsule with minute seeds (Mackenzie 1914; Steyermark et al. 1959; Steyermark 1963; Keith et al. 2004).

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