Status of

Streptanthus bracteatus, Philadelphus ernestii

and Amorpha roemerana in Travis County:

a report for the

Austin Regional Habitat Conservation Plan

by

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under contract to the

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Introduction

A survey was conducted to locate populations of and to collect information on three rare plant species (Amorpha roemerana, Philadelphus ernstii, and Streptanthus bracteatus) in Travis County. Although locations were known for each species in the county, a more thorough study was needed to define areas of potential habitat, to survey as many such areas as possible, and to acquire any other information concerning phenology, ecology, reproductive biology, and threats. This study is intended for use in the Austin Regional Habitat Conservation Plan (ARHCP). It was administered by the Texas Natural Heritage Program, a branch of the Resource Protection Division of the Texas Parks and Wildlife Department.

The study began in March 1989. Herbarium specimens at the University of Texas Plant Resource Center were examined. All information in files of the Texas Natural Heritage Program was reviewed. Heritage program methodologies were employed for collecting and recording species-specific and locality information. Field surveys were conducted in March to verify historical locations, to update past information, to develop a habitat profile, and to develop the most appropriate search method for each species. Areas of probable habitat were identified using the habitat profiles developed during the preliminary site reviews. These areas were marked on USGS 7.5' topographic maps. Outlined areas were then selectively field-checked for the occurrence of the target species. Given the time constraints, it was not possible to survey all areas of potential habitat. Areas surveyed versus potential habitat not surveyed are indicated on the attached maps.

The field surveys were successful in locating new occurrences of Streptanthus bracteatus and Amorpha roemerana. No new populations of Philadelphus ernstii were found by the author, although the extent of the known populations was considerably expanded. However, a new population of P. ernstii was discovered by a local consulting firm.

A separate report is provided for each of the species. Sections within each species report provide a description of the species and information on its habitat, demography, phenology, reproductive biology, population ecology, and threats. Recommendations for acquisition and management are included with each species report.

Included with the report are two sets of maps. Currently known locations for the species under study are indicated on one set as well as areas recommended for acquisition. The other set outlines the areas of probable habitat, both those field surveyed and not surveyed. Currently known locations are mapped according to Heritage program methodology. Further information on specific sites and populations is housed at the Texas Natural Heritage Program.
Status of *Streptanthus bracteatus* in Travis County

*Streptanthus bracteatus* Gray

Common name: bracted twistflower

Family: Brassicaceae (Mustard Family)

Description

Herbaceous, somewhat succulent, waxy annual; stems unbranched, 18-24(-54) in. tall, shiny light green, with secondary and smaller stems arising from the lower leaf axils; leaves to 8 in. long, glossy grayish light green to dark forest green; basal leaves 6-18, forming a clump 2-8 in. across, usually less than 2 in. tall, alternate, spoon-shaped, stalked; lower leaves irregularly lobed, margins slightly toothed, with stiff hairs; upper leaves arrow-shaped, unstalked, margins entire; flower stalks arising from the axils of the upper leaves which are reduced to prominent, triangular, green bracts; flowers near top of stalk, purple, 1/2-1 in. long; petals 4, spoon-shaped, arching backwards; fruit a long thin pod 3-7 in. long, 1/4 in. in diameter, curved, brown, with many seeds; seed flat, broadly oblong to round, winged, reddish brown to brown. (Adapted from Correll and Johnston 1970 and the author's observations).

Throughout much of its life-cycle, *S. bracteatus* is extremely difficult to locate. Only when in bloom, is the plant easy to locate; however that time is very short.

Habitat

*Streptanthus bracteatus* occurs on thin clay soils overlaying limestone. Soil types vary as does the type of limestone underlaying each site. The habitat where *S. bracteatus* is found is characterized by a higher level of soil moisture in the winter and a covering of low, dense, woody shrubs. Most of the locations are dominated by woodland, i.e. oak/juniper, oak/ash/black cherry, or juniper. One site is in a juniper/little bluestem grassland and will be discussed in more detail later. The canopy cover ranges from around 25 percent to 100 percent. At all sites there is a strong association between the occurrence of *S. bracteatus* and the presence of thick, dense brush. The species composition of this shrub layer is different at each site. The most common species are *Rhus virens*, *Garrya ovata* ssp. *lindheimeri*, *Quercus sinuata* var. *breviloba*, *Bernardia myricaefolia*, and *Forestiera pubescens*. The Barton Creek Greenbelt site is atypical, containing shrubs more representative of more arid, well-drained areas. All sites except Cat Mountain are to a great degree free of any
herbaceous ground cover. Cat Mountain is approximately 50 percent grassland, but *S. bracteatus* occurs on the site only under the brushy mottes of *Rhus virens*, which are relatively free of grass.

