

**REVISION OF THE *ANDROPOGON TERNARIUS* COMPLEX
OF SECT. *LEPTOPOGON* (POACEAE)
WITH TWO NEW SPECIES FROM PENINSULAR FLORIDA**

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ABSTRACT

The *Andropogon ternarius* complex (section *Leptopogon*) has long been taxonomically troublesome, particularly within its center of diversity in Florida, and was not included in the last revision of this section. Two cryptic species, ***Andropogon cumulicola*** E.L. Bridges & Orzell, **sp. nov.**, and ***Andropogon miamiensis*** E.L. Bridges & Orzell, **sp. nov.**, are described in relation to three allied taxa, *A. arctatus* Chapm., *A. ternarius* Michx., and *A. cabanisii* Hackel. All are pyrophytic species, flowering profusely following lightning season fires. *Andropogon cumulicola* is a psammophyte of sub-xeric uplands and is apparently endemic to peninsular Florida. It is distinguished from *A. arctatus* by its caespitose habit, sparsely hairy leaves, and longer peduncles and spikelets. In contrast, *A. arctatus* is rhizomatous, with densely whitish-villous basal leaves and occurs in seepage slopes and wet pineland savannas primarily in the Florida panhandle. *Andropogon miamiensis* is described as a narrow endemic of pine rockland savannas in Miami-Dade and Monroe counties, Florida. It is distinguished from *A. cabanisii* by its larger stature, and longer bluish-glaucous leaves.

Andropogon L. (Poaceae: Andropogoneae) is a wide-ranging pantropical and warm-temperate genus of 110-120 species, all with the C₄ photosynthetic pathway (Nagahama & Norrmann 2012). The genus comprises four sections — *Andropogon* Stapf, *Leptopogon* Stapf, *Notosolen* Stapf, and *Piestium* Stapf (Nagahama et al. 2014). In the western hemisphere, *Andropogon* comprises about 60 species grouped in the first three of these sections (Nagahama & Norrmann 2012). Most species of sect. *Leptopogon* in the western hemisphere are within three species complexes — the *Andropogon lateralis* complex (hexaploid species of South America), the *A. selloanus* complex (South and Central American diploid species), and the *Andropogon virginicus* complex (North American diploid species) (Nagahama et al. 2013, 2014). As circumscribed by Campbell (1983, 2003) sect. *Leptopogon* includes 12 species and numerous infraspecific taxa in North America north of Mexico.

All 12 of the species of sect. *Leptopogon* recognized by Campbell occur in Florida: *Andropogon arctatus* Chapm., *A. bicornis* L., *A. brachystachyus* Chapm., *A. floridanus* Scribn., *A. glomeratus* (Walt.) B.S.P. (with four varieties), *A. gracilis* Spreng., *A. gyrans* Ashe (two varieties), *A. liebmannii* Hack. var. *pungensis* (Ashe) C.S. Campb., *A. longiberbis* Hack., *A. tracyi* Nash, *A. ternarius* Michx. (two varieties), and *A. virginicus* L. (three varieties). Although often sympatric, probable sibling species (varieties and variants) in sect. *Leptopogon* rarely if ever produce hybrids (except within the *glomeratus* group), lack readily distinguishing morphological gaps, are reproductively isolated, and form discrete variants (Campbell, 1980, 1982a, 1982b, 1983, 1986, 2003; Rosen & Wipff 2003; Nagahama & Norrmann 2012). Nevertheless, there continues to be disagreement over the number of recognized taxa. Without Campbell's treatments (1980, 1982a, 1982b, 1983, 1986, 2003) it would have been even more difficult to achieve our understanding of the genus or to discern additional differences between various southeastern *Andropogon* species.

Since Campbell's (1983, 1986, 2003) landmark *Andropogon* treatments, much additional morphological and ecological information has been gathered by the authors and other southeastern botanists (McMillan et al. 2002; Weakley 2015; Weakley et al. 2011). The most recent floristic treatment of *Andropogon* for the southeastern USA (Weakley 2015) recognizes 18 species (not including *A. bicornis* or *A. gracilis*), plus one named and one unnamed variety, as well as alluding to the two new species described in the present manuscript. This, plus recognition of *A. subtenuis* Nash in Small at species rank brings the total number of recognized taxa in sect. *Leptopogon* in the southeastern USA to 24. The two previously unrecognized species described here are a result of our field studies throughout the southeastern USA and especially in Florida, the center of diversity for sect. *Leptopogon* (Hilu 1984).

