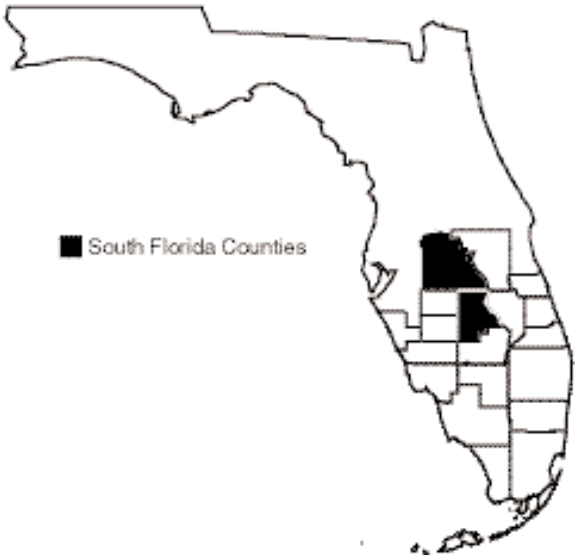
Wireweed

Polygonella basiramia (= ciliata var. *b.)* (Small) Nesom and Bates

Federal Status:	**Endangered (January 21, 1987)**
Critical Habitat:	**None Designated**
Florida Status:	**Endangered**
Recovery Plan Status:	**Revision (May 18, 1999)**
Geographic Coverage:	**Rangewide**

Figure 1. County distribution of wireweed.



Polygonella basiramia is an herbaceous perennial endemic to the central ridges of the Florida peninsula. One of a suite of herbs found primarily in the rosemary phase of sand pine scrub, *P. basiramia* requires periodic disturbance, such as fire, to maintain habitat suitable for its survival and persistence. Today, the primary threats to this plant are the destruction of scrub vegetation and the lack of large-scale disturbance events.

This account represents a revision of the existing recovery plan for the wireweed (FWS 1996).

Description

The Lake Wales Ridge in central Florida is the center of diversity for the genus *Polygonella*, whose species have remarkably diverse growth habits ranging from tall and leafy, to upright and virtually leafless (wireweeds), to prostrate (Horton 1960). Though it was incorrectly reported as an annual by Lewis and Crawford (1995), *P. basiramia* is a short-lived, perennial herb (Hawkes, University of Pennsylvania, personal communication 1995). When vegetative, the plant consists entirely of basal, compressed stems with narrow, alternate leaves. Ocreae, the sheaths formed at stem nodes, are ciliate. Stems and leaves range in color from green to dark red; red coloration in the stems and leaves appears to be associated with individuals more exposed to sunlight and with older vegetative parts (although even seedlings are often red). As basal stems elongate, plants develop 1 to 46 slender, flowering, spike-like panicles as tall as 0.8 m (Hawkes and Menges 1995). This species is gynodioecious and plants have either only female flowers or hermaphroditic flowers. Individual flowers are small, white to slightly pink with 5 sepals (no petals), pink pistils, and black anthers. The gynoecium consists of 3 united carpels, 1-ovuled, ovary superior. Flowering occurs from the top spikelet downward on each stem. The fruit is a three-sided achene 1 to 3 mm in length.

Polygonella basiramia can be distinguished from *P. ciliata* based on growth form and filaments of the stamens (Nesom and Bates 1984). Whereas *P. basiramia* branches at ground level, *P. ciliata* does not do so until 10 to 50 cm above ground. Both species have basally dilated filaments with an additional basal, bilateral flange. In *P. basiramia*, the short, interwoven trichomes of the flange on each filament together surround the ovary in an undefined mass. In *P. ciliata*, the flanges are sharply defined and appear as flat sheets of tissue (Nesom and Bates 1984).

Taxonomy

Originally named *Delopyrum basiramia* by Small in 1924 (Nesom and Bates 1984), this species was later thought to be a variety of *Polygonella ciliata* by Horton (1963). In 1984 Nesom and Bates recognized *P. basiramia* as a separate species. This species is commonly known as hairy or tufted wireweed.

Polygonella basiramia is most closely related to *P. ciliata* and *P. gracilis* (Lewis and Crawford 1995). *P. basiramia* and *P. ciliata* are believed to have originated from *P. gracilis*, but whether they did so independently or from a single intermediate ancestral species is unknown.

