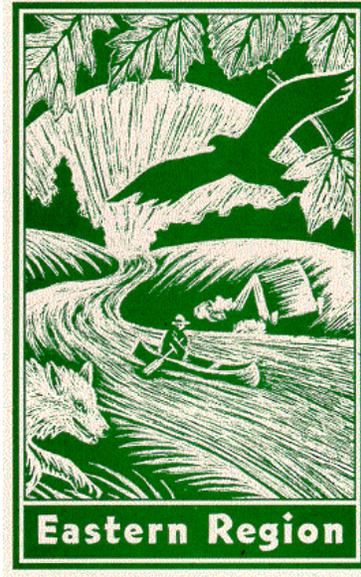


*Conservation Assessment  
for  
Fraser's Loosestrife (*Lysimachia fraseri* Duby)*



*USDA Forest Service, Eastern Region*  
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*This document is undergoing peer review, comments welcome*

*This Conservation Assessment was prepared to compile the published and unpublished information on the subject taxon or community; or this document was prepared by another organization and provides information to serve as a Conservation Assessment for the Eastern Region of the Forest Service. It does not represent a management decision by the U.S. Forest Service. Though the best scientific information available was used and subject experts were consulted in preparation of this document, it is expected that new information will arise. In the spirit of continuous learning and adaptive management, if you have information that will assist in conserving the subject taxon, please contact the Eastern Region of the Forest Service - Threatened and Endangered Species Program at 310 Wisconsin Avenue, Suite 580 Milwaukee, Wisconsin 53203.*

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## EXECUTIVE SUMMARY

*Lysimachia fraseri* is a rare member of Primulaceae that is found primarily in the southeastern U.S. The glandular hairs on much of the plant and red leaf margins help to distinguish the species from other members of the genus. *Lysimachia fraseri* occupies a variety of natural and anthropogenic open habitats including edges of rock outcrops, roadsides, and riparian corridors. The species typically occurs as vegetative stems in more shaded communities and the most robust populations with flowering individuals occur in open habitats. Environmental conditions range from xeric on steep south- and west-facing slopes to mesic in upland forests.

The species is classified as globally imperiled (G2), state endangered in North Carolina and Tennessee, and a Regional Forester Sensitive Species on the Shawnee National Forest in Illinois. Although several populations of more than 500 individuals occur and a number of the populations are considered to be stable, more than 40 populations have been extirpated due to natural and anthropogenic factors including woody encroachment as a result of fire suppression, damming of streams, and routine roadside maintenance. Other threats to the species include competition from exotic species and predation. *Lysimachia fraseri* is dependent on natural and anthropogenic disturbances to maintain an open canopy and reduce competition; however, severe and/or frequent anthropogenic disturbances also threaten many of the extant populations.

The U. S. Forest Service identifies species that are sensitive within each region, i.e., Regional Forester Sensitive Species (RFSS). For each RFSS a conservation assessment is developed to help maintain viable populations of these species. The purpose of this assessment of *Lysimachia fraseri* is to document the current scientific knowledge of the species. Specific objectives include the following:

- 1) describe the plant and distinguish it from other similar species,
- 2) determine the status of the species including geographical distribution and population trends,
- 3) determine ecological requirements of the species and its reproductive biology, and
- 4) identify threats to the species.

## ACKNOWLEDGEMENTS

I sincerely thank Steve Olson for review of this conservation assessment. Gary Kauffman (National Forests of North Carolina), Robin Roeckers (Francis Marion-Sumter National Forests), Thomas Patrick (Georgia Natural Heritage Program), and Robert Gottfried (Illinois Natural History Survey) provided valuable information on the species.