Based primarily on chromosome numbers and morphology, North American species of sect. *Leptopogon* have been divided into the *Andropogon virginicus* and the *A. ternarius* groups (Hilu 1984; Gould 1967; Campbell 1980), both with their center of diversity in Florida. Within these groups, the present study is concerned with three closely allied but distinct entities: *Andropogon arctatus* Chapm., *A. ternarius* Michx. var. *ternarius*, and *A. ternarius* Michx. var. *cabanisii* (Hack.) Fernald & Griscom, the latter two having been treated as varieties (Fernald & Griscom 1935; Campbell 1983, 2003; Hitchcock, 1950) or species (Nash 1912; Small 1933; Gould 1967; Hilu 1984; Long & Lakela 1971; DeSelm n.d.). *Andropogon ternarius* has been distinguished from *A. cabanisii* by its denser villous inflorescence and fewer intercarinal nerves (0-2, obscure) on the lower glume of the sessile spikelet (Hilu 1984) as compared to 2-3 prominent nerves in *A. cabanisii* (Long & Lakela 1971; Hilu 1984). Furthermore, *A. ternarius* is tetraploid ($2n=40$), whereas the chromosome counts for members of the *A. virginicus* complex are all diploid ($2n=20$), although the chromosome number for *A. cabanisii* is not known (Gould 1956; Hilu 1984).

While conducting field work over the past 25 years in Florida we had doubt about the identity of *Andropogon* collections from south-central Florida that keyed with much difficulty to *A. arctatus*. Specimens of *A. arctatus* cited in Campbell (1983) from south-central and southern Florida and questionable reports of *A. arctatus* from south Florida (Gann et al. 2002) seemed improbable. We were familiar with *A. arctatus* from frequently burned pinelands and seepage-herb bogs in the Florida panhandle and northeastern Florida, but these differed in both morphology and habitat from our "south-central Florida entity." Meanwhile we continued to voucher specimens of this *Andropogon* from burned xeric sandy uplands in central and south-central Florida. These specimens differed in gross morphology from *A. arctatus* and *A. cabanisii*. We determined that all specimens at FLAS labeled as *A. arctatus* from peninsular Florida are the same entity as our south-central Florida entity. With additional study, we concluded that what had been called *A. arctatus* (sensu lato) is polymorphic, consisting of the Florida panhandle near-endemic of wetland savannas (typical *A. arctatus* Chapman) and an undescribed species of xeric uplands in peninsular Florida.

The objectives of this study were (1) to identify morphological traits or characters which define cryptic species within the *Andropogon ternarius* complex of sect. *Leptopogon*, (2) to formally describe these cryptic species, and (3) to provide a new key to this group and a discussion of the biogeography and ecology of each species. Since many specimens of *A. cumulicola* had been attributed to *A. arctatus*, *A. cabanisii*, or *A. ternarius*, we deemed it critical to prepare new species descriptions to clarify and segregate salient differences of *A. cumulicola* that had been previously subsumed within the existing species descriptions. These descriptions are based primarily on Florida specimens and may not encompass all of the variation found in the more widespread *A. ternarius*.

***Andropogon* inflorescence morphology**

Before proceeding with discussion of character states in the species considered here, some mention must be made of the difficulty in determining character states within the complex and derived morphology of the *Andropogon* inflorescence. Allred (1982) and Campbell (1983) clarified many of these terms and their comments should be used as additional references in understanding and interpreting the descriptions and keys in this treatment. The inflorescence of species of sect. *Leptopogon* has a complex but highly ordered branching system requiring the use of specialized terminology to describe differences between species in these patterns. Inflorescence units in this group are subtended by expanded stem sheaths or vegetative sheaths which enclose the culm and the bases of the inflorescence peduncles (and can envelop almost the entire inflorescence in some species, such as *A. gyrans*). Each inflorescence branch axis also bears a sheath, which as variously been termed the "raceme sheath," "subtending sheath," or "spatheole." For ease of distinguishing these from the stem sheaths or vegetative sheaths subtending the inflorescences, we will use the term "raceme sheath" for these structures, as did Campbell (1983). The raceme sheath subtends the inflorescence peduncle, which is terminated by a pair or small cluster of up to 13 branches or "rames" terminating each inflorescence peduncle. A "rame" is defined as an inflorescence branch that bears repeating pairs of sessile and pedicellate spikelets (Allred 1982) and is characteristic of *Andropogon* in the modern, narrowly defined sense of the genus. The length of the inflorescence peduncle and the number of rames present on each peduncle are important taxonomic characters in this group, as is the total number of "inflorescence units" (a pair or digitate cluster of rames) per culm. Each rame consists of a number of paired spikelets, with one sessile and one pedicellate spikelet in each pair. The sessile spikelet of each pair is almost always bisexual and fertile and constitutes the obvious spikelets of the rames. The pedicellate spikelet is either absent (represented only by its pedicel), vestigial (consisting of undeveloped scales less than 2 mm long), or much reduced and sterile (evident, 2-4 mm long). The dispersal unit within this group of *Andropogon* consists of a sessile spikelet, the pedicel of the pedicellate spikelet (and the pedicellate spikelet if developed), and the rachis internode immediately above the sterile spikelet. In order to understand and assess the characters used in this manuscript, it is recommended that the user carefully break apart or examine these dispersal units, in order to be certain which parts have various types of pubescence.