All *S. bracteatus* locations in Travis County are either on the Balcones Fault (a line drawn through the three southern populations exactly describes the fault where it intersects Barton Creek and both sides of Lake Austin) or at the nearest permanent water to the fault. All the sites are located above permanent flowing water. Except for one population at Cat Mountain, all sites are on or near the tops of ridges. Only one population (Barton Creek Greenbelt) extends into the creek-bottom. Other species often found in the same habitat are *Commelinantia anomala*, *Pinaropappus roseus*, *Maurandya antirrhiniflora*, *Clematis texensis*, and *Asclepias texana*.

Because the habitat characteristics are so variable, the area of potential habitat is quite large. It is not known what characteristics are preventing the distribution of *S. bracteatus* into additional areas.

**Demography**

Numbers of individuals in populations of *Streptanthus bracteatus* fluctuate dramatically from year to year. Each population covers a very small area, and density is high. In 1989 277 individuals were located in 11 populations from the following five sites.

- North Cat Mountain - 71 plants, three populations
- Cat Mountain - 60 plants, four populations
- Mount Bonnell - 94 plants, one population
- Bee Creek Nature Preserve - 3 plants, one population
- Barton Creek Green Belt - 49 plants, two populations

The North Cat Mountain site is a group of three populations on or surrounding a ridge top in the North Cat Mountain development. This ridge is above Bull Creek Park due east of the intersection of Lakewood Drive and Loop 360. Valburn Drive runs along the top of the ridge. At the northwest end of the street is the second largest population of *S. bracteatus*. In 1989 approximately 54 individuals were counted on the west face of the ridge top, with a small number (14) occurring north, beyond the end of Valburn Drive on a trail that continues northwest along the ridge top, and three plants southeast of the others on the south side of Valburn Drive.

On the northern slopes and drainages of Cat Mountain are four populations of *S. bracteatus* containing a total of 60 plants. Three populations are on the north slope, northeast slope, and the northwest slope at the same elevation. The population on the north slope is found in juniper woodland-grassland, while the other two
occur in the more typical habitat of dense brush. Also one small population (10 plants) occurs in a drainage to the northeast.

A large population of *S. bracteatus* is located in and next to the Barton Creek Green Belt. In April and May 1989 approximately 48 individuals were found in two populations on a south facing slope. A small number (nine plants) were located next to the old dirt road that runs along the bottom of the Green Belt next to the creek. Most were located on the slopes above the creek.

Approximately 100 individual plants were found in Mount Bonnell City Park in April and May 1989. All but one were near the southern boundary of the park. Past records show that the plants were found to occur around the top of the park. This year the plants were 300 to 400 feet south of the previous location.

**Phenology**

Due to time frame of the report, part of the seasonal growth cycle was not observed. *Streptanthus bracteatus* appears to be a winter annual. The growth cycle begins when the seed germinates in the fall. Through the winter and early spring, the plant grows slowly and maintains itself as an inconspicuous, basal rosette. An undetermined stimulus causes the plant to send up flowering stems, usually starting in March and ending in May, with the greatest numbers of individuals blooming toward the end of that period. A secondary flush of flowers occurs on some plants after the main blooming period. These flowers are smaller than the first, up to one-half the size (Dieringer 1989). Fruit can be observed on some plants at the same time as flowers, but ripe seed is not released until after flowering is completely finished.

**Reproductive Biology**

*Streptanthus bracteatus* is primarily an outcrossing species, although some autogamy and self-compatibility has been observed (Dieringer 1989). Bees in the genus *Megachile* were observed to be the main pollinators (Dieringer 1989). Less than one-third of the flowers (an average of 15.5 per plant) produced fruit. The average number of seeds per fruit was around 35 (Dieringer 1989). Predation by deer and insects significantly reduces these figures. Dispersal, at least on the steeper slopes, seems to be mostly downslope. Many of the populations form a narrow band running perpendicular to the horizontal contours. There does not appear to be much seed dispersal along the contours.

Based on casual observations the variation in numbers of individuals in a population from year to year can be very large. The largest positive variation has been about 200 percent (from 55 plants in 1987 to 94 in 1989). The greatest negative variation
has been from 40 plants in 1987 to three plants in 1989. As these results represent the observations of two different observers and no permanent plots are in place, such variations may be artifactual. However the variations could be a normal part of the reproductive biology or indicative of a true change in the permanent population. At some sites, populations appear in different areas from year to year. Some populations have been observed as much as 450 feet from the location of the previous year. Such movement needs to be further investigated to determine if it is attributable to a mechanism of seed dispersal or to the storage of seed in soil and random germination patterns.