## NOMENCLATURE AND TAXONOMY

Scientific Name: *Lysimachia fraseri* Duby

Common Names: Fraser's Loosestrife and Fraser's Yellow Loosestrife

Synonyms: None  
Class: Dicotyledoneae  
Order: Primulales  
Family: Primulaceae

*Lysimachia*, a member of Primulaceae, is a rather large and wide-ranging genus of approximately 150 species found most commonly in the northern hemisphere, especially in Asia (Small 1933, Fernald 1950, Ray 1956, Gleason and Cronquist 1991). *Lysimachia* is derived from the Greek “lysis” meaning a release from, and “mache,” meaning strife, in reference to King Lysimachus of Thrace who supposedly pacified an angry bull with a loosestrife plant (Fernald 1950). The species was named in honor of John Fraser, a botanist in southern Appalachia, who first collected the species (Bates 1998).

## DESCRIPTION OF SPECIES

Plant	herbaceous perennial with slender rhizomes that may deeply penetrate the substrate.
Stems	erect, simple or branched, terete, stipitate-glandular near nodes and above, otherwise glabrous, stout, 0.7-1.5 (2) m tall, 3-7 mm in diameter at the base.
Leaves	surface punctate with round or elongated dark purple or black glands that are much paler beneath than above; entire, in whorls of 3-5 (6); lanceolate, lance-elliptic, oblanceolate, or ovate-lanceolate; (4) 6-15 cm long, 1.5-6 cm wide, acute, base cuneate to rounded; margins finely stipitate-glandular; petioles 4-10 mm long; lower-most leaves reduced and often scale-like.
Inflorescence	broad, leafy, terminal panicle, 0.5-2.5 dm long, branches of inflorescence densely stipitate-glandular; bracts linear-lanceolate to subulate; pedicels 5-9 mm long and densely stipitate-glandular with red margins.
Calyx	5 lobed, densely stipitate-glandular, 3-5 mm long, lobes lanceolate, acute to acuminate, margins purple or maroon; tube 5 mm long.
Corolla	yellow, 5-cleft, rotate, 1.5-1.6 cm wide; petal lobes 6-9 mm long and many times longer than the tube, 0.7-4 mm wide, elliptic, entire, ovate, obovate, or oblong, rounded apices that may be notched with one or more large teeth, fine glandular-stalked trichomes, margins entire to erose.
Stamens	5; filaments united 1/3-1/2 their length (1-3 mm long), form a cup at the base, free portions unequal in length (1-2 mm long), glandular-puberulent; anthers yellow, ovate, deeply notched below, somewhat versatile, longitudinal dehiscence.
Carpel	stigma truncate; style slender, 3-4 mm long; unilocular inferior ovary with numerous ovules.

- Capsule        globose to subglobose, 3-5 mm long, 3-4 mm thick.
- Seeds         several (4-15), angular, dark brown to black, surface finely pitted, 1.5-2.3 (3) mm long with a thin, reticulate, rust-colored layer that can be removed upon drying.
- Flowering     June-August; fruiting Sept.-Oct.

(Small 1933, Ray 1956, Radford *et al.* 1968, Mohlenbrock 1978, Godfrey and Wooten 1981, Bates 1998, Basinger 2000, Mohlenbrock 2002).

*Lysimachia fraseri* (Figure 1) is most closely related to *L. salicifolia* of Australia and *L. vulgaris* of Eurasia, but is not closely related to the other North American species (Ray 1956). *Lysimachia vulgaris* has been introduced to North America and can be distinguished by the absence of glandular hairs on the leaf margin characteristic of *L. fraseri* (Ray 1956). *Lysimachia fraseri* and *L. quadrifolia* are somewhat similar in vegetative states, but the red leaf margins on *L. fraseri* separate this species from other *Lysimachia* species, especially when the plants are vegetative (Bates 1998, Porcher and Rayner 2001). Weakley (1995 in Bates 1998) noted that the aforementioned characteristics also are evident in *L. fraseri* seedlings. Another character that separates *L. fraseri* and *L. quadrifolia* seedlings are the abundant sinuous, translucent lineations on *L. quadrifolia* that can be observed with a 10x lens when backlighted (Wheatley 1995 in Bates 1998).