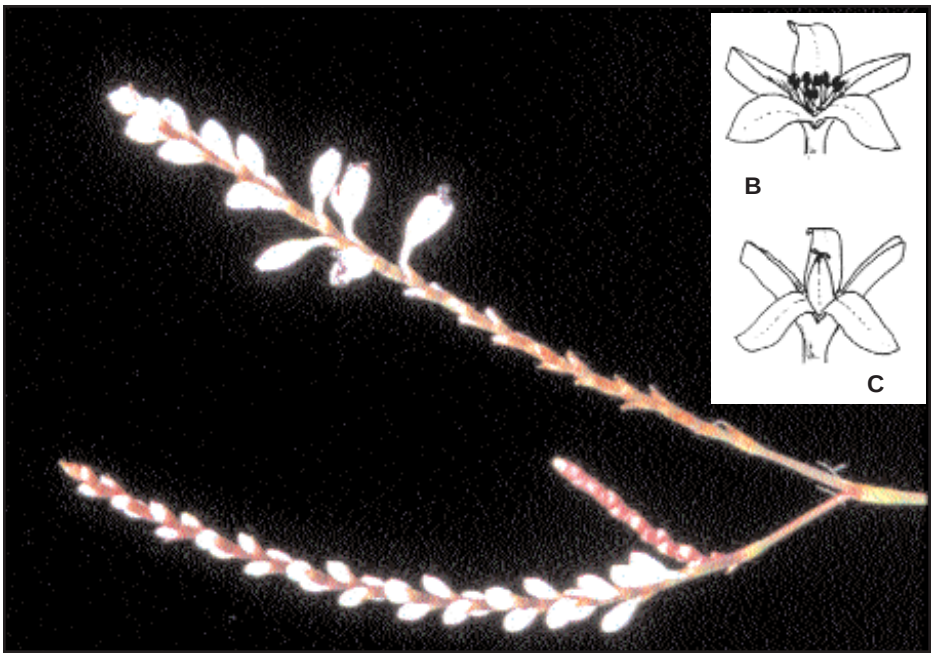
Distribution

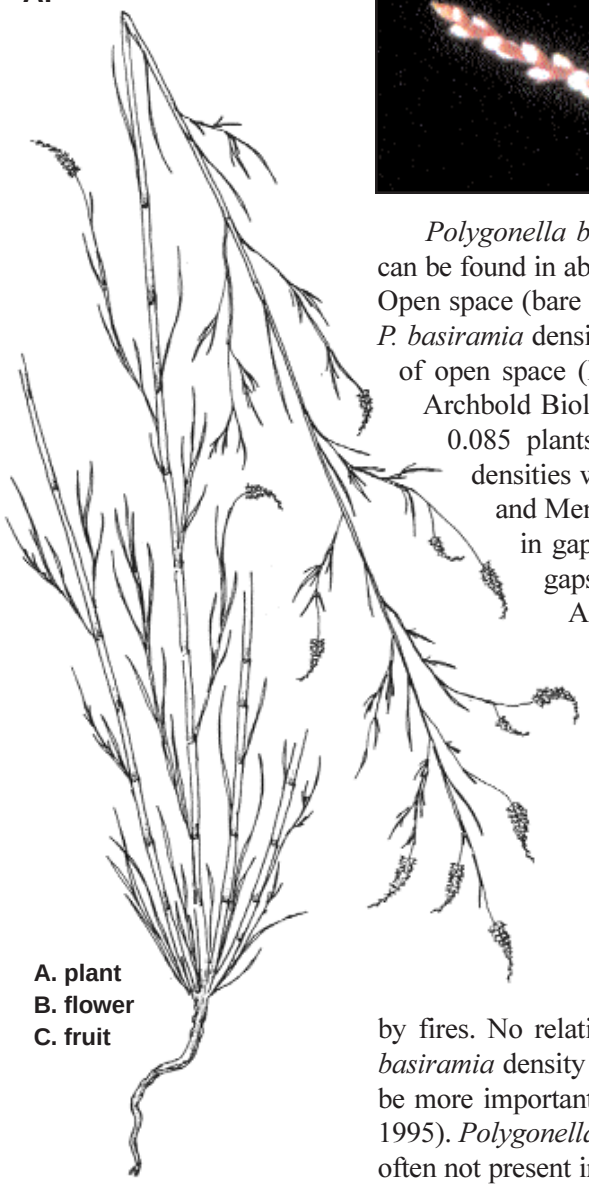
Polygonella basiramia is endemic to the Lake Wales, Winter Haven, and Bombing Range ridges in central peninsular Florida. It ranges from Lake Pierce in Polk County southward to Venus near the southern tip of the Lake Wales Ridge in Highlands County (Christman and Judd 1990) (Figure 1). Christman (1988) found *P. basiramia* at 123 scrub sites.