We have found that some characters are too variable within species in this group to be of much value in delineating species. Much of this variability is due to variation on a single culm, particularly in terms of peduncle length, raceme sheath length, rame length, and number of inflorescence units per culm. However, most of this variation within a single culm or even within a population is due to differences in maturity within the inflorescence. There is a tendency for the last developing inflorescence units to be smaller in most of these quantitative characters than those developed midway within the flowering season. This is expected, since the rames are themselves indeterminate and are parts of a larger indeterminate inflorescence. Therefore, as the flowering season is ending, rames are produced on shorter peduncles, and each rame is often shorter and consists of fewer spikelets. However, if one measures only the larger inflorescence units on well-developed inflorescences, there are clear differences in the average values of these characters, even between species where the range of these characters overlaps. We have therefore given character states for these variable quantitative characters in a bracketed format, such as (10–) 20–30 (–45), where the majority of well-developed inflorescences will have measurements in the middle of the range and the parenthetical measurements represent infrequent outliers. Another character which may be of some taxonomic utility, but which has not been used in this treatment, is the degree of twisting of the lemma awn. There do seem to be some differences in this character among the following species, but it is complicated by variability due to degree of maturity of a particular spikelet and perhaps due to conditions during the drying of the inflorescence.

Taxonomic treatment

1. ANDROPOGON CUMULICOLA E.L. Bridges & Orzell, **sp. nov.** **TYPE: Florida:** Polk Co.: Open scrubby pine savanna, ca. 0.5 mi N of Smith Rd jct. with Delta Rd in Avon Park Air Force Range, SEQ, SEQ, NWQ, Sec. 22, T32S, R30E, 27°41'01" N, 81°18'42" W, 6 Nov 2002, *S.L. Orzell & E.L. Bridges 26058* (holotype: USF; isotypes, FLAS, FSU, MO, NCU, NY, TEX, US).

Similar to *Andropogon arctatus* Chapman, differing in its glabrous to sparsely pubescent leaf sheaths, narrower and less pubescent leaf blades, thinner culms, fewer inflorescence units per culm, and shorter peduncles.

Plants with short, stout, knotty rhizomes, usually forming small clumps ca. 10–20 cm in diameter. **Culms** (70–) 95–125 (–155) cm tall, 1.5–2.0 mm in diameter, glabrous, not glaucous, the branches slender, straight, erect to ascending, basal leaves erect, stem leaves erect to slightly spreading. **Leaf sheaths** not scabrous, moderately to densely villous with antrorsely appressed to slightly spreading white hairs, the hairs mostly 1–2 mm long. **Ligule** membranaceous, 0.3–0.6 mm long, very finely ciliate, cilia 0.1–0.3 mm long. **Leaf blades** strongly folded, V-shaped, yellowish-green, (10–) 15–21 (–35) cm long, (1.5–) 2–2.5 (–3.0) mm wide (unfolded), appearing only half as wide due to almost complete folding of lamina, glabrous to sparsely pubescent with long (ca. 3 mm) erratically spreading hairs. **Inflorescence** slender, ca. (30–) 50–60 (–80) cm long and (2–) 3–5 (–7) cm wide, the branches erect, maximum branch order 1–2 (–3), inflorescence units (3–) 8–14 (–27) per culm; distal part of inflorescence axis moderately to densely pubescent, the longest hairs ca. 2–3 mm long and occurring 1–2 mm below base of raceme sheath, mostly exerted above the vegetative sheaths at inflorescence maturity. **Raceme sheaths** (3.5–) 4.5–5.5 (–7.0) cm long, ca. 1–2 mm wide, all exerted from vegetative sheaths. **Peduncles** (38–) 48–65 (–85) mm long, all with 2 rames. **Rames** (20–) 35–45 (–51) mm long, all exerted at maturity, the long rachis internode pubescence evenly distributed. **Sessile spikelets** 4.0–4.5 mm, callus hairs 1–2 mm, keels of lower glume scabrous from below the midpoint, awns (6–) 7–8 (–12) mm long. **Pedicellate spikelets** vestigial or absent. **Anther** 1, ca. 2 mm long, red, yellow, or purple. Figures 1 and 6.

Endemic to peninsular Florida, from Putnam, Clay, and Alachua counties south commonly to Highlands County, with isolated historical records from Charlotte and Collier counties. *Andropogon cumulicola* is an obligate psammophyte occurring in well to excessively well-drained, acidic, loose to compacted siliceous soils. It is found on sub-xeric uplands in peninsular Florida, where it flowers profusely following lightning season fires. It is locally abundant in dry sandy pinelands, sandhills, Florida scrubby pinelands, and occasionally in Florida scrub. It can co-occur with *A. cabanisii*, but no intergrades have been encountered, and these two species are easily distinguished within mixed populations.