Although some species of *Lysimachia* may hybridize, there is no evidence that *L. fraseri* does.

## LIFE HISTORY

*Lysimachia fraseri* asexually reproduces by rhizomes (Ray 1956) and it has been successfully rooted (Bates 1998). Sexual reproduction occurs by outcrossing or autogamy, i.e., it is self-compatible (Bates 1998, Basinger 2000). Bates (1998) indicated that oftentimes populations found on ridge tops and/or rock outcrops provide seeds for sexual reproduction in smaller populations located on moderate slopes at lower elevations. It was determined that the seeds float and this may be a means of dispersal for populations in riparian habitats (Bates 1998). The capsule apex opens to release the seeds, which average 4.84 seeds/capsule (Bates 1998).

*Lysimachia fraseri* is capable of existing for a number of years by asexual reproduction, but it is unknown how long the population can maintain itself without sexual reproduction (Bates 1998). Some botanists have suggested the species may persist for up to 20 years vegetatively (Bates 1998). The species has been successfully transplanted into 5 separate “low maintenance wild gardens” and in two locations it spread into uncultivated areas (Kauffman 1999). In addition, individuals in a large North Carolina population that would have been destroyed by road construction were transplanted to another site. Preliminary results indicate the plants been successfully transplanted and a similar project is underway to rescue plants from private property in North Carolina (Kauffman 2003).

The species has a high light requirement and flowering usually occurs when exposed to sufficient sunlight (Porcher and Rayner 2001). Factors that maintain open canopies enhance flowering and seed production in *L. fraseri* (Bates 1998). Natural factors include rock outcrops, thin soils, windfalls, flooding, and fire. In Spring 1997, a Tennessee population of *L. fraseri* sprouts survived a natural fire (Bates 1998).

In Tennessee, the species typically is dormant from December until March. Leaves emerge in mid-April and senesce in late October (Bates 1998).

Although definitive pollinators have not been identified, Simpson *et al.* (1983) indicated that *Macropis* (bee) females collect secretions and pollen from *L. fraseri* flowers. Possible pollinators include *M. ciliata*, *M. patellata*, and *M. steironimata steironimata* (Simpson *et al.* 1983), but apparently, *L. fraseri* is not dependent on *Macropis* for reproduction because the species is rhizomatous, may be autogamous, and is occasionally visited by other species of bees (Simpson *et al.* 1983).

## **HABITAT**

*Lysimachia fraseri* may occupy a variety of habitats that are maintained by natural or anthropogenic disturbances including edges of rock outcrops, roadsides, and borders of streams (Bates 1998). The species also has been found in alluvial meadows, mesic woods, sunny rocky slopes, sandy stream banks, stream terraces, and moist pastures (Kearney 1897, Small 1933, Radford *et al.* 1968, Chester 1975, Mohlenbrock 1978, Godfrey and Wooten 1981, Mohlenbrock 1986, Medley 1993, Smith 1998, Basinger 2000, Porcher and Rayner 2001, Mohlenbrock 2002), and may occasionally occur in “swamps” (Ray 1956). Environmental conditions range from xeric on south and west steep rock outcrops to moderate slopes with deep soil to flats along streams (Bates 1998). It may reside in riparian corridors with sand, gravel deposits, or alluvial soil (Bates 1998). Roadside habitats range from disturbed gravel substrates to banks and ditches with thick, loamy soil (Bates 1998). Bates (1998) determined that the most vigorous populations occur on ridge tops or on south or west slopes and indicated that smaller populations may be found on more moderate slopes downhill from rock outcrops and/or ridge tops. Apparently light intensity is the limiting environmental factor (Kauffman 1999).