Habitat

Polygonella basiramia is most commonly found in rosemary scrub, also known as rosemary phase of sand pine scrub (Abrahamson *et al.* 1984, Menges and Kohfeldt 1995). At Archbold Biological Station, rosemary scrubs are found only on the higher ridges and knolls at 40 to 50 m in elevation, and are largely restricted to St. Lucie and Archbold soil types (Abrahamson *et al.* 1984), both well drained white sands (Carter *et al.* 1989). Outside Archbold Biological Station, rosemary scrubs are generally found on white sands and higher elevations (Hawkes, University of Pennsylvania, personal communication 1998). The fire cycle in rosemary scrub can range from 10 to as long as 100 years (Johnson 1982, Myers 1990). Rosemary scrub is dominated by Florida rosemary (*Ceratiola ericoides*) and oak species (*Quercus chapmannii*, *Q. geminata*, *Q. inopina*) with occasional sand pine *(Pinus clausa*). Abrahamson *et al.* (1984) provide a full description of the rosemary scrub habitat. The shrub matrix is interspersed with open sandy areas that contain a cover of herbs and lichens (Abrahamson *et al.* 1984, Hawkes and Menges 1996); these gaps are more persistent in rosemary scrubs than in scrubby flatwoods (Menges and Hawkes 1997).

Wireweed.
Original drawings by Anna-Lisa King.; original photograph by Steve Shirah.





Polygonella basiramia occupies open spaces or gaps between shrubs and can be found in abundance along sandy fire lanes, which provide similar habitat. Open space (bare sand) in rosemary scrub was found to be a good indicator of *P. basiramia* density: higher plant densities are associated with greater amounts of open space (Hawkes and Menges 1995). Within rosemary scrub sites at Archbold Biological Station, density of *P. basiramia* ranged from 0.000 to 0.085 plants per m^2. Along fire lanes where open sand is abundant, densities were much higher, with a mean of 8.1 plants per m^2 (Hawkes and Menges 1995). Compared to other herbs, *P. basiramia* can persist in gaps of smaller size and is often found in the small, ephemeral gaps of scrubby flatwoods which border rosemary scrub (Hawkes, Archbold Biological Station, personal communication 1995). As gaps begin to close, there may be a shift in species composition among *Eryngium cuneifolium*, *Hypericum cumulicola,* and *P. basiramia;* with the bare sand specialist *E. cuneifolium* being lost first, followed by *H. cumulicola*, then *P. basiramia* (Quintana-Ascensio, Archbold Biological Station, personal communication 1995).

In rosemary scrub, open space decreases from nearly 100 percent immediately after fire to approximately 30 percent 4 years after fire when a great deal of habitat variation exists (Hawkes and Menges 1996). Gaps are affected by the fire cycle, because they are originally created by fires. No relationship, however, was found between time-since-fire and *P. basiramia* density (Hawkes and Menges 1995). Small-scale gap dynamics may be more important than the fire regime for *P. basiramia* (Hawkes and Menges 1995). *Polygonella basiramia* is an obligate seeder (Menges and Kohfeldt 1995**)** often not present in the first few years after fire, but whether it recovers through delayed post fire germination from a soil seed bank or disperses into sites remains unknown.

Reproduction

Polygonella basiramia is gynodioecious, with individual plants producing either pistillate (female) or perfect flowers (both sexes in a single flower). The ratio of female to hermaphroditic plants is 1:1 at Archbold Biological Station (Hawkes and Menges 1995). Pollinators of *P. basiramia* include small halictid bees, *Perdita polygonellae* (a bee specific to the genus *Polygonella*), Eumenidae wasps, and potentially *Glabellula* spp. (Bombyliidae) (M. Deyrup, Archbold Biological Station, personal communication 1995).

