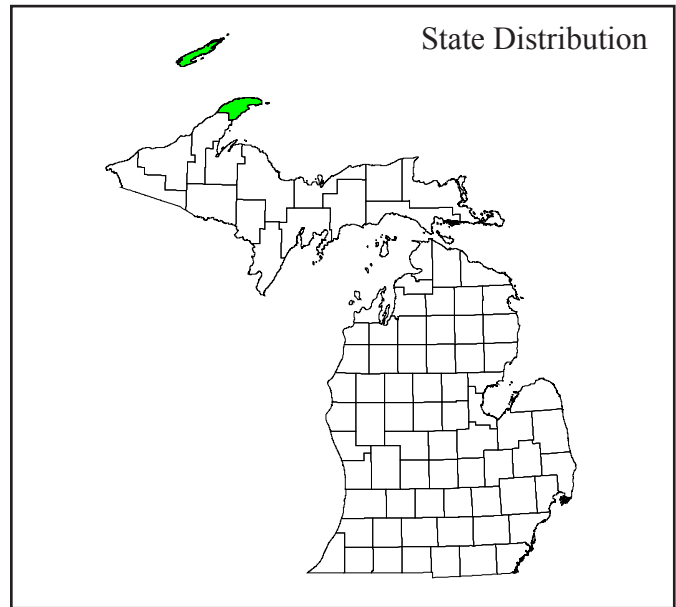
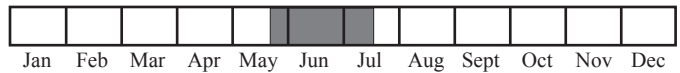




Photo by Ben Legler, University of Washington



Best Survey Period



Status: State endangered

Global and state rank: G5/S1

Other common names: heartleaf arnica, heartleaf leopardbane, arnica

Family: Asteraceae (aster family), also known as the Compositae

Synonyms: *Arnica cordifolia* var. *pumila* (Rydberg) Maguire; *A. paniculata* A. Nelson; *A. whitneyi* Fernald (Flora of North America 2006).

Taxonomy: Keweenaw plants of heart-leaved arnica were recognized as an endemic species, *A. whitneyi*, by Fernald (1935). Maguire, in his 1943 monograph of the genus, treated these plants as a subspecies, *A. cordifolia* subsp. *whitneyi*, on the basis of geographic isolation but a very similar morphology, whereas other authors (Ediger and Barkley, 1978, Wolf 1980a, and recent treatments) simply consider Michigan occurrences to comprise disjunct localities of the wide ranging *A. cordifolia* var. *cordifolia*. Of the several subgenera delineated, *A. cordifolia* is commonly placed in the subgenus *Austromontana* (Ekenas 2008, Wolf and Denford 1984a, Wolf 1980). A related species, *A. gracilis*, is believed to have been derived as a natural

hybrid between *A. cordifolia* and *A. latifolia* (Wolf and Denford 1984b).

Range: Michigan stations for heart-leaved arnica are markedly disjunct from a broad western range that extends primarily from Alaska south to California, Arizona and New Mexico. This species also occurs at disjunct localities in the Black Hills of South Dakota, the Riding Hills of Manitoba (Marquis and Voss, 1981), and in a provincial park on the north shore of Lake Superior. It is considered rare in Manitoba, Ontario, and Saskatchewan, and is known only from historical records in North Dakota (NatureServe 2007).

State distribution: Michigan’s eleven known localities for heart-leaved arnica all fall within an approximately 20 mile long area along the northern coastal region of the Keweenaw Peninsula. No population is more than one mile from the Lake Superior shoreline. Ten occurrences have been discovered or confirmed extant since 1980, whereas one site known, Hebard Park, is known only from an historical record, although suitable habitat has been reported following brief surveys in the early 1980s. *A. cordifolia* is one of the many boreal and western disjunct species – several of which are rare – shared between the Isle Royale archipelago and the Keweenaw Peninsula, although heart-leaved arnica was not known to occur in the Isle Royale complex until discovered there on the main island near the south shore



of Siskiwit Bay in 1997. (See also the comments section below regarding a related species).

Recognition: *Arnica cordifolia* is a perennial understory forb that produces heart shaped, relatively long stalked basal leaves on plants that are usually unbranched and range to ca. 40 cm in height. **There are commonly from 2-4 pairs of cauline (stem) leaves, which are opposite and stalked, the lower pairs with flattened, winged petioles. Both the stem and upper side of the leaves are finely hairy, and the leaves are very coarsely-toothed, the tips of the teeth sharp to somewhat rounded.** The stems terminate in typically 1-5 long-stalked flower heads with **bright yellow rays much longer than the flower head bracts (the phyllaries or collectively the involucre).** Heart-leaved arnica is most likely to be confused with big-leaved aster (*Aster macrophyllus*), with which it commonly



Basal leaves of *Arnica cordifolia*
Photo by Ben Legler, University of Washington

occurs, based on the superficial similarity of its basal leaves. Big-leaved aster, however, is a ubiquitous species that can be easily distinguished by its flowers, which terminate leafy stems in short-stalked clusters and have light blue to purplish rays, and in vegetative condition by its leafy stems with alternate leaves and

sharply serrate (saw-toothed) margins, as well as its markedly larger basal leaves.