## **DISTRIBUTION AND STATUS**

*Lysimachia fraseri* was considered endemic to the southern Appalachians (Ray 1956) until disjunct populations were discovered in Illinois, Kentucky, and Alabama (Figure 2) (Bates 1998). The center of distribution remains in the southeastern U.S. in North Carolina, South Carolina, and Georgia, and the disjunct populations are located in areas that receive less precipitation per year than those at the center (Bates 1998). By 1998, 86 extant populations in 18 counties had been confirmed, along with 42 extirpated/historic populations (Bates 1998). Recently, two historic populations in North Carolina have been relocated, one of which has not been seen since 1897 (Kauffman 2003).

According to historical records, *L. fraseri* was once more widely distributed (Bates 1998) and Porcher and Rayner (2001) suggested the species was probably more abundant in presettlement times when Native Americans routinely burned these areas. Bates (1998) suggested that *L. fraseri* may have spread along routes used by Native Americans and early settlers.

*Lysimachia fraseri* is classified as G2 species indicating that it is globally imperiled (NatureServe 2001) and was considered a candidate for federal listing but lacked sufficient information for classification (Basinger 2000). The species is rare throughout its range, but in South Carolina some populations of thousands of individuals exist (Roeckers 2003). Numerous populations have been extirpated but in some areas, such as South Carolina, some of the extant populations are considered stable and the species is not very vulnerable to extinction there (Bates 1998, NatureServe 2001, Roeckers 2003). The Nature Conservancy classifies *L. fraseri* as critically imperiled in South Carolina (NatureServe 2001); however, the species is more abundant there than this listing indicates (Roeckers 2003). In other areas, *L. fraseri* is more vulnerable; the species is state listed as endangered in North Carolina and Tennessee, is rare in Georgia, and is not listed in Alabama, although there is only one population there (NatureServe 2001). Apparently, the species is extirpated in Kentucky and Illinois (Basinger 2000). Additionally, it is classified as a Regional Forester Sensitive Species on the Shawnee National Forest in Illinois. State Heritage Status Rank is as follows:

Alabama	S1	critically imperiled
Georgia	S1	critically imperiled
North Carolina	S2	imperiled
South Carolina	S1	critically imperiled
Tennessee	S2	imperiled

## Illinois

*Lysimachia fraseri* was known from two Pope County populations in southern Illinois in the Shawnee National Forest (Figure 3). Both sites were protected, but the species apparently has been extirpated from the state (Basinger 2000).

One population was located along the edge of a floodplain on a 14% northeast-facing slope in a 40% forested sandstone canyon on slightly acidic (pH = 6.3), shallow soil (average depth less than 10 cm). Associated species included *Alnus serrulata*, *Andropogon gerardii*, *Athyrium angustum*, *Cornus obliqua*, *Dichantheium yadkinense*, *Eupatorium fistulosum*, *Solidago caesia*, *S. patula*, *Viburnum dentatum*, and *Zizia aurea* (Basinger 2000). (For an extensive list of associated species see Basinger 2000.) In 1991, 100 plants were found, five of which were in flower. The population began declining when a tree fell into the population. By 1998, only 3 plants were found; in 1999, one was found; and none were found by 2000 (Basinger 2000). This population is thought to be extirpated, but Basinger (2000) suggested that searches for the species continue.

The other Illinois population was discovered in 1968 but searches to relocate this population have been unsuccessful (Bates 1998).

## Alabama

The only Alabama population is found in a seep in a mesic hardwood forest along a stream. Possible associated species at this location include *Quercus velutina*, *Q. rubra*, *Q. alba*, *Liriodendron tulipifera*, *Pinus* sp., *Liquidambar styraciflua*, *Acer rubrum*, *Cornus florida*, *Vitis rotundifolia*, and *Vaccinium pallidum* (NatureServe 2001).