We were surprised that *Andropogon arctatus* was mapped in Campbell (1983) and others as occurring in peninsular Florida. Despite extensive floristic study and vegetation sampling of central Florida wet pine savannas, wet grasslands, and seepage slopes, we never encountered an *Andropogon* which would refer to as *A. arctatus* as we knew it from the Florida Panhandle. Meanwhile, we began to recognize an *Andropogon* of xeric sandy uplands in peninsular Florida, different from *A. cabanisii*, with which it was often sympatric. Upon closer examination we realized that they shared at least as many characters with *A. arctatus* as with *A. ternarius* and were perhaps more closely allied with that species although clearly differing in vegetative characters. We then made a large series of field measurements and collections of this entity and determined that it differed from *A. arctatus* and from all other recognized species of section *Leptopogon* in several additional characters.



Figure 1. *Andropogon cumulicola* (from Orzell & Bridges 26058). A. Whole plant, dried (scalebars in mm). B. Inflorescence group. C. Rames. D. Dispersal unit. E. Dispersal unit, scalebar not shown, sessile spikelet, rachis joint, and pedicellate spikelet. Photos by James Cheak.

Andropogon arctatus (as circumscribed by Campbell 1983, 2003) is polymorphic, consisting of a species of the Florida panhandle and adjacent southern Alabama, which is found in wetland pine savannas (typical *A. arctatus* Chapm.) and the new species described here, which occurs in sub-xeric uplands of peninsular Florida. These two entities can be difficult to determine on incomplete herbarium specimens but have several consistent differences. Although *A. ternarius* resembles *A. arctatus*, the latter differs significantly in leaf epidermis features (Hilu 1984), its rhizomatous habit, its long, usually solitary anther and shorter spikelets (Campbell 1983, 2003), grooved glumes (Hitchcock 1951), and almost complete chasmogamy (Campbell 1983, 2003). Previous confusion of these species might be attributed to the inclusion of *A. cumulicola* characters within the more broadly defined concept of *A. cabanisii* and *A. arctatus* and the placement of the peninsular Florida specimens (here named as *A. cumulicola*) within either *A. arctatus* (Campbell 1983, 2003; Gann et al. 2002) or *A. ternarius* (Long & Lakela 1971). Although some consider *A. cabanisii* as a variety of *A. ternarius*, we have decided to follow Gould (1967) in recognizing *A. arctatus*, *A. cabanisii*, and *A. ternarius* each at species rank.

Based upon abundance, distribution, and habitat preference data we recommend that *Andropogon cumulicola* be classified as in the category Vulnerable (VU) according to IUCN Red List criteria (IUCN 2001). Although locally abundant, *A. cumulicola* is currently known from 12 counties in peninsular Florida. It requires frequent fire to enhance flowering and to maintain its pyrogenic habitat.

2. ANDROPOGON ARCTATUS Chapm., Bot. Gaz. 3:20. 1878. Based on *Andropogon tetrastachyus* Ell. var. *distachyus* Chapm., Fl. South. U.S. 581. 1860, not *Andropogon distachyus* L. 1753. *Andropogon arctatus* Chapm., Bot. Gaz. (Crawfordsville) 3: 20. 1878. *Sorghum arctatum* (Chapm.) Kuntze, Revis. Gen. Pl. 2: 791. 1891. *Leptopogon carinatus* (Nees) Roberty subvar. *arctatus* (Chapm.) Roberty, Boissiera 9: 197. 1960. **LECTOTYPE** (Campbell 1983): **Florida**. Franklin Co.: Low pine barrens, Apalachicola, without date, A.H. Chapman s.n. (NY).

Plants with short, stout, knotty rhizomes, usually forming small clumps ca. 15–30 cm in diameter. **Culms** (90–) 130–150 (–170) cm tall, 2.5–4.5 mm in diameter, glabrous, sometimes somewhat glaucous just below the nodes, the branches slender, straight, erect to ascending, basal leaves spreading to ascending, stem leaves ascending. **Leaf sheaths** not scabrous, usually densely villous with antrorsely appressed to slightly spreading white hairs, the hairs mostly 1–2 mm long, the sheaths often appearing silver in color due to the dense pubescence. **Ligule** membranaceous, 0.3–1.0 mm long, smooth to sometimes densely ciliate, the cilia up to 4 mm long. **Leaf blades** flat to slightly folded, bluish-green to purplish-green (when fresh) (25–) 40–50 (–70) cm long, (3–) 5–6 (–8) mm wide, sparsely to densely pubescent with long (ca. 3 mm) mostly appressed hairs, the lower surface of some leaves silvery-silky like the sheaths. **Inflorescence** slender, ca. 50–90 cm long and 5–15 cm wide, the branches erect, maximum branch order 2–3, inflorescence units (10–) 30–40 (–50) per culm, distal part of inflorescence axis moderately to densely pubescent, the longest hairs ca. 3 mm long and occurring 1–2 mm below base of raceme sheath, slightly included within to long-exserted from vegetative sheaths at inflorescence maturity. **Raceme sheaths** 5.0–8.0 cm long, 2–3 mm wide, mostly exserted from vegetative sheaths. **Peduncles** (50–) 70–90 (–115) mm, with 2–4 rames. **Rames** (30–) 40–50 (–55) mm long, all exserted at maturity, rachis internodes pubescent throughout, the hairs somewhat longer and denser distally. **Sessile spikelets** 4–5 mm long, callus hairs 1.5–3.0 mm, the lower glume strongly concave, nerveless between the keels, keels of lower glume scabrid to short-ciliate for the distal 3/4 of their length, sometimes long-ciliate towards the tip; awn 5–10 (–15) mm long. **Pedicellate spikelets** vestigial or absent. **Anthers** 2.5–3 mm long, red. Figures 2 and 7.



