



Status: Endangered.

Global and state rank: G4/S1

Other common names: heartleaf plantain

Family: Plantaginaceae (plantain family)

Taxonomy: Bassett (1967) provides a thorough overview of the taxonomy of the genus *Plantago* in North America.

Range: *P. cordata* extends over a broad geographical range but tends to be known only from rather localized occurrences. In eastern North America it occurs from New York and Ontario through the upper Midwest, ranging south to Florida and west to Iowa, Missouri, and Arkansas. It is tracked as a rare taxon throughout its range with the exception of South Carolina, where it is not currently known to be ranked. This species is considered rare in Alabama, Arkansas, Georgia, Illinois, Indiana, Mississippi, Missouri, New York, North Carolina, Ohio, Ontario, Tennessee, and Wisconsin, and is known only from historical records in the District of Columbia, Florida, Iowa, Kentucky, Maryland, and Virginia (NatureServe 2009).

State distribution: This species has been documented from several southern Lower Michigan counties, but the vast majority of records are now considered to be historical and their status doubtful. It is likely that this species is extirpated in a number of sites owing to owing to habitat fragmentation and other land use changes coupled with the senescence and decline of widely disparate, small populations. After a long period in which this species was considered extinct within the state, with a last observation date of 1925, a vigorous colony was discovered in Hillsdale County by P. Fritsch and W.H. Wagner, Jr. in 1990. Thereafter large populations were subsequently found in Ionia and Tuscola counties and small colonies have been reported as extant in St. Clair County.

Recognition: Heart-leaved plantain is a robust, semi-aquatic perennial arising from **one to several elongated, fleshy roots**. The mature leaves, which are smooth and somewhat fleshy, arise from basal rosettes and are **long-stalked with broadly oval to heart-shaped (cordate) blades that range from ca. 10-30 cm or more in length and have smooth to finely and irregularly toothed margins**. The flowers are borne in **dense terminal spikes on thick stalks that are hollow when mature and may be impressively long, ranging from 10-50 cm or more in height**. Although large mature plants of ***P. cordata*** are distinctive, small



or young individuals might be confused with the native but weedy *P. rugelii* or the non-native but equally ubiquitous and weedy *P. major*. The latter two species can be distinguished by their mature (older) leaf blades, which are broadly tapered to truncate at the base as opposed to cordate, and their leaf venation; in *P. cordata* the principal leaf veins closely follow the midvein before diverging laterally, whereas in *P. rugelii* and *P. major* the principal leaf veins are all parallel and arise and diverge from the base of the leaf.

Best survey time/phenology: *Plantago cordata* has been collected from late April, when plants with incipient flower stalks (and young leaves) have been collected, to early August, when plants with well developed leaves and deteriorating fruiting stalks persist. This species is therefore identifiable over a majority of the growing season, and thus the optimal survey period is considered to be from late April through mid-September, and possibly earlier and later depending on seasonal and local weather patterns.

FQI Coefficient and Wetland Category: 10, OBL

Habitat: Heart-leaved plantain is an obligate wetland species found in forested floodplains and typically in and along small streams and tributaries in low woodlands. The Hillsdale County populations was discovered in a very shallow, sandy-mucky, ephemeral stream, occurring under a canopy of *Acer rubrum* (red maple), *Platanus occidentalis* (Eastern sycamore), *Fraxinus nigra* (black ash), *Quercus alba* (white oak), *Carpinus caroliniana* (musclewood), and *Ulmus rubra* (slippery elm), and associated with such forbs as *Laportea canadensis* (wood nettle), *Impatiens capensis* (jewelweed), *Cardamine bulbosa* (spring cress), *Carex bromoides* (sedge), *Iris virginicus* (southern blue flag), and *Ranunculus hispidus* (swamp buttercup). In Tuscola County, Michigan's largest population of this species was found in a similarly swampy site, growing under *Acer saccharinum* (silver maple), *Fraxinus pennsylvanica* (red ash), *Populus deltoides* (Eastern cottonwood), and *Tilia americana* (basswood). Another large population is known to occur under similar dominants within a floodplain of the Maple River. Elsewhere within the broad range, this species is known in the Chicago region from cool, clear, shaded, gravel-bottom streams, colonizing newly formed gravel bars according to the dynamics of stream bed changes (Swink and Wilhelm 1994). In other areas, such as the

southeastern states, heart-leaved plantain is known as a plant of marshes, small woodland streams and adjacent wet woodlands, and other low wet sites with flowing water (Godfrey and Wooten 1981). In field visits to a number of known sites for *P. cordata* in Michigan, Illinois, Wisconsin, Missouri, and Ohio, Tessene (1969) frequently observed calcareous substrates, including several historical localities for the species consisting of streams flowing over limestone bedrock.

Biology: As a rare species, *P. cordata* has received considerable attention, especially in the thorough systematic and ecological studies conducted by Tessene (1969). Tessene found a high degree of morphological variability in the leaves of heart-leaved plantain corresponding to seasonality, noting that it produces its large, characteristically heart-shaped leaves only the summer, the smallest leaves being those developed for overwintering and with intermediate-sized leaves produced in the spring and fall periods. As evidenced by a number of flowering specimens obtained in April, *P. cordata* is a short-day plant, with flowering occurring as early as mid-April. Sexual reproduction occurs via wind pollination, and although plants are self-compatible, the flowers are protogynous (i.e. the stigmas become receptive prior to the maturation of the stamens) and thus outcrossing does occur, particularly for the first flowers to form at the base of the inflorescence (Tessene 1969). Vegetative reproduction is also known to occur in this species (Stromberg and Stearns 1989, Primack 1979, Tessene 1969). Seed production in natural populations of *P. cordata* was found to be the lowest in comparison to other species of *Plantago*, including both perennial species and annual species (Primack 1979, 1978), and seedling mortality is reported as being high (NatureServe 2009). Genetic diversity in *P. cordata* was concluded by Tessene (1969) to be low, whereas Meagher et al. (1978) came to the opposite conclusion. Subsequent morphological and genetic studies by Mymudes and Les (1993) found little genetic variation within populations (likely reflecting their isolation) but high regional variation between populations, possibly due to the very low reproductive output in this species.

Conservation/management: Watershed protection is the overarching management and stewardship concern for heart-leaved plantain, as this species is unlikely to be maintained without the perpetuation of hydrological regime. The land-use patterns of adjacent upland areas strongly influence the functioning of the riverine



systems and their tributaries that this species depends upon, and thus large-scale conservation planning should be employed to help sustain all known populations. Mymudes and Les (1993) stress in their genetic study that owing to the loss of populations throughout its range this species now has a very high risk of extinction, and may sustain further losses if streams, adjoining marshes and uplands cannot be protected from ongoing cultural disturbance.

Comments: A discussion of the ethnobotany and economic uses of *P. cordata*, long reputed as a medicinal plant, is provided by Tessene (1969).

Research needs: The discovery of four new populations in Michigan over the past two decades indicates that further inventories are warranted for this species given that apparently suitable habitat remains. Monitoring efforts would assist in attaining a better understanding the ecology of *P. cordata* in Michigan while periodically tracking the status of colonies, and natural history and population studies of any kind would provide important information to land managers and stewards.

Related abstracts: Floodplain forest, Blanding's turtle, box turtle, cerulean warbler, red-shouldered hawk, smallmouth salamander, yellow-throated warbler, American beak grass, cup-plant, purple turtlehead, red mulberry, snow trillium, Virginia bluebells, Virginia water-horehound.

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