

**Assessment of Rare Plant Species and Pine Rockland Habitat at Proposed  
U.S. Army Special Operations Command South Headquarters Adjacent to the  
U.S. Air Reserve Base, Homestead, Florida**

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### *Background*

A preliminary survey of the proposed SOCSOUTH HQ facility on 90 acres of county-owned lands adjacent to the U.S. Air Force Reserve Base, Homestead, Florida revealed the presence of two rare plant species. These were *Galactia smallii* (Small's milkpea) which is listed as Endangered under the Endangered Species Act (ESA), and *Linum arenicola* (Sand flax), which is a candidate for listing under the ESA. These species were found in many parts of the 90-acre tract, at varying densities. The two species were growing in relictual pine rockland habitats that had formerly been cleared, but later regenerated. The degree of habitat quality was found to vary from high to low.

It was determined that a survey should be conducted to determine the distribution of both *Galactia smallii* and *Linum arenicola*, and the densities of each species. In addition, where rare plants did occur, an assessment of habitat quality and management recommendations was also desired.

### *Methods*

To perform a baseline, systematic assessment of the 90-acre tract, a grid consisting of 25 x 25 meters was overlain on the project boundary. Using a Global Positioning System (GPS) accurate to 1 meter (m), the entire project site was surveyed following this grid system. The center of each grid was walked, at a minimum. If potential habitat for any rare species considered as Endangered, Threatened, or a Candidate by the U.S. Fish and Wildlife Service was encountered, the cell was walked more thoroughly to determine presence or absence. A preliminary visual assessment of density of each rare species in the cell was given: low, medium, high, or very high density. These roughly equate to observing the following densities while standing in a representative station within each 25x25 m cell: Low = 1-2 plants, moderate = 3-5 plants, high = 6-10 plants, very high = >10 plants. In addition, pine rockland habitat quality was also recorded (low, medium, high). If habitat quality varied within a cell this was recorded. The grassy strip between the fence line and the runway was not walked, but no rare plants and no suitable habitat were visible through the fence.

Following the initial surveys, plot sampling was done to determine densities of rare plant species. In places where either species was determined to be of medium or higher densities, randomly placed 1 x 1 m plots were placed within populations of rare plants, and individuals of each species were counted. In areas of lower density, individuals of each species were counted.

Polygons of rare plant habitat were created from data generated during the initial grid survey. After polygons were created, a second site assessment was done to verify that polygon boundaries accurately delineated the habitats present in each rare plant location. The vegetation within each polygon was assessed. This was a qualitative assessment based on my experience in pine rockland ecosystems throughout southern Florida. Factors that were considered in assessing habitat quality were dominance of pine rockland plant species versus exotic or native weedy plant species and diversity of pine rockland plant species. Abundance of

the two rare plant species was not considered as an indicator of habitat quality since the intent was to assess overall quality of pine rockland habitat, not just that of one or two plant species.

### Results

No other species considered as Endangered, Threatened, or Candidates by the US Fish and Wildlife Service were found other than *Galactia smallii* and *Linum arenicola*. Twenty three species listed by the State of Florida Department of Agriculture and Consumer Services as Endangered, Threatened, or Commercially Exploited were found on the property (Table 3). While most of these species are State-listed, they are typical components of pine rocklands throughout southern Florida. An exception is *Ernodea cokeri*, which is extremely rare in the state, and is listed as Critically Imperiled by the Florida Natural Areas Inventory and The Institute for Regional Conservation. A small population of this species was found in Area G.

*Galactia smallii* and *Linum arenicola* were found in 27 different locations covering 13.2 acres (Map 1, Table 1). These were distributed widely on the 90-acre tract, occupying all areas but the northeastern portion. It is estimated that approximately 100,000 *Galactia smallii* and 74,000 *Linum arenicola* occur on the site. Densities ranged as high 4.5 plants m<sup>2</sup> for *Linum arenicola* and 8.0 plants m<sup>2</sup> for *Galactia smallii*.

Of the 27 areas with rare plants, Areas A, B, C, and G contain the highest quality habitat. These 4 areas cover 9.1 acres and together contain approximately 50,000 *Galactia smallii* and 61,500 *Linum arenicola*. These areas not only contain rare plant species, but are dominated by native pine rockland species. They have ground covers dominated by native grasses, and a diverse array of other native plant species.