Figure 2. *Andropogon arctatus* (from Orzell & Bridges 21003). A. Whole plant, dried (scalebars in mm). B. Basal leaf sheaths. C. Rames. D. Dispersal unit. E. Dispersal unit, scalebar not shown, sessile spikelet, rachis joint (bottom), and pedicellate spikelet (top). Photos by James Cheak.

Andropogon arctatus is primarily found in the Florida Panhandle and adjacent southeast Alabama, where it is relatively common in hillside seepage slopes and wetland pine savannas. We have found it in a very few sites in Clay County in northeast Florida in similar habitats, which is a common disjunction pattern for Florida Panhandle seepage wetland species. There is a curious record from Pamlico County, North Carolina (the specimen at GH, collected by Randolph and Randolph in 1922, annotated as *A. arctatus* by Campbell), which was reported by LeBlond and Sorrie (2001) and which Weakley (2015) considers to be likely a waif. *Andropogon arctatus* is an obligate wetland plant, being found only in seasonally to permanently saturated wetlands but rarely with more than a few cm of surface water. We have recorded it as present in at least 168 locations, with these concentrated in two small regions — the wetland pine savannas of the Apalachicola Lowlands (mostly in Liberty, Franklin, and Gulf counties, Florida), and the hillside seepage slopes of the western Florida Panhandle (mostly in Walton and Okaloosa counties, Florida). We cite voucher specimens for all counties where we have seen *A. arctatus* except for Escambia County, Alabama, and Leon and Wakulla counties, Florida, where it apparently has never been collected. The sites in Clay County, Florida, where we have seen this species at four locations, are ecotonal seepage slopes known for disjunct locations of seepage species more common in the Florida Panhandle. Kral (1983) described *A. arctatus* with the same narrow circumscription as this manuscript and mapped it only from the central Florida Panhandle, southeast Alabama, and Clay County, Florida.

All specimens of *Andropogon arctatus* that we have seen have thick culms, wide leaves, dense appressed pubescence, tawny hairs, and dark spikelets. In the field it can be identified even when in vegetative condition based upon its relatively large silvery-silky basal leaf sheaths and blades. In describing *A. arctatus*, Chapman (1878) specifically noted that the leaves were "shaggy with long mostly deciduous hairs, as are the sheaths" and gave its habitat and range as "Low pine barrens, West Florida." When in flower it is easily identified based on a generally larger number of inflorescence units, some of which have more than two racemes terminating each peduncle, and the generally darker gray color of the spikelets, in comparison to the whitish to tawny appearance of the racemes of the other taxa considered here. The illustration of *A. arctatus* in *Flora of North America* (Campbell 2003) is based on specimens now referred to both *A. cumulicola* (Ray *et al.* 10490, 10496) and *A. arctatus* (Campbell 3937), and perhaps other specimens. However, since the illustration does not include the plant base and these two species differ little in inflorescence characters, the illustration cannot be clearly referred to only one of these species. It does not show the grooved lower glume of *A. arctatus*, so perhaps the spikelet illustration may be based on an *A. cumulicola* spikelet.

All specimens previously identified as *Andropogon arctatus* from peninsular Florida that we have seen are either definitely or probably referable to *A. cumulicola*. Some specimens are too fragmentary to make a definitive determination. Therefore, what had been called *A. arctatus* (*sensu lato*) is polymorphic, consisting of the Florida panhandle near-endemic of wetland pine savannas (the true *A. arctatus* Chapman) and the new species of xeric uplands in peninsular Florida, *A. cumulicola*. These two entities are close in many inflorescence characters, but on specimens with ample vegetative material they are easy to separate. Tentatively, we believe that *A. cumulicola* may be more closely related to *A. arctatus* than to either *A. ternarius* or *A. cabanisii*, but there is no molecular data available to clarify relationships in this group. In a phylogenetic reconstruction of the *Andropogon virginicus* complex based on morphological characters, Campbell (1986) found that *A. arctatus* was in a clade with *A. floridanus* in some trees. However, in the consensus tree in of the same study, *A. arctatus* is shown as the basal branch within the complex. Since slight differences in assumptions about character state polarity resulted in changes to these trees based on morphology, the results should be thought of as only a tentative hypothesis of actual evolutionary relationships within the group.

3. ANDROPOGON TERNARIUS Michx., Fl. Bor. Amer. 1: 57. 1803. **TYPE:** “**Carolina,**” *A. Michaux s.n.* (holotype: P).

Andropogon argenteus Ell., Sketch Bot. S. Carolina 1: 148. 1816, non de Candolle 1813.