## Georgia

Bates (1998) determined that there are 14 extant and 4 extirpated/historic populations of *L. fraseri* in Georgia. Most of these occur along small streams but one is found on a steep, rocky roadside. Associates species include *Lysimachia quadrifolia*, *Helianthus* sp., *Eupatorium* sp., *Eryngium yuccifolium*, *Hydrangea arborescens*, and *Rudbeckia heliosidis* (NatureServe 2001).

## North Carolina

Kauffman (1999) confirmed 26 extant populations in North Carolina and 14 extirpated/historic locations. Recently, two historic populations have been relocated (Kauffman 2003). The extant populations occur in open and closed woods; however, *L. fraseri* is more vigorous in open habitats than in the shaded areas where it tends to remain vegetative (NatureServe 2001). Associated species include *Impatiens capensis*, *Acer rubrum*, *Quercus alba*, *Calycanthus floridus*, *Campanula* spp., *Coreopsis major*, *Hydrangea radiata*, *Silene* spp., *Aster divaricatus*, *Lysimachia quadrifolia*, *Oxydendrum arboreum*, *Rubus* spp., *Solidago curtisii*, *Rhododendron maximum*, *Prenanthes* spp., *Pinus strobilus*, *Houstonia purpurea*, *Saxifraga* spp., *Carex biltimoreana*, *Juncus gymnocarpus*, *Tsuga canadensis*, *Gillenia* sp., *Polystichum* sp., *Prenanthes trifoliata*, *Vitis aestivalis*, *Viola rotundifolium*, *Liriodendron tulipifera*, and *Thelypteris hexagonoptera* (NatureServe 2001).

## South Carolina

Forty extant *L. fraseri* populations have been identified in South Carolina, with 35 of these occurring on the Andrews Pickens Rangers District (Sumter National Forest 1997, Bates 1998). The primary habitat is openings along roads, powerline right-of-ways, and river corridors in deep, well-drained, strongly acidic upland soils (Sumter National Forest 1997). Associated species include *Quercus alba*, *Q. rubra*, *Q. coccinea*, *Q. falcata*, *Liriodendron tulipifera*, *Acer rubrum*, *Pinus echinata*, *Oxydendrum arboreum*, *Rubus* sp., *Lysimachia quadrifolia*, *Kalmia latifolia*, and *Pteridium aquilinum* (Sumter National Forest 1997). Bates (1998) identified seventeen extirpated/historic populations and stated that a number of the historical populations were extirpated due to flooding after dam construction (Bates 1998).

## POTENTIAL THREATS

A number of *L. fraseri* populations have been extirpated due to natural and anthropogenic factors including mowing of roadsides, dam construction, road improvements, exotic species, and natural succession (Bates 1998, Kauffman 1999, Basinger 2000). *Lysimachia fraseri* depends on disturbance to open the canopy and allow for sexual reproduction to occur; however, because over half of the populations occur in anthropogenically-altered landscapes, such as roadsides, powerline corridors, old logging road, old home sites, forest clear cuts, and hiking/horse trails, human activities also threaten the survival of the species (Bates 1998).

In one North Carolina population, approximately 1200 ramets were damaged by a road grader (Bates 1998). Although no plants were observed later that year, the following year approximately 300 ramets were found and 2 years after the disturbance the population was approximately 50% of its original size (Bates 1998, Kauffman 1999). South Carolina roadside populations have been destroyed by herbicide spraying, widening and grading roads, and possibly mowing (Bates 1998). Bates (1998) found in 1997-98 that 24% of the *L. fraseri* populations were mowed. Due to the large number of roadside populations, it is imperative that routine maintenance, such as mowing, occurs at times that allow for proper growth and reproduction of *L. fraseri*. Periodic mowing when the plants are dormant appears to benefit the species but routine mowing is not recommended (Sumter National Forest 1997). Other threats include the elimination of plants and rootstock by mowing too close to the ground and the use of herbicides (Sumter National Forest 1997).