Overall pine rockland and habitat quality on the project site does not always correlate with density of rare plant species. Many areas where *Galactia smallii* is dense are dominated by the exotic lawn grass *Zoysia tenuifolia*. *Galactia* has adapted to this artificial habitat, whereas few other native plant species manage to occur there. Examples include those mapped as Areas J and F.

Below is a description of each of the 27 areas where rare plants were found. Map 1 delineates these areas. These are also summarized in Table 1.

- A. Area: 6.05 acres      *Galactia smallii*: 33,735      *Linum arenicola*: 37,287  
Good quality habitat, among the best on the base and with the largest contiguous area. It contains the largest population sizes of both *Galactia smallii* and *Linum arenicola*. Area A is dominated by native grasses and herbs, including *Schizachyrium gracile*, *S. sanguineum*, and *Andropogon ternarius*. A diverse array of additional pine rockland plant species is also present including *Lantana involucrata*, *Coccothrinax argentata*, *Crossopetalum ilicifolium*, and *Ipomoea microdactyla*. A few *Pinus elliottii* var. *densa* are also present.

Patches of *Zoysia tenuifolia* are scattered across this area, limiting the diversity of native species (except *Galactia smallii*). There are also occasional plants of *Schinus terebinthifolius*, *Casuarina equisetifolia*, *Lantana camara*, and *Neyraudia reynaudiana*.

- B. Area: 1.10 acres      *Galactia smallii*: 10,870      *Linum arenicola*: 3,705  
Habitat varies in quality in Area B, from good quality with a diverse assemblage of native species in the westernmost portions, to *Zoysia* dominated, low diversity (but with high density of *Galactia smallii*) in the east. Higher quality areas are dominated by *Schizachyrium gracile*, *S. sanguineum*, and *Andropogon ternarius*. Several *Pinus elliottii* var. *densa* exist here.

There are large colonies of exotic plant species around the perimeters, and some clusters within the interior of this Area. These include *Schinus terebinthifolius*, *Leucaena leucocephala*, and the native but weedy *Chromolaena odorata*. There are also a number of cultivated *Ixora coccinea*.

- C. Area: 0.69 acres      *Galactia smallii*: Trace      *Linum arenicola*: 4,494  
High quality habitat with dense colonies of *Linum arenicola*. *Galactia smallii* is rare here and was not detected in sample plots. Most areas are dominated by a diverse assemblage of native species. Dominant grasses include *Schizachyrium gracile* and *S. sanguineum*. There are more native shrubs and palms here than in most other areas, including *Coccothrinax argentata*, *Byrsonima lucida*, and *Psidium longipes*.

Exotic plant species occur at low densities. There are patches of *Zoysia tenuifolia* which suppress native species. There are also patches of *Schinus terebinthifolius*, *Neyraudia reynaudiana*, and *Lantana camara*, particularly around the perimeter.

- D. Area: 0.33 acres      *Galactia smallii*: 1,116      *Linum arenicola*: 2,903  
Variable in quality, portions along Rabaul Road are of the best quality, with patches of good habitat along the railroad easement. Typical native species include *Schizachyrium gracile*, *S. sanguineum*, *Phyllanthus pentaphyllus* var. *floridana*, *Andropogon longiberbis*, *Rhynchospora floridensis*, *Aristida purpurascens*, and *Chiococca parvifolia*.

Exotic plant species are frequent, including *Neyraudia reynaudiana*, *Schinus terebinthifolius*, *Casuarina equisetifolia*, and *Lantana camara*. *Zoysia tenuifolia* is present, but currently very sparse. There is also a perimeter of *Schinus terebinthifolius* around the best.

- E. Area: 0.81 acres      *Galactia smallii*: 14,471      *Linum arenicola*: 2,199  
This is medium quality habitat due to dense infestations of the exotic grass *Zoysia tenuifolia*. *Galactia smallii* is common in this exotic grass, but *Linum arenicola* is mainly restricted to areas where the grass does not occur along the embankments of the ditch which runs across the area. Few other native pine rockland plant species occur here in

any abundance, except along the ditch banks. Native species include *Rhynchospora floridensis*, *Schizachyrium sanguineum*, and *S. gracile*.