Andropogon argyreus Schultes [nom. nov.], Mant. 2: 450. 1824. *Andropogon elliottii* Chapman [nom. nov.], Fl. South. U.S. 581. 1860. *Sorghum elliottii* Kuntze, Revis. Gen. Pl. 2: 791. 1891. *Anatherum argyreum* (Schultes) Roberty, Boissiera 9: 209. 1960. **TYPE:** [South Carolina?]. Without collection data (holotype: CHARL). Although Hitchcock (1935) contended that *Andropogon elliottii* was intended by Chapman to represent the species now known as *A. gyrans*, Campbell (1983) stated that by citing “*A. argenteus* Ell., not of DC.” in the description, Chapman inadvertently made *A. elliottii* a new name for *A. argenteus*.

Andropogon argyreus Schultes var. *macrus* Scribner, U.S.D.A. Div. Agrost. Bull. 1: 20. 1895. **TYPE: Florida.** Duval Co.: Without data, *A.H. Curtiss 4592* (holotype: US?).

Andropogon elliottii Chapm. var. *glaucescens* Scribner, Bull. Torrey Bot. Club 23: 145. 1896. *Andropogon scribnerianus* Nash, Bull. New York Bot. Gard. 1: 432. 1900. *Andropogon ternarius* Michx. var. *glaucescens* (Scribner) Fern. & Griscom, Rhodora 37: 137. 1935. **TYPE: Florida.** Lake Co.: Vicinity of Eustis, Apr 1894, *G.V. Nash 473* (holotype: US; isotypes: GH, NY).

Plants with short, stout knotty rhizomes, forming small clumps up to 10 cm in diameter. **Culms** stiffly erect, (90–) 100–120 cm tall, 2–3 mm in diameter. **Leaf sheaths** 6–10 mm long, 3–5 mm wide, glabrous to sparsely long-villous, green, not glaucous. **Ligule** membranaceous, 1.0–1.2 mm long, the margins slightly erose, not ciliate. **Leaf blades** 30–40 cm long, 3–4 mm wide, green, not glaucous, with long papillose-ciliate margins, particularly in the lower part of the leaf. **Inflorescence** units shortly to moderately exerted from the stem sheaths, thus the inflorescence appearing more compact (than in *A. cabanisii* or *A. miamiensis*). **Peduncles** (80–) 90–110 (–125) mm long, sometimes with a tuft of 4–7 mm long hairs at a point 1–2 mm below the base of the raceme sheath. **Rames** paired, (30–) 45–50 (–55) mm long, the spikelets mostly obscured by the long ciliate hairs of the rachis internodes and pedicels, the rachis internode pubescence not equally distributed, the longer, denser hairs concentrated near the apex, up to 8–9 mm long, spreading, nearly twice the length of the spikelet, pure white to slightly tawny. **Sessile spikelet** 4.5–5.5 (–7.0) mm long, 2-keeled, the first glume somewhat scabrous on the keels, glabrous and smooth to sparsely and minutely scabridulous between the keels, without additional nerves; lemma awns very delicate, tawny, straight to only slightly twisted at the base, (18–) 20–22 (–25) mm long. **Pedicellate spikelet** vestigial, 1–2 mm long. **Anthers** red, ca. 2 mm long. Figure 3.

Sandhill woodlands and savannas, openings in dry-mesic hardwood or hardwood-pine forests, old fields, and cleared openings in other relatively dry and sandy soils. Delaware west to Kentucky and southern Missouri, south to central peninsular Florida and eastern Texas. In central Florida, at its southern range limit, *Andropogon ternarius* seems to be restricted to open longleaf pine sandhill savannas on yellow sand, reaching its southern limit in the few remaining examples of this habitat on the Lake Wales Ridge in Polk County, Florida.

Andropogon ternarius (sensu lato) is similar to *A. arctatus* but differs in having three anthers, longer sessile and pedicellate spikelets (Campbell 2003), and flattened lower glumes (Weakley 2005). Oddly, in the treatment of the varieties of *A. ternarius* in Flora of North America (Campbell 2003), it seems that the characteristics used to distinguish var. *ternarius* and var. *cabanisii* have been reversed. In this treatment, *A. ternarius* var. *cabanisii* is said to have the rames densely villous, the internode hairs are twice as long as the obscured sessile spikelets, and the lower glumes of the sessile spikelets glabrous (sometimes scabrous), but not conspicuously veined between the keels, all of which are characters of var. *ternarius* (Nash 1912; Hitchcock 1950). Conversely, in this treatment *A. ternarius* var. *ternarius* is said to have rames that are sparsely villous, the hairs of the rachis internodes about as