Seed production by female plants greatly exceeds that of perfect plants, with an average of 217.8 seeds per stem for females, but only 32.1 for perfect plants. *P. basiramia* is an obligate seeder which means that no adult plants survive a fire event and all new growth is from seedlings. On a population level, the number of seeds produced by *P. basiramia* in one reproductive season is more than 30 times the average plant density, sufficient to replace existing populations if only 3 percent of seeds were able to germinate and survive.

Density and seed production of *P. basiramia*, in relation to open sand and time post fire was studied by Hawkes and Menges (1995). Their analysis showed that *P. basiramia* densities and burn interval were not related, so it appears that *P. basiramia* can persist for many years without fire in the long-lasting sandy areas of rosemary balds. However, this species may require small-scale disruptions of the soil crust for populations to persist. Density and seed production of *P. basiramia* both increased with the area of open sand and were highest along firelanes where the soil crust had been disturbed by chopping (C. Hawkes, University of Pennsylvania, personal communication 1998). Large areas of open sand have especially dense populations of the plant, and seed production is greater on high-density than it is on low-density sites. They suggest that *P. basiramia* plants are sensitive to competition from shrubs, and only slightly sensitive to competition from each other. The lack of intraspecific competition probably is due to *P. basiramia* plants having shallow root systems bearing their leaves at ground level. Dense *P. basiramia* populations may also be especially attractive to pollinators that may also account for the high seed production.

Seedlings of *P. basiramia* at Archbold Biological Station and Lake Wales Ridge SF have been observed in highest numbers between late November and January. Flowering begins in September and achenes are produced in late November and early December. Because flowering is sequential, beginning at the top of each spike-like panicle and moving downwards, flowers and achenes are present at the same time mid-autumn. Achenes drop readily from the plant and most fall by mid-January.

Relationship to Other Species

A wide variety of herbs, grasses, small shrubs, and lichens (*Cladonia* spp.) utilize the same gap habitats as *P. basiramia*, but relationships among these species have not been studied extensively. These species include: *Calamintha ashei*, *Cnidosculus stimulosus*, *Eryngium cuneifolium*, *Euphorbia floridana*, *Hypericum cumulicola*, *Lechea cernua*, *L. deckertii*, *Licania michauxii, Paronychia chartacea, Polanisia tenuifolia, Polygonella polygama, P. robusta, Selaginella arenicola*, and *Stipulicida setacea*.

Christman (1988) reports that populations intermediate between *P. basiramia* and *P. ciliata* occur in scrubs near Lake Pierce and Lake Weohyakapka in Polk County, populations of *P. ciliata* occur in the same area, and that specimens from a Highlands County site have been tentatively assigned to *Polygonella ciliata*. However K. DeLaney (Environmental Research Consultants, Inc., personal communication 1995) cautions that in his experience, *P. basiramia* is a very distinctive species whose habitat does not overlap with that of *P. ciliata*, and that *P. gracilis* is easily misidentified as *P. ciliata* during its leafless phase.

In addition to the associations already described, soil crust organisms may provide a sealed surface layer for seed germination and a source of nitrogen for adult vascular plants like *P. basiramia* (C. Hawkes, University of Pennsylvania, personal communication 1998).

Status and Trends

Polygonella basiramia was federally listed January 21, 1987 (52 FR 2234), because of habitat loss and modification. It is restricted in distribution with a small number of remaining sites and is faced with continued and dramatic habitat loss. In addition, modification by trampling and off-road vehicles impacts some of the remaining habitat. Scrub habitat continues to diminish in the wake of land clearing for residential housing construction, citrus groves, and cattle ranches. Only if a sufficient amount of suitable habitat is conserved and properly managed will *P. basiramia* remain locally abundant.

The persistence of appropriate habitat for *P. basiramia* is dependent on disturbance processes which periodically create gaps. Historically, fire has been a large-scale disturbance which maintained open patches of different ages across the landscape. Today, wildfires no longer sweep through central Florida. Although *P. basiramia* also appears to be able to take advantage of smaller-scale disturbances which disrupt soil crust and create space (such as animal paths and burrow mounds), this has not been studied and such disturbances may only be suitable for colonization if created at the right place and time. In unmanaged areas, lack of disturbance, especially in less xeric sites where open space is fleeting, will be a major threat to *P. basiramia*.