F. Area: 0.54 acres      *Galactia smallii*: 12,379      *Linum arenicola*: Trace  
Medium to good quality habitat with dense colonies of *Galactia smallii*. *Linum arenicola* is present, but only a few plants were detected in sample plots. More *Linum* does occur along the ditch banks within the area, but random sample plots did not fall in this area. Much of the area is dominated by the exotic *Zoysia tenuifolia*, but native grasses such as *Schizachyrium sanguineum*, *S. gracile*, and *Andropogon ternarius* dominate small patches.

G. Area: 1.23 acres      *Galactia smallii*: 5,174      *Linum arenicola*: 15,928  
High quality habitat with dense colonies of *Galactia smallii* and *Linum arenicola*. Most areas are dominated by a diverse assemblage of native species. Dominant grasses include *Schizachyrium gracile*, *S. sanguineum* and *Paspalum caespitosum*. The extremely rare, State-listed Endangered *Ernodea cokeri* was also found here.

Exotic plant species occur at low densities. There are patches of *Zoysia tenuifolia* which suppress native species. There are also patches of *Schinus terebinthifolius*, *Neyraudia reynaudiana*, and *Lantana camara*, particularly around the perimeter.

H. Area: 0.26 acres      *Galactia smallii*: 8,395      *Linum arenicola*: 2,799  
Medium quality habitat with patches of the exotic *Zoysia tenuifolia*, and also colonies of native grasses such as *Schizachyrium sanguineum* and *S. gracile*.

I. Area: 0.21 acres      *Galactia smallii*: Trace      *Linum arenicola*: 3,935  
Medium quality habitat, but with a high density of *Linum arenicola*. *Galactia smallii* is present, but at such low densities that it was not detected in sample plots. Native species include the grasses *Schizachyrium sanguineum*, *S. gracile*, and *Aristida purpurascens*. Exotic plants include sparse *Zoysia tenuifolia*, and also plants of *Neyraudia reynaudiana* and *Schinus terebinthifolius*.

J. Area: 0.61 acres      *Galactia smallii*: 13,614      *Linum arenicola*: Trace  
Medium quality habitat. This Area is dominated by the exotic *Zoysia tenuifolia*. Some native grass species occur here, including *Andropogon ternarius* and *Schizachyrium sanguineum*. *Linum arenicola* occurs here, but densities were too low to be detected in sample plots.

K. Area: 0.04 acres      *Galactia smallii*: 205      *Linum arenicola*: 359  
This is a small area, but with good quality habitat and high densities of both *Galactia smallii* and *Linum arenicola*. It is dominated by native grasses including *Schizachyrium gracile* and *S. sanguineum*, and includes a diverse assemblage of additional native plant species. There are dense colonies of the exotic grass *Zoysia tenuifolia*.

- M. Area: 0.01 acres      *Galactia smallii*: 5      *Linum arenicola*: 0  
 Poor quality habitat dominated by the exotic *Zoysia tenuifolia*. Only a few *Galactia smallii* are present.
- O. Area: 0.004 acres      *Galactia smallii*: 5      *Linum arenicola*: 0  
 Poor quality habitat dominated by the exotic *Zoysia tenuifolia*. Only a few *Galactia smallii* are present.
- P. Area: 0.25 acres      *Galactia smallii*: 75      *Linum arenicola*: 0  
*Galactia smallii* is scattered at low densities throughout this patch, and most habitat quality is poor. There are small pockets of better habitat dominated *Schizachyrium gracile* and other native species, but otherwise exotic and weedy species are common, including *Zoysia tenuifolia*, *Chromolaena odorata*, *Lantana camara*, and *Stenotaphrum secundatum*.
- Q. Area: 0.02 acres      *Galactia smallii*: 5      *Linum arenicola*: 0  
 A small area of poor habitat dominated by the exotic *Zoysia tenuifolia*, with a few plants of *Galactia smallii*.
- R. Area: 0.35 acres      *Galactia smallii*: 50      *Linum arenicola*: 100  
 Patches of good habitat along edges of railroad easement, dominated by *Schizachyrium gracile* and *Schizachyrium sanguineum*. Exotic plant species are common, including *Neyraudia reynaudiana*, *Schinus terebinthifolius*, *Zoysia tenuifolia*, and *Leucaena leucocephala*.
- S. Area: 0.05 acres      *Galactia smallii*: 50      *Linum arenicola*: 0  
 Poor quality habitat. Some native species occur here, such as *Schizachyrium gracile*, but exotics and weeds are dominant, particularly *Zoysia tenuifolia*, but also *Stenotaphrum secundatum*, *Chromolaena odorata*, *Eupatorium capillifolium*, *Poinsettia heterophylla*, and *Lantana camara*.
- T. Area: 0.02 acres      *Galactia smallii*: 25      *Linum arenicola*: 0  
 Small area with medium quality habitat dominated by native species including *Schizachyrium sanguineum* and *Schizachyrium gracile*. Exotic and weedy species include *Lantana camara* and *Chromolaena odorata*.
- V. Area: 0.13 acres      *Galactia smallii*: 0      *Linum arenicola*: 20  
 Good quality habitat, but a very small area, and low densities of *Linum arenicola*. This is dominated by native grasses including *Schizachyrium gracile* and *S. sanguineum*.
- W. Area: 0.004 acres      *Galactia smallii*: 0      *Linum arenicola*: 10  
 Poor quality habitat dominated by the exotic *Zoysia tenuifolia*. Only a few *Linum arenicola* are present.