Population Ecology

*Streptanthus bracteatus* occurs in areas of dense shrubs. When it does occur without the protection of woody thickets, plants are subject to severe damage from herbivory. Most sites show signs of an over-population of deer. At sites apparently without a large deer population, some plants will grow and reproduce in the open. These plants tend to be larger, more reproductive, and more vigorous than plants growing in the brush at the same site. Such observations suggest that the preferred habitat of *S. bracteatus* may be woodlands where the ground is relatively free of shrubby vegetation. The frequent occurrence of *S. bracteatus* in brushy thickets may be due to intense herbivory rather than natural preference. Intense herbivory has two effects: severe reduction of suitable habitat, and the decline of quantity and quality of occurrences and individuals.

Threats

The present populations in Travis County are threatened with loss of habitat due to development on or around the two largest sites (Cat Mountain and North Cat Mountain). Decreases in suitability of the remaining habitat due to changes in the vegetation, changes in the flow of water and water quality, erosion, brush clearing, trash dumping, foot and vehicular traffic, and herbivory due to a large and unmanaged deer population. Threats to the Barton Creek Green belt site are from construction above the population, and rock and dirt that was pushed over the edge to flatten the top during construction. It is possible that without direct and active intervention, *Streptanthus bracteatus* will eventually be exterminated from Travis County.

Due to the annual nature of *S. bracteatus*, the species is at great risk from any number of catastrophic events that could reduce or destroy its capacity to produce seed. If such events occur successively, the species could well be extirpated.
Recommendations

The North Cat Mountain site, due to the size of the population and the immediate threat of destruction, should be acquired as quickly as possible. Protection of *Streptanthus bracteatus* here will protect plants along the ridge top, slopes, and in a drainage to the northeast. This site will also protect the largest population of *Amorpha roemerana* which is situated below on Bull Creek.

The individuals of *Streptanthus bracteatus* growing on the top of the ridge are in immediate danger from continued construction. In fact two homes have been built on the largest population in the last two years. Both homes were surrounded by *S. bracteatus* in 1989. The plants on the sides of the ridge, below the homes, seemed able to exist with the disturbance, even growing up through the piles of brush that were cut from the home sites and dumped down the hill. On North Cat Mountain the short term protection of *S. bracteatus* depends on bringing home construction to a halt or around plant locations, and modifying landscaping practices and eliminating trash and brush dumping on existing residential lots. The long-term existence of *S. bracteatus* on North Cat Mountain cannot be determined until more information is collected over a greater period of time. Even without that information, the best method of protection is land acquisition which will guarantee protection of the remaining habitat (with the exception of the lots that are already fully in place). It is also important to educate the present homeowners about the special nature of their neighborhood and enlist their voluntary help in meeting the management goals. Management of the area depends on cooperation of the residents and land acquisition. Also vital is control of browsing animals, maintaining the present vegetational structure, controlling the quantity and quality of water entering the site, prohibiting trash and brush dumping by the residents, discouraging foot travel on the steeper slopes, and restricting the encroachment of non-native species. As more information is gathered about the area to be preserved, specific management methods can be developed.

Areas on Cat Mountain inhabited by *S. bracteatus* should be acquired including the north face of Cat Mountain and the watershed of the drainage at the base of the north slope. The management plan for the area should first address the problem of herbivory, then encroachment of juniper, promoting and maintaining a better vegetational structure, maintenance of water quality and quantity entering the site, and restricting vehicular traffic on the old dirt roads running through the site. Although a general slow-down of development in the surrounding area means these sites are of less immediate concern than the sites at North Cat Mountain, it is still vital to begin to protect these sites. Even though persistence of *S. bracteatus* at these sites for the short term is probable even without active management, assurance of long-term
preservation will require that the recommendations be implemented within the next few years.

The areas where S. bracteatus is growing outside the Barton Creek Greenbelt should be acquired including the watershed up to Loop 360. Surrounding landowners should be educated to the needs of the site. Voluntary cooperation of the adjacent landowners to limit damage is essential. City staff needs to be notified and educated about monitoring the site and implementing future management strategies. Because this site is in good shape, immediate management is unwarranted. However, park managers should monitor the site as needed to assess threats such as degradation of the vegetational structure, increased herbivory, and the impacts of construction above the site. Management practices should be implemented when threats are detected.