Several populations are threatened by invasion of exotic species including *Miscanthus* sp., *Dioscorea oppositifolia*, and *Microstegium vimineum* (Bates 1998, Basinger 2000). Also, *Monostegia abdominalis*, an exotic sawfly, feeds on *L. fraseri* leaves, and in 1997-98 it was found in 40% of the populations (Bates 1998).

Deer browse was observed at 13% of the populations Bates (1998) examined. Although she does not believe this is a serious threat to the survival of the species, Thomas (2003) indicated deer browse is a problem in Georgia. Also, fulgoroid planthoppers were observed in some South Carolina roadside populations (Bates 1998). These organisms, which insert their proboscis into the stems to extract plant juices, may cause plant wilting (Bates 1998). In addition, an unidentified caterpillar caused significant damage at some sites (Bates 1998) and birds also prey on *L. fraseri* fruits (Sumter National Forest 1997).

A major threat identified in South Carolina was shading from early successional shrubs (Sumter National Forest 1997). Approximately half of the South Carolina populations monitored in 1994-95 were experiencing encroachment (Sumter National Forest 1997). In addition, a Georgia population is potentially threatened by competition and shading of woody species (NatureServe 2001).

Although Bates (1998) identified a nursery in North Carolina that sells *L. fraseri*, another nursery has stopped propagating the species due to lack of interest as a garden species.

The only Alabama population is threatened by human activities (NatureServe 2001). It occurs along a roadside that has potential as a “convenient turnaround or parking area” (NatureServe 2001).

In summary, although *L. fraseri* is dependent on disturbance to maintain an open canopy and reduce competition, the frequency and severity of disturbance is very important. Lack of disturbance as well as high rates of disturbance that decimate populations both are threats to this taxon.

## **RESEARCH AND MONITORING**

Research on the reproductive biology of *L. fraseri* was conducted at the University of North Carolina at Asheville but additional research is needed to confirm the preliminary results of this study (Bates 1998). Plant monitoring has occurred at some locations including the populations at the Sumter and Shawnee national forests as well as in North Carolina (Sumter National Forest 1997, Basinger 2000, Kauffman 2003).

Bates (1998) conducted extensive field work to determine the extant populations of *L. fraseri*; however, many of the extant populations lack specific information on number of individuals, reproduction, and population trends. It has been stated that a number of the populations are stable but research to confirm these observations is lacking. In North Carolina, the number of *L. fraseri* ramets increased following a prescribed fire, however, the ramets did not spread to previously unoccupied areas (Bates 1998, Kauffman 2003). It is apparent that the species thrives in open communities that are subjected to sufficient disturbance to reduce competition from woody species. Also fire reduces competition and opens the canopy, which may lead to increased flowering and seed production; however, specific responses to fire have not been determined. Currently, it is not known how long *L. fraseri* can maintain vegetative populations or how much shading the species can tolerate.

Research is needed to determine the impact of *Monostegia abdominalis* on *L. fraseri*. Sawflies are often serious plant pests (Bates 1998, Basinger 2000) so their effect on the species may be significant. Also predation by white-tailed deer, fulgoroid planthoppers, and other predators should be monitored to ensure survival of the species.

## **RESTORATION**

There is a lack of consensus on the restoration potential of *L. fraseri*. In North and South Carolina, botanists and ecologists believe it can be re-established at extirpated sites if suitable habitat remains (NatureServe 2001) and transplantation is considered a viable management tool (Kauffman 1999). There has been successful vegetative propagation of the species by a North Carolina nursery (NatureServe 2001) and in garden settings it readily spreads by rhizomes (Thomas 2003) and has been successfully established in 5 separate wildflower garden (Kauffman 1999). Also, preliminary results of a transplantation in North Carolina indicate the project was successful (Kauffman 1999). However, further west in Kentucky and Illinois, propagation

efforts have not been successful leading ecologists there to question its restoration potential (NatureServe 2001). Unfortunately, restoration efforts were unsuccessful in some of the disjunct, now extirpated, populations. Whether these differences are due to ecological, genetic, or experimental factors have not been determined.