- X. Area: 0.07 acres      *Galactia smallii*: 413      *Linum arenicola*: 0  
 A small area of medium quality habitat. It is dominated by the exotic *Zoysia tenuifolia*, with some native grasses including *Schizachyrium sanguineum* and *S. gracile*.
- Y. Area: 0.12 acres      *Galactia smallii*: 20      *Linum arenicola*: 20  
 This is medium quality habitat with some native grasses including *Schizachyrium sanguineum* and *Paspalum caespitosum*. Otherwise native plant diversity is low. Small populations of *Galactia smallii* and *Linum arenicola* were found here.
- Z. Area: 0.02 acres      *Galactia smallii*: 25      *Linum arenicola*: 0  
 Poor quality habitat dominated by the exotic *Zoysia tenuifolia*. Only a few *Galactia smallii* are present.
- AA. Area: 0.004 acres      *Galactia smallii*: 5      *Linum arenicola*: 0  
 Poor quality habitat dominated by the exotic *Zoysia tenuifolia*. Only a few *Galactia smallii* are present.
- BB. Area: 0.09 acres      *Galactia smallii*: 25      *Linum arenicola*: 0  
 Poor quality habitat with sparse *Galactia smallii*. This area is dominated by the exotic *Zoysia tenuifolia*, with only a few native species.
- CC. Area: 0.07 acres      *Galactia smallii*: 20      *Linum arenicola*: 0  
 Poor quality habitat dominated by the exotic *Zoysia tenuifolia*. Only a few *Galactia smallii* are present.
- DD. Area: 0.06 acres      *Galactia smallii*: 20      *Linum arenicola*: 0  
 A small, narrow band of medium quality habitat along the edge of a parking lot with native species, there are small patches of *Galactia smallii*. Native species include *Schizachyrium gracile*, *Paspalum caespitosum*, *Eustachys petraea*, *Aristida purpurascens*, and *Andropogon longiberbis*.
- There are a few patches of *Zoysia tenuifolia*, but they are low density. There are also plants of *Schinus terebinthifolius*, *Leucaena leucocephala*, *Neyraudia reynaudiana*, and *Leucaena leucocephala*.

#### *Pine Rockland Management Recommendations*

All pine rockland areas that were delineated have been disturbed. They were all cleared mechanically and all understory palms and shrubs, and almost all trees, were removed. Following clearing native grasses and herbaceous species were able to recolonize and persist, although native shrub species and *Pinus elliottii* var. *densa* have not recruited very successfully in most places (only a few *Pinus* were seen on the site). Of great help in maintaining this recovered pine rockland habitat was infrequent mowing before 1992 which acted as a surrogate for periodic fires, a necessary disturbance in pine rocklands. Mowing helped to

maintain a low density of hardwoods, particularly exotic hardwoods, and weedy native species such as *Chromolaena odorata*, but was infrequent enough to allow grasses and herbaceous species to flower and set fruit.