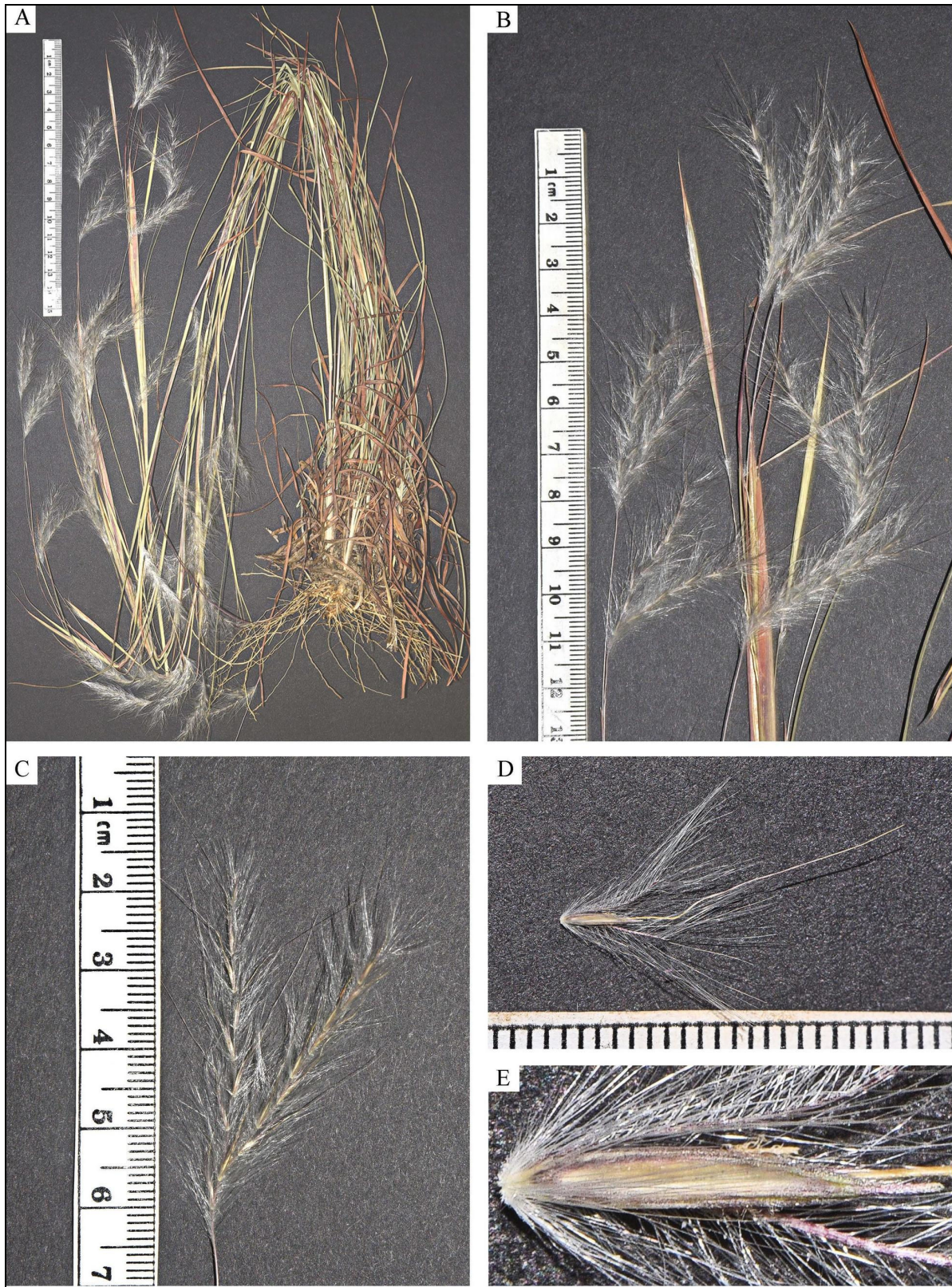


Figure 3. *Andropogon ternarius* (from Orzell & Bridges 26605). A. Whole plant, dried (scalebars in mm). B. Inflorescence group. C. Rames. D. Dispersal unit. E. Dispersal unit, scalebar not shown, sessile spikelet, rachis joint (top), and pedicellate spikelet (bottom). Photos by James Cheak.

long as, but not obscuring the sessile spikelets, and the lower glumes scabrous, often with 2 conspicuous veins between the keels, all of which are characters of var. *cabanisii*.

This revised description here of *Andropogon ternarius* has been created to specifically exclude specimens referred herein to *A. cabanisii* and *A. miamiensis*, therefore it is narrower than most previously published descriptions of *A. ternarius*. The description is based mostly on specimens from Florida and southern Georgia and may not encompass all of the variation present in this species from throughout its range.

We considered whether the type specimen of *Andropogon elliottii* var. *glaucescens* (= *A. scribnerianus*) might represent any species other than *A. ternarius* of the present treatment. Nash (1900, 1912) described *A. scribnerianus* as distinct in having the first glume glabrous and shining between the keels, the leaf sheaths glabrous and glaucous, and the leaf blades glaucous. The type specimen for *A. elliottii* var. *glaucescens* does have bluish leaf blades and sheaths, but it is impossible to tell if these were glaucous when fresh. The first glumes are very similar to those we have found in plants of *A. ternarius* from sandhill woodlands in northern and central peninsular Florida, but do not seem to consistently differ from it from other regions. This entity needs further study, but for now it is best accommodated in synonymy of *A. ternarius*.