Bee Creek Preserve, a City of Austin nature preserve, supports a small number of S. bracteatus. City staff already manages Bee Creek Preserve with the preservation of S. bracteatus in mind. Part of the area, however, is a City of Austin utility right-of-way. The areas where S. bracteatus occur, should be relinquished to the preserve plus a buffer. Materials on the management of the species should be made available to the city staff.

The largest population of S. bracteatus in Travis County occurs on Mount Bonnell, a City of Austin park. This site presents many special problems. Park staff should be notified of the presence of S. bracteatus in the park. Because of the popularity of Mount Bonnell City Park and its small size, a tremendous amount of destruction occurs from the unrestricted foot traffic. Destruction of vegetation is the worst problem, leading to severe erosion in many areas. Both problems threaten the species existence. Routine park operations should be carried out in a fashion that does not endanger the plants. To protect S. bracteatus, location security is appropriate for this site. Park rules prohibiting collecting plants, flowers, and seeds or damaging plants in any way should be strategically posted and enforced. Park workers or park police should also be more visible. Barriers should be erected in the areas of severe erosion to reduce foot traffic. Any eroded area should be revegetated using plant species native to the park. This park will need to be closely monitored so that threats can be eliminated before they harm S. bracteatus.

Because three of the sites are on or partially on City of Austin property, a program should be developed to involve city park planners, park managers, and park workers, teaching them to manage and monitor for S. bracteatus. Their aid should be enlisted in tailoring practices for each park into their present operational frame work.

Hard evidence is still lacking and more data collection is needed to determine the proper steps needed to protect S. bracteatus and
assure its continued existence in Travis County. The species is in danger of being extirpated from Travis County if steps to protect it are not taken soon. First, site acquisition must begin. Second, data collection and analysis should continue. Detailed information needs to be gathered before management methods can be designed to stabilize or even expand populations. Specific areas which require more study are seed germination, seed viability and dispersal, viable population structure, the importance of soil moisture and climatic conditions on establishment, early growth cycle, and effects of adjacent development and other land uses. Identification of herbivores and their impact is also important. Further refinement of the habitat profile must also be done so that probable habitat can be accurately predicted and any other remaining occurrences more easily located.
Summary

The first priority is to begin land acquisition for *Streptanthus bracteatus*. It is in extreme danger of being extirpated from Travis County where seven of the nine known locations in the world exist. *Amorpha roemerana* and *Philadelphus ernestii* are less threatened than *S. bracteatus*. Populations of *A. roemerana* are more widespread and individuals more numerous than those of *S. bracteatus*. Individuals of *P. ernestii* are more numerous than individuals of *S. bracteatus*. Also both *A. roemerana* and *P. ernestii* are shrubby perennials with a longer reproductive life than that of the annual *S. bracteatus*. The recommendations outlined in the text need to begin as soon as possible, especially in the areas that are being actively being developed. The protection of these plants by land acquisition must go hand in hand with a program to educate the landowners in and around the occurrences and to educate the general public. Many of the populations are near or literally in homeowners back yards, making cooperation with residents vital to overall management. It must be stressed that the voluntary cooperation of the landowners and the backing of the community are as important as the acquisition of the land. This survey also highlights the lack of basic information about these plants and their ecology. This report should not be construed as the definitive source of data on these species. Many questions could not be answered because of the time constraints. The only way to answer these questions is to continue information gathering over multiple seasons. These answers are necessary to decide what types of management practices will best support the long-term protection and preservation of these plants. Specifically more field surveys are needed to identify probable habitat and locate other occurrences. Monitoring present sites will also be required to identify future threats and the steps that can be taken to avert damage.

Acknowledgements

I wish to take this opportunity to thank those who helped me in producing this report: Burford Westlund for the companionship and extra set of eyes on many of the field surveys, William Carr for sharing his time and the large fund of information he has about these plants and their occurrences, Clark and Francis Handcock, John Ahrns, John Gee, Terry Seigenthaler, Chuck Sexton, Patsy Turner, Clif Ladd, Marshall Enquist, Lorraine Atherton, Helen Ballew and the staff at the Nature Conservancy, Jackie Poole and the staff at Texas Natural Heritage Program, and John Gleason for allowing me to mess up his house and computer for days on end.
References


Maps

The following maps depict currently known locations of *Amorpha roemerana*, *Philadelphus ernestii*, or *Streptanthus bracteatus* (indicated by solid lines). Also shown are suggested preserve boundaries (single hatched lines), areas of probably habitat which was surveyed (double hatched lines), and areas of unsurveyed probable habitat (lines with circles; A = *Amorpha roemerana*, P = *Philadelphus ernestii*, and S = *Streptanthus bracteatus*). North is the top of all maps. All maps are at the scale of 1 mile = 2 5/8 inches except figures 1, 14, 16, and 31 which are at the scale of 1 mile = 1 3/4 inches.