Management of the better quality habitats on the project site, as determined by the USFWS and US Army Corps of Engineers, should consist of eliminating exotic and weedy plant species, transitioning the current mowing regime to a prescribed fire program, and augmenting the palm/shrub and tree layers. These are discussed below.

Exotic Plant Control. Even where habitat quality is highest, there are usually colonies of exotic plant species. The most common species on the site are *Schinus terebinthifolius*, *Zoysia tenuifolia*, and *Neyraudia reynaudiana*, although others such as *Lantana camara* and *Leucaena leucocephala* are also frequent. Control of most of these species is very straightforward using herbicides. However, *Zoysia tenuifolia* is more problematic to control because native species, including very commonly on the site *Galactia smallii*, grow entangled in the *Zoysia* ground cover. Using herbicides as a control is problematic because in most locations 100 percent of the area would have to be sprayed with herbicide, which would kill not only *Zoysia* but all native species. Several strategies should be employed to eliminate this species. Where no other native species occur (in patches of *Zoysia* surrounded by better habitat) an herbicide such as Roundup should be used. Prescribed fire can be used for some control, with Roundup being applied several weeks after a burn while native plant densities are low and cover of *Zoysia* is still low. A very effective method, although time consuming, is to cut stems of all native plant species by hand at ground level. The following day after calluses have formed on cut stems, the entire area can safely be sprayed with Roundup to kill the *Zoysia*. Native species will then resprout.

Mowing and Prescribed Burning. While periodic mowing prior to Hurricane Andrew was effective in maintaining the pine rockland habitat, it is not an effective long-term solution. It should be replaced with prescribed fire, which will provide better habitat for an even wider array of native plant species than are already present. In the absence of fire the pine rockland areas should still be mowed at intervals of 1-2 years in the winter, although experimentation should be done to ensure that species are flowering and setting seed during this interval. Prescribed fires are preferred, and should be conducted at 3-7 year intervals. For long-term management of smoke levels during burns, shorter intervals are preferred to prevent fuel accumulation between fires.

Plantings. Additional palms, shrubs, and trees are needed to re-create the structural diversity of a natural pine rockland fragment. The use of prescribed burns rather than mowing will probably allow for more recruitment of native hardwoods, so direct planting of shrubs and palms is not recommended at this time. Pine tubelings should be planted in all areas to achieve a canopy of no more than 25 percent cover. Plantings should be done after prescribed fires to allow maximum growth between burns. Plantings should also be staggered to create a multi-aged stand, with sparse densities of trees planted following each burn until the desired density is reached over 10-15 years.



Additional Exotic Control/Colonization/Restoration Areas. In addition to exotic plant control within rare plant colonies described above, additional exotic control could serve to expand habitat of rare plant species and pine rockland on the site. Many of the perimeters of rare plant populations contain colonies of exotic plants that have eliminated native plant assemblages. These areas should be cleared mechanically to eliminate all plants as well as loose organic soils, while minimizing disturbance to the bedrock. Follow up management of newly recruiting exotic plant species and conducting prescribed burns would serve to allow succession to pine rockland. This is especially true around Areas A, B, C, and G where there are already diverse, thriving assemblages of pine rockland plant species and rare plant species that would colonize into restoration areas.

**Table 1: Summary of rare plant population sizes by Area**

<b>Area</b>	<b>Acres</b>	<b><i>G. smallii</i></b>	<b><i>L. arenicola</i></b>
A	6.05	33,735	37,287
AA	0.004	5	-
B	1.10	10,870	3,705
BB	0.09	25	-
C	0.69	Trace	4,494
CC	0.07	20	-
D	0.33	1,116	2,903
DD	0.06	20	-
E	0.81	14,471	2,199
F	0.54	12,379	Trace
G	1.23	5,174	15,928
H	0.26	8,395	2,799
I	0.21	Trace	3,935
J	0.61	13,614	Trace
K	0.04	205	359
M	0.01	5	-
O	0.004	5	-
P	0.25	75	-
Q	0.02	5	-
R	0.35	50	100
S	0.05	50	-
T	0.02	25	-
V	0.13	-	20
W	0.004	-	10
X	0.07	413	-
Y	0.12	20	20
Z	0.02	25	-