Best survey time/phenology: The foliage of this species is very similar to that of the common big-leaved, *Aster macrophyllus*, with which it may commonly occur, but regardless, this species is best sought when in flower, which is approximately from late May to mid-July.

FQI Coefficient and Wetland Category: 9, UPL

Habitat: Michigan colonies of the heart-leaved arnica occur on circumneutral, gravelly clay loam in rocky, second-growth, dry-mesic northern forests composed of such species as *Populus tremuloides* (quaking aspen), *Betula papyrifera* (paper birch), *Abies balsamea* (balsam fir), *Pinus strobus* (Eastern white pine), *Picea glauca* (white spruce), *Acer saccharum* (sugar maple), and *Thuja occidentalis* (white cedar). Shrubs such as *Shepherdia canadensis* (buffaloberry), *Prunus virginiana* (chokecherry), *Lonicera canadensis* (fly honeysuckle), and *Rubus parviflorus* (thimbleberry) are also frequently present, especially in more open or disturbed, successional sites. Common groundcover plants include such typical species as *Aralia nudicaulis* (wild sarsaparilla), *Polygonatum pubescens* (hairy Solomon's-seal), *Maianthemum canadense* (Canada mayflower), *Pteridium aquilinum* (bracken fern), *Oryzopsis asperifolia* (rough-leaved rice grass), *Polygala paucifolia* (gay-wings), *Goodyear* spp. (rattlesnake orchid), and especially big-leaved aster, which is virtually a constant associate. In the main portion of its western range, *Arnica*'s habitat varies from moist, shady woods to drier, more exposed sites, including coniferous forests and subalpine meadows (Flora of North America 2006). It grows best in semi-shaded conditions (Young 1983).

Biology: *A. cordifolia* is an herbaceous perennial and one of the relatively few early blooming composite species, initiating flowering as early as late May, with the majority of plants flowering in June in Michigan. It arises from long, thin rhizomes, with sterile basal rosettes commonly present in colonies. It is also a well known apomictic species, i.e. producing seeds without fertilization (Barker 1966) and reproduces vigorously by rhizomes as well. Kao (2008) and Wolf (1980b) note the widespread occurrence of polyploid complexes throughout the range of the species, with



triploids and tetraploids being the most common, and pentaploids rare. Its fruits are wind dispersed. Western plants are known to exhibit great variability in leaf form, depending on the amount of sunlight received (Young and Smith 1980), although that phenomenon has not been reported to occur in Michigan plants. Young (1983) found in Wyoming that patches growing in open sun produced more and larger seeds as well as more vegetative biomass per plant than those growing in the shade. Although the seeds of sun and shade plants germinated best in conditions of high and low light respectively, maximum overall germination was achieved for seeds of shaded plants. Knapp et al. (1989) and Young and Smith (1983) show that for subalpine understory herbs such as *A. cordifolia* and *A. latifolia*, intermittent shade (such as through the diurnal cloudcover that commonly occurs in mountainous regions) is beneficial to photosynthesis by preventing increases in transpiration rates without reducing carbon gain.

Conservation/management: Several of Michigan's heart-leaved arnica populations lie along trails, and particularly in highway and power line rights-of-way, and are thus vulnerable to some activities associated with maintenance activities, although light clearing along forest edges, such as through the removal of woody vegetation, likely assists in maintaining the successional habitat apparently required by this species. Mowing poses less of a threat to these colonies than grading, plowing, herbiciding, or road widening. One population of *A. cordifolia* occurs on state park property, and one grows within a Michigan Nature Association preserve. Active management may be necessary to maintain the successional character of Arnica's forest habitat.

Comments: *Arnica lonchophylla*, an arctic and boreal species ranging from Alaska to Labrador, with disjunct localities in Wyoming and South Dakota (Flora of North America 2006), was discovered on Isle Royale in 1997 by W.A. MacKinnon, a potential location suggested by Voss (1996) based on occurrences known for northeastern Minnesota and adjacent areas of Ontario.

Research needs: Perhaps the principal need for this species at present is an understanding of the most appropriate management regime necessary for perpetuating colonies, thus experimental restoration management studies are desirable, as well as any aspect

of population structure, diversity, or natural history due to the fact that so little is known about this species in Michigan.

Related abstracts: Dry-mesic northern forest, bald eagle, black-backed woodpecker, merlin, northern goshawk, pinedrops, pale Indian paintbrush, purple clematis.

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Abstract citation:

M.R. Penskar and S.R. Crispin. 2009. Special Plant Abstract for heart-leaved arnica (*Arnica cordifolia*). Michigan Natural Features Inventory. Lansing, MI. 4 pp.

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MSU Extension is an affirmative-action, equal-opportunity organization.

Funding for abstract provided by the Michigan Department of Transportation.