Stratigraphic cores from Lake Annie (Archbold Biological Station, Highlands County) contained pollen from what was thought to be *P. ciliata* 37,000 ± 3,200 years ago. Watts (1975, 1980) reported that the flora from before 44,300 years ago to after 33,000 years ago was a dry, rosemary-dominated scrub habitat, much like what exists today. Because pollen from *P. basiramia* and *P. ciliata* are indistinguishable, the Lake Annie record is more than likely attributable to *P. basiramia* or a recent ancestor of both species. *Polygonella basiramia* may have been present on the central ridges as early as the mid-to late Pleistocene when its habitat, sand pine scrub, is thought to have originated (Laessle 1958).

The protected sites for *P. basiramia* include Catfish Creek, Lake Arbuckle State Preserve, and Saddle Blanket Lakes, Highlands Hammock SP, Flamingo Villas, Placid Lakes, Archbold Biological Station, Lake Apthorpe, and the west side of Lake June in Winter, Florida. It is present at targeted acquisition sites including Holmes Avenue (East), Avon Park Lakes, Carter Creek, Eagle Lake, Flaming Arrow, Polk #52, and Sun Ray.

Management

Florida scrub is a fire-adapted community experiencing shifting fire intensity and frequency (Myers 1990). The fire cycle in rosemary scrub can range from 10 to as long as 100 years (Johnson 1982, Myers 1990). This species is an obligate seeder that does not mature for 10 to 15 years and is adapted for a 10-40 year fire interval (Johnson 1982). Unlike oak-dominated scrubs, rosemary scrubs recover slowly from burns (Johnson *et al.* 1986) and openings persist longer. These openings are used by a number of rosemary scrub endemics, such as *Cladonia* spp., *Calamintha ashei*, *Cnidosculus stimulosus*, *Eryngium cuneifolium*, *Euphorbia floridana*, *Hypericum cumulicola*, *Lechea cernua*, *L. deckertii*, *Licania michauxii, Paronychia chartacea, Polanisia tenuifolia, Polygonella polygama, P. robusta, Selaginella arenicola*, and *Stipulicida setacea*. In designing fire management for rosemary scrubs, responses of the particular species present must be taken into account when planning fire return intervals (Hawkes and Menges 1995). Menges and Kohfeldt (1995) suggest a 15 to 40 year burn interval with mosaic burns on large pieces of property.

Using fire to manage the habitat is the preferred option for *P. basiramia*. In rosemary scrub, open space decreases from nearly 100 percent immediately after fire to approximately 30 percent at 4 years post fire, after which a great deal of variation exists (Hawkes and Menges 1996). Gaps are affected by the fire cycle, as they are originally created by fires. There is no relationship, however, between fire intervals and *P. basiramia* density. Small-scale gap dynamics may be more important than the fire regime for *P. basiramia* (Hawkes and Menges 1995). *Polygonella basiramia* is an obligate seeder (Menges and Kohfeldt 1995**)** often not present in the first few years after fire, but whether it recovers through delayed post fire germination from a soil seed bank or disperses into sites remains unknown. *Polygonella basiramia* seedlings require about 1 year to mature and set seed, so populations would not recover if fires occur at intervals insufficient for sprouting and maturity (Hawkes and Menges 1995). Long fire-return intervals may not negatively affect *P. basiramia* if openings persist, but it may be harmful to other species that share the habitat (Hawkes and Menges 1995)

In cases where fire is not an option, mechanical disturbance can have some benefits by providing openings.

Literature Cited

Abrahamson, W.G., A.E. Johnson, J.N. Layne, and P.A. Peroni. 1984. Vegetation of the Archbold Biological Station, Florida: an example of the southern Lake Wales Ridge. Florida Scientist 47:209-250.

Carter, L.J., D. Lewis, L. Crockett, and J. Vega. 1989. Soil survey of Highlands County, Florida. U.S. Department of Agriculture, Soil Conservation Service.

Christman, S.P. 1988. Endemism in Florida's scrub interior. Project No. GFC-84-101, Florida Game and Freshwater Fish Commission; Tallahassee, Florida.