**Table 2: Scientific and Common Names used in text**

<b>Scientific Name</b>	<b>Common Name</b>
<i>Andropogon longiberbis</i>	Hairy bluestem
<i>Andropogon ternarius</i>	Splitbeard bluestem
<i>Aristida purpurascens</i>	Arrowfeather threeawn
<i>Byrsonima lucida</i>	Locust berry
<i>Casuarina equisetifolia</i>	Australian-pine
<i>Chiococca parvifolia</i>	Pineland snowberry
<i>Chromolaena odorata</i>	Jack-in-the-bush
<i>Coccothrinax argentata</i>	Silver palm
<i>Crossopetalum ilicifolium</i>	Quail berry
<i>Ernodea cokeri</i>	Coker's beach creeper
<i>Eupatorium capillifolium</i>	Dogfennel
<i>Eustachys petraea</i>	Pinewoods fingergrass
<i>Galactia smallii</i>	Small's milkpea
<i>Ipomoea microdactyla</i>	Man-in-the-ground
<i>Ixora coccinea</i>	Scarlet jungleflame, Ixora
<i>Lantana camara</i>	Shrubverbena
<i>Lantana involucrata</i>	Buttonsage
<i>Leucaena leucocephala</i>	White leadtree
<i>Linum arenicola</i>	Sand flax
<i>Neyraudia reynaudiana</i>	Burma reed
<i>Paspalum caespitosum</i>	Blue crowngrass
<i>Phyllanthus pentaphyllus</i> var. <i>floridana</i>	Fivepetal leafflower
<i>Pinus elliottii</i> var. <i>densa</i>	Slash pine
<i>Poinsettia heterophylla</i>	Fiddler's spurge
<i>Psidium longipes</i>	Long stalked stopper
<i>Rhynchospora floridensis</i>	Florida whitetop
<i>Schinus terebinthifolius</i>	Brazilian-pepper
<i>Schizachyrium gracile</i>	Wire bluestem
<i>Schizachyrium sanguineum</i>	Crimson bluestem
<i>Stenotaphrum secundatum</i>	St. Augustine grass
<i>Zoysia tenuifolia</i>	Manila templegrass

Table 3: State-listed Endangered, Threatened, and Commercially Exploited Plant Species found on the project site

<b>Scientific Name</b>	<b>Common Name</b>	<b>State List</b>
<i>Angadenia berteroi</i>	Pineland golden trumpet	Threatened
<i>Byrsonima lucida</i>	Locustberry	Threatened
<i>Chaptalia albicans</i>	White sunbonnets	Threatened
<i>Coccothrinax argentata</i>	Florida silver palm	Threatened
<i>Crossopetalum ilicifolium</i>	Quailberry	Threatened
<i>Cynanchum blodgettii</i>	Blodgett's swallowwort	Threatened
<i>Ernodea cokeri</i>	Coker's beach creeper	Endangered
<i>Galactia smallii</i>	Small's milkpea	Endangered
<i>Ipomoea microdactyla</i>	Man-in-the-ground	Endangered
<i>Jacquemontia curtisii</i>	Pineland clustervine	Threatened
<i>Lantana depressa</i>	Rockland shrubverbena	Endangered
<i>Linum arenicola</i>	Sand flax	Endangered
<i>Phyla stoechadifolia</i>	Southern fogfruit	Endangered
<i>Poinsettia pinetorum</i>	Pineland spurge	Endangered
<i>Psidium longipes</i>	Long stalked stopper	Threatened
<i>Pteris bahamensis</i>	Bahama ladder brake	Threatened
<i>Sachsia polycephala</i>	Bahama sachsia	Threatened
<i>Scutellaria havanensis</i>	Havana scullcap	Endangered
<i>Smilax havanensis</i>	Everglades greenbrier	Threatened
<i>Spermacoce terminalis</i>	Everglades false buttonweed	Threatened
<i>Thelypteris augescens</i>	Abrupt-tip maiden fern	Threatened
<i>Tragia saxicola</i>	Rockland noseburn	Threatened
<i>Zamia integrifolia</i>	Coontie	Commercially Exploited

Figure 1: *Linum arenicola* (photo by Keith A. Bradley)



Figure 2: *Galactia smallii* (photo by Richard Reaves)