The numbering system of the attached maps appears random because the maps are pieces of the larger 7.5' USGS topographic quadrangles within the database maintained by the Texas Natural Heritage Program. Also some maps represent more than one quadrangle (thus the need for map locator numbers such as 1A, 1B, etc.). Numbers (such as .030, .011, etc.) following species names refer to populations or population clusters (occurrences) tracked by the Texas Natural Heritage Program. If a site name follows this number, the site is mentioned in this report. If a site name does not appear, the occurrence was not rechecked during the course of this study. More detailed information for each occurrence and site is available through the Texas Natural Heritage Program.

These maps do not represent all localities for *A. roemerana*, *P. ernestii*, or *S. bracteatus*; only those presently known. Nor do the delineated areas of unsurveyed probable habitat indicate that the rare plants will only be found in these areas, only that the species are most likely to be found there.
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Figure 1 - Jollyville (top) and Austin West (bottom) 7.5' quadrangles
Figure 3 - Austin West 7.5' quadrangle (east central section)

7 - *Streptanthus bracteatus* .009 Mount Bonnell
8 - *Streptanthus bracteatus* .007 Bee Creek
Figure 4 - Austin West 7.5' quadrangle (south central section)

11 - *Streptanthus bracteatus* .017 Barton Creek
Figure 11 - Nameless 7.5' quadrangle (southeast corner)

Probable habitat for *Amorpha roemerana*, *Philadelphus ernestii*, and *Streptanthus bracteatus*
Figure 14 - Travis Peak (east central section) and Nameless (west central section) 7.5' quadrangles

Probable habitat for *Amorpha roemeriana*, *Philadelphus ernstii*, and *Streptanthus bracteatus*
Figure 15 - Travis Peak (southeast corner) and Nameless (southwest corner) 7.5' quadrangles

Probable habitat for *Amorpha roemerana*, *Philadelphus ernestii*, and *Streptanthus bracteatus*
Figure 16 - Jollyville 7.5' quadrangle (west central section)

Probable habitat for Amorpha roemerana, Philadelphus ernestii, & Streptanthus bracteatus
Figure 19

Jollyville (southeast section) and Austin West (northeast section) 7.5 quadrangles

Probable habita for Amorpha roemert Philadelphus ernestii, and Streptanthus bracteatus
Figure 20 - Jollyville (south central section) and Austin West (north central section) 7.5' quadrangles

Probable habitat for *Amorpha roemerana*, *Philadelphus ernestii*, and *Streptanthus bracteatus*
Figure 26 - Austin West 7.5' quadrangle (central section)

Habitat surveyed for Amorpha roemerana, Philadelphus ernestii, and Streptanthus bracteatus
Figure 27 - Austin West 7.5' quadrangle (central section)

Probable habitat for Amorpha roemerana, Philadelphus ernestii, and Streptanthus bracteatus
Figure 28 - Austin West 7.5' quadrangle (east central section)

Probable habitat for *Amorpha roemariana* and *Spreptanthus bracteatus*
Figure 29 - Austin West 7.5' quadrangle (west central section)

Probable habitat for Amorpha roemerana, Philadelphus ernestii, and Streptanthus bracteatus
Figure 30 - Austin West 7.5' quadrangle (south central section)

Surveyed probable habitat for *Streptanthus bracteatus*
Figure 31 - Bee Cave 7.5' quadrangle (north central section)

Probable habitat for Amorpha roemerana, Philadelphus ernestii, and Streptanthus bracteatus
Figure 32 - Bee Cave 7.5' quadrangle (east central section)

Probable habitat for *Philadelphus ernestii* and *Streptanthus bracteatus*
Figure 33 - Shingle Hills 7.5' quadrangle (northeast corner)

Probable habitat for *Amorpha roemerana*, *Philadelphus ernestii*, and *Streptanthus bracteatus*
Figure 34 - Shingle Hills 7.5' quadrangle (central section)

Probable habitat for Amorpha roemerana, Philadelphus ernestii, and Streptanthus bracteatus