Christman, S.P. and W.S. Judd. 1990. Notes on plants endemic to Florida scrub. Florida Scientist 53:52-73.

Delaney, K. 1995. FWS Multi-Species Recovery Team Meeting. December 6-8, 1995.

Hawkes, C.V. and E.S. Menges. 1996. The relationship between open space and fire for species in a xeric Florida shrubland. Bulletin Torrey Botany Club 123(2):81-92.

Hawkes, C.V. and E.S. Menges. 1995. Density and seed production of a Florida endemic, *Polygonella basiramia*, in relation to time since fire and open sand. American Midland Naturalist 133:138-148.

Hawkes, C. 1995. Comments on draft account. July 1995.

Hawkes, C. 1998. Comments on draft species account. January 21.

Horton, J.H. 1960. A monograph of *Delopyrum* Small, *Dentoceras* Small, *Polygonella* Michx., and *Thysanella* Gray (Polygonaceae). Unpublished PhD dissertation, University of North Carolina, Chapel Hill, North Carolina.

Johnson, A. 1982. Some demographic characteristics of the Florida rosemary *Ceratiola ericoides* Michx. American Midland Naturalist 10:170-174.

Johnson, A. F., W.G. Abrahamson, and K.D. McCrea. 1986. Comparison of biomass recovery after fire of a seeder (*Ceratiola ericides*) and a sprouter (*Quercus inopina*) species from south-central Florida. American Midland Naturalist 116:423-428.

Laessle, A.M. 1958. The origin and successional relationships of sandhill vegetation and sand-pine scrub. Ecological Monographs 28:361-387.

Lewis, P.O. and D.J. Crawford. 1995. Pleistocene refugium endemics exhibit greater allozymic diversity than widespread congeners in the genus *Polygonella* (Polygonaceae). American Journal of Botany 82:141-149.

Menges, E.S. and N. Kohfeldt. 1995. Life history strategies of Florida scrub plants in relation to fire. Bulletin Torrey Botanical Club 122:282-297.

Myers, R.L. 1990. Scrub and high pine. Pages 150-193 *in* R.L. Myers and J.J. Ewel (eds.). Ecosystems of Florida. University of Central Florida Press; Orlando, Florida.

Nesom, G.L. and V.M. Bates. 1984. Reevaluations of intraspecific taxonomy in *Polygonella* (Polygonaceae). Brittonia 36:3744.

Quintana-Ascensio, P. 1995. FWS Multi-Species Recovery Team Meeting. December 6-8, 1995.

U.S. Fish and Wildlife Service [FWS]. 1996. Recovery plan for nineteen central Florida scrub and high pineland plants (revised). U.S. Fish and Wildlife Service; Atlanta, Georgia.

Watts, W.A. 1975. A late Quaternary record of vegetation from Lake Annie, south-central Florida. Geology 3:344-346.

Watts, W.A. 1980. The late Quaternary vegetation history of the southeastern United States. Annual Review Ecological Systems 11:387-409.

Recovery for the Wireweed

Polygonella basiramia (= ciliata var. b.*)* (Small) Nesom and Bates

Recovery Objective: RECLASSIFY to threatened.

Recovery Criteria

Polygonella basiramia may be reclassified from endangered to threatened when: enough demographic data are available to determine the appropriate numbers of self-sustaining populations and sites needed to assure 20 to 90 percent probability of persistence for 100 years; when these sites, within the historic range of *P. basiramia*, are adequately protected from further habitat loss, degradation, and fragmentation; when these sites are managed to maintain the rosemary phase of xeric oak scrub communities to support *P. basiramia*; and when monitoring programs demonstrate that populations of *P. basiramia* on these sites support the appropriate numbers of self-sustaining populations, and those populations are stable throughout the historic range of the species. Individuals growing opportunistically in unnatural areas, for example fire lanes, should be excluded from consideration when determining the status of this species.

This recovery objective is an interim goal because of the limited data on the biology, ecology, and management needs of this species. The recovery objective will be reassessed annually based on new research, management, and monitoring information. Reclassification criteria may be refined if new information identifies ways of re-establishing populations of this species to expand its current distribution within its historic range.