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- Figure 1. *Lysimachia fraseri*. a) Habit, X1/2. b) Capsules, X6. c) Flower, X21/2. (Mohlenbrock 1978, page 176). Reprinted by permission of the publisher.

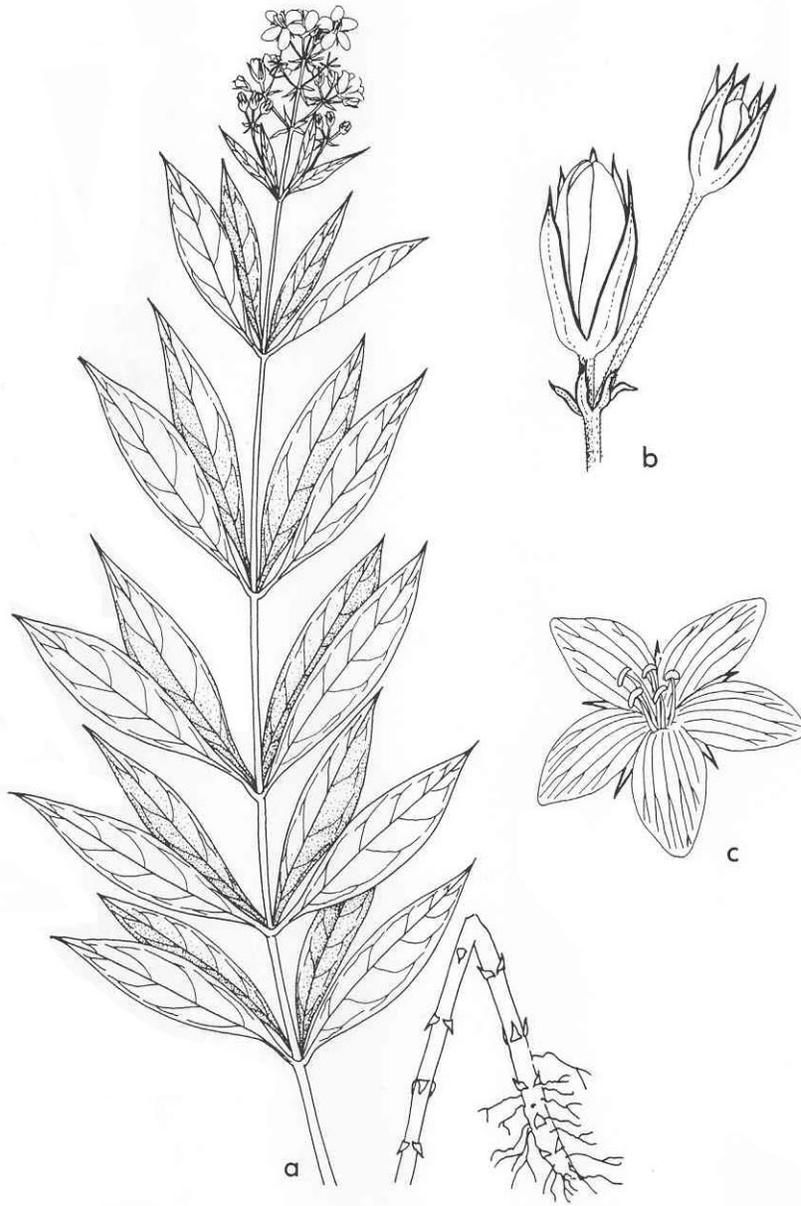


Figure 2. Distribution of *Lysimachia fraseri* in the U.S. (NatureServe 2001).