Species-level Recovery Actions

S1. Determine current distribution status of *Polygonella basiramia*. This species' distribution is somewhat questionable for taxonomic reasons. A thorough survey is needed to determine the distribution for this species.

S1.1. Conduct surveys for populations of *P. basiramia*.

S1.1.1. Continue surveys in Polk and Highlands counties. The Lake Wales Ridge has been well surveyed, but because it is quite common within this region, new sites may still be found. Polk County should be the focus of survey work.

S1.1.2. Continue surveys on protected lands. New sites for listed species are still being found on protected lands. This survey work should be continued to catalog all existing protected sites and new sites as they are purchased.

S1.2. *Polygonella basiramia* identification. Some uncertainty remains over the identification of this plant (versus *Polygonella ciliata* and *P. gracilis*), and therefore its geographic range is somewhat unclear. Herbarium specimens from as many protected sites as possible (especially Avon Park AFR) should be evaluated by a

systematist to assure that they have been identified correctly. If they are not already available, voucher specimens must be collected from protected sites, especially in Polk County where the distributions of the two species might overlap. The systematics of these species was reviewed by Nesom and Bates (1984), and there is no apparent need for further systematic investigations.

S1.3. Maintain distribution of known populations and suitable habitat in GIS database. Use GIS to map existing populations and to assess the species' status and trends over time. The database should contain information on locations, population sizes, and status. This information should also be used for project review, in land acquisition activities, and to coordinate updates with the Florida Natural Areas Inventory database. Currently, the Lake Wales Ridge Ecosystem Working Group and Archbold Biological Station are proposing to map the entire central ridge. This information would show potential habitat for scrub endemics based on their habitat needs.

S2. Protect and enhance existing populations. Much of the native xeric uplands on the Lake Wales Ridge and surrounding counties have been converted to agriculture or urban development. The remaining habitat is fragmented into small parcels and in many cases, isolated. For this reason, existing populations are in need of protection from a variety of threats.

S2.1. Protect populations on private land through acquisition, conservation easements, or agreements with landowners.

S2.2. Protect populations on public lands. Develop management guidelines that allow for a fire regime that includes a mosaic of successional stages.

S2.3. Continue *ex situ* conservation. *Ex situ* collections are important for preserving genetic diversity, preventing extirpation, and determining ecological characteristics and habitat management needs of species. These collections will be instrumental in the recovery of *P. basiramia*.

S2.3.1. Conserve germ plasm. The seed of this species is not presently in long-term storage.

S2.3.2. Maintain *ex situ* collection. Currently, the Center for Plant Conservation coordinates conservation activities and maintains a database for the National Collection. Bok Tower Gardens, as a participating institution, maintains and propagates *P. basiramia* as part of the National Collection.

S2.4. Enforce available protective measures. Use local, State and Federal regulations to protect this species. Regulations should also be used to protect xeric vegetative communities where *P. basiramia* lives.

S2.4.1. Initiate section 7 consultation when applicable. Initiate section 7 consultations when Federal activities may affect this species.

S2.4.2. Enforce take prohibitions. This species is protected by take provisions of the Endangered Species Act (including its prohibition against removing and reducing to possession any endangered plant from areas under Federal jurisdiction; maliciously damaging or destroying any such species on any such area; or removing, cutting, or digging up any such species), by the Preservation of Native Flora of Florida Act, and by the Florida rules regarding removal of plants from State lands.

S3. Conduct research on life history characteristics. Though much of the basic biology and ecology of this species is understood, to effectively recover this species additional biological information is needed.

S3.1. Conduct research to determine demographic information, such as numbers of sites and populations, numbers of individuals in a population, recruitment, survival, microhabitat requirements, and mortality. Dispersal is an important issue for this species.

S3.2. Once demographic data are known, conduct population viability and risk assessment analysis to determine the numbers of plants, sites, subpopulations/populations, and spatial distribution needed to ensure persistence of the species.

S3.3. Conduct research to assess management requirements of *P. basiramia*. Determine which natural populations can be stabilized or increased by habitat management. Surveys, research, and monitoring information on the localities of *P. basiramia* sites will provide factors contributing to any declines at each site. Monitoring of populations should be in reference to various habitat management practices. Site-specific management guidelines should be provided to land managers and close coordination among land managers is essential to develop adaptive management techniques.

S4. Monitor existing populations of *Polygonella basiramia*.

S4.1. Develop monitoring protocol to assess population trends for *P. basiramia*.

S4.1.1. Monitor to detect changes in demographic characteristics, such as reproduction, recruitment, growth, dispersal, survival, and mortality. Also monitor for pollinators, herbivory, disease, and injury.

S4.1.2. Monitor the effects of various land management actions on *P. basiramia*. Assess any changes in demographic characteristics of *P. basiramia* in response to land management activities, such as prescribed fire, exotic plant control, *etc*.

S4.2. Develop a quantitative description of the population structure of *P. basiramia*. This description will provide a baseline for monitoring population dynamics in response to natural environmental changes and management treatments. Data recorded should include morphology, survivorship, mortality, and reproduction for individual plants. It should also include data about each plant's microsite (vegetation cover, litter depth, substrate, and closest neighbors).

S5. Provide public information about *P. basiramia*. It is important for the recovery of this species that governmental agencies, conservation organizations such as the Florida Native Plant Society, and private landowners be appropriately informed about this species.

Habitat-level Recovery Actions

H1. **Prevent degradation of existing habitat.** Extensive habitat loss, degredation, and fragmentation have already occurred throughout the range of this species. Both development and fire suppression have decreased the available habitat. To date, there are 13 protected or planned acquisition sites for *P. basiramia*.

H1.1. **Secure habitat through acquisition, landowner agreements, and conservation easements.** Since little xeric scrub habitat remains for this species, any method of securing unprotected populations should be sought.

H1.2. **Manage and enhance habitat.** Manage habitat to maintain P. basiramia populations by providing proper management of habitat, including prescribed fire.

H1.2.1. **Conduct prescribed burns.** Fire is a necessary and integral characteristic of the scrub community. A variable interval in fire return and in season is important to mimic the natural fire regime. A 15 to 40 year cycle is recommended for *Polygonella basiramia.* In addition, spatial variation in fire intensity and unburned patches is necessary to construct a natural fire landscape. The scrub is naturally made up of islands of suitable and unsuitable habitat. To repeat this landscape pattern, sites should be burned as a mosaic when possible to allow for variation.

H1.2.2. **Control and eliminate exotic and invasive plants and animals.** Exotic plant and animal species are not yet a major threat in Florida scrub as compared to other communities in South Florida. However, in isolated areas, exotic species are becoming established. Without control, exotic/invasive plants may become a threat to the survival and recovery of *P. basiramia*.

H2. **Restore areas to suitable habitat.** Native habitats that have been disturbed or that have experienced a long history of fire suppression may be good candidates for future reserves. Rehabilitation of a site may be a lengthy process, but with fewer and fewer sites remaining, these sites may become more valuable for future recovery. On these sites a seed bank may exist that could include rare endemic species.

H2.1. **Restore natural fire regime**. Long periods without fire can change the species composition and the ability of the site to carry fire.

H2.2. **Ensure natural populations.** This species grows readily in fire lanes and old road beds. These should not be considered natural populations and should not be counted toward the recovery of this species.

H3. **Conduct habitat-level research projects.** Study the response of *P. basiramia* to various land management practices, such as prescribed fire regimes, vegetative thinning, and control of exotic/invasive vegetation. More information is needed on the response to management activities for this species.

H4. **Monitor habitat/ecological processes.** Monitor the effects of land management actions, such as prescribed fire, exotic plant control, *etc.,* on the habitats where *P. basiramia* occurs.

H5. **Provide public information about scrub and its unique biota.** Educational efforts, especially those conducted by Archbold Biological Station, have been successful. Without these successful efforts, the Lake Wales Ridge NWR would not have been created. Florida's

system of biological preserves depends on a broad base of public understanding and support for its funding and future success. In addition to past and ongoing educational efforts by The Nature Conservancy, Bok Tower Gardens, and Archbold Biological Station, future efforts by these organizations, and the Florida Park Service, the Florida Division of Forestry, the SFWMD, the Florida Native Plant Society, and local garden clubs are crucial in increasing public appreciation of scrub and high pine communities, and their associated plant species. The Arbuckle Appreciation Day sponsored by the Florida Division of Forestry has been especially successful in disseminating knowledge about these unique communities.