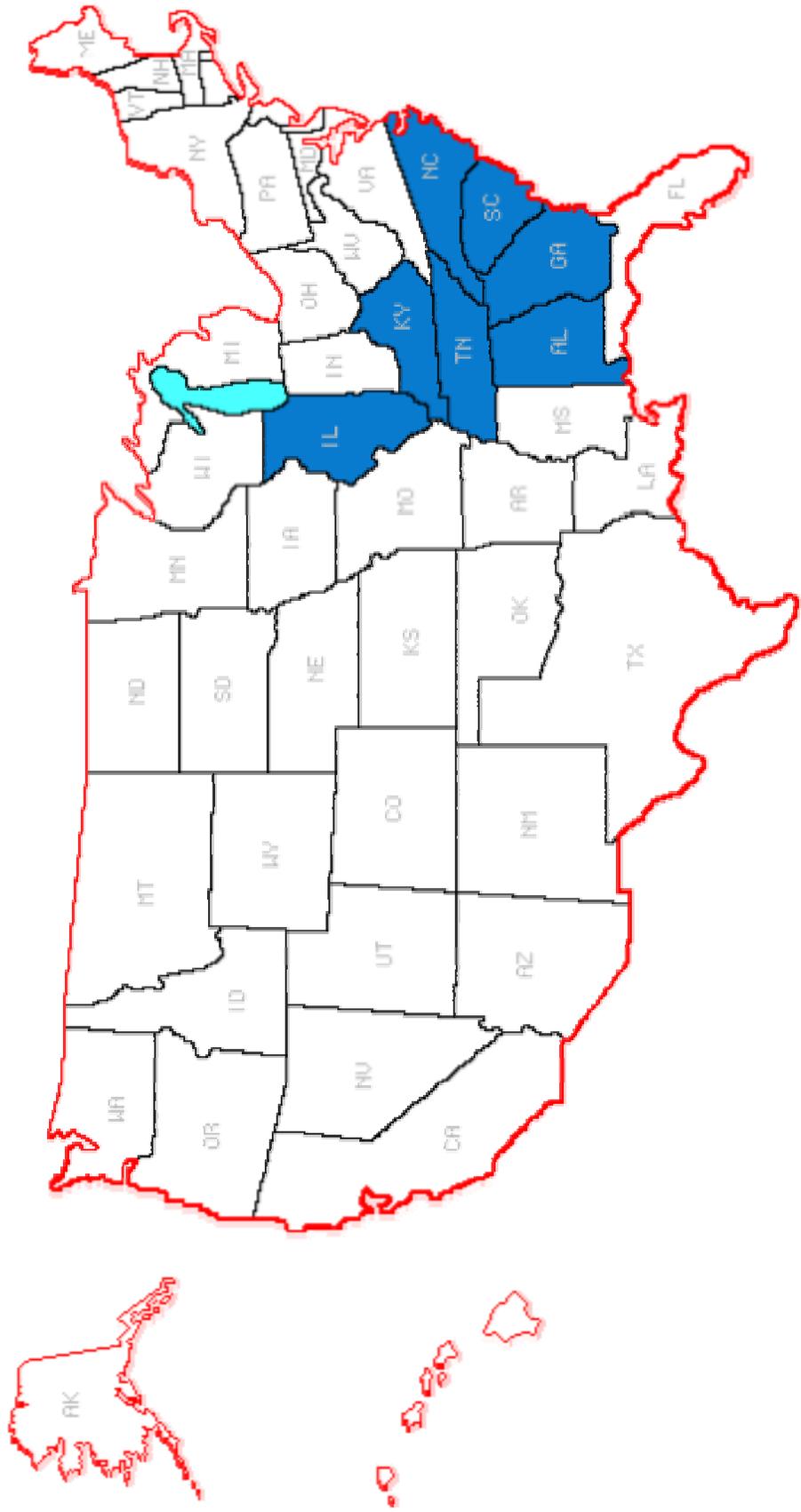


Figure 3. Distribution of *Lysimachia fraseri* in Illinois. Circles indicate counties with extant populations (Gottfried 2002, Mohlenbrock 1978, 2002).