4. ANDROPOGON CABANISII Hack., Flora 68: 133. 1885. *Andropogon cabanisii* Hack., Flora 68: 133. 1885. *Sorghum cabanisii* (Hack.) Kuntze, Revis. Gen. Pl. 2: 791. 1891. *Andropogon ternarius* Michx. var. *cabanisii* (Hack.) Fern. & Griscom, Rhodora 37: 138. 1935. **LECTOYPE** (Campbell 1983): **Florida**. Franklin Co.: Prope Apalachicola, 1884, A.H. Chapman s.n. (W digital image!). The sheet at W reads “Ex. Herb. E. Hackel and had been originally identified and distributed by Chapman as *Andropogon arctatus* Chapm. There is also a fragmentary sheet of the original type at US, from the “Specimens obtained from European herbaria in 1922 by Agnes Chase, Ex. Herb. Berlin.” In 2010, L. Pignotti designated a specimen at W (1916-0028605) as a syntype, with the same label data as described above for the lectotype. These could be the same sheet, or two sheets with this specimen data at W.

Plants forming small clumps from short, knotty rhizomes, the clumps usually 10–20 cm in diameter. **Culms** ascending to stiffly erect, (115–) 140–170 (–190) cm tall, 2–5–3 (–4) mm in diameter, glabrous, not glaucous, the internodes pinkish-purple to reddish, basal leaves spreading to reflexed, stem leaves progressively shorter, strongly reflexed. **Leaf sheaths** glabrous to sparsely appressed or spreading pubescent, the surfaces not scabrous. **Ligule** membranaceous 0.5–1.0 mm long, not ciliate. **Leaf blades** with the upper surface greenish, the lower surface bluish-green, not glaucous, (20–) 25–32 (–35) cm long, (2.5–) 3–4 (–5) mm wide. **Inflorescence** (50–) 70–90 (–100) cm long, (5–) 10–15 cm wide; Inflorescence units (5–) 10–20 (–26) per culm, inflorescence axis glabrous below the raceme sheath. **Raceme sheath** mostly shortly to moderately exerted from the stem sheath, (60–) 70–80 (–105) mm long, 1–3 mm wide. **Peduncles** (85–) 110–140 (–210) mm long, all exerted from the raceme sheaths. **Rames** paired, (40–) 50–65 (–75) mm long, with spikelets clearly visible through the rachis pubescence. **Sessile spikelets** 6–7 mm long; first glume strongly 2-keeled, the keels densely scabrous-ciliate, particularly in the distal half, 2–3 nerved between the keels, the surface densely scabridulous; callus hairs dense, 1–2 mm long; lemma awns straight or slightly twisted at base, (9–) 11–13 (–17) mm long; rachis internode pubescence unequally distributed, concentrated in distal half of internode, longest hairs 4–6 mm long, spreading to slightly ascending; pubescence of pedicellate spikelet pedicels similar to that of rachis internodes. **Pedicellate spikelet** sterile, slender, 3–4 mm long, scabrous. **Anthers** red, 2–2.5 mm long. Figures 4 and 7.



Figure 4. *Andropogon cabanisii* (from Orzell & Bridges 22510). A. Whole plant, dried (scalebars in mm). B. Inflorescence group. C. Rames. D. Dispersal unit. E. Dispersal unit, scalebar not shown, sessile spikelet, rachis joint (bottom), and pedicellate spikelet (top). Photos by James Cheak.

Peninsular Florida, west near the coast to the central Florida Panhandle. Common in scrubby pinelands, mesic to wet-mesic pinelands, and some hyperseasonal grasslands, most often on somewhat poorly drained to poorly drained soils (Spodosols or Alfisols).

5. ANDROPOGON MIAMIENSIS E.L. Bridges & Orzell, **sp. nov.** **TYPE:** Florida. Miami-Dade Co.: Open grassy pine rockland savanna, on S side of Research Rd, ca. 0.1 mi E of east end of Boy Scout Camp Everglades, ca. 2.7 mi E of Daniel Beard Research Center, Everglades National Park; Long Pine Key 7.5' Quad.; 25° 23' 19" N, 80° 38' 24" W, community dominated by *Pinus densa* /*Andropogon miamiensis*–*Schizachyrium semiberbe*–*Sorghastrum secundum*, with scattered tropical shrubs, 1 Oct 2009, S. Orzell and E. Bridges 26400 (holotype: USF; isotypes: EVER, FLAS, FSU, GH, MO, NCU, NY, TEX, USF).

Similar to *Andropogon cabanisii* Hackel, differing in its taller stature, fewer inflorescence units per culm, and glaucous culms, basal leaf sheaths, and leaf blades.

Plants with short, stout, knotty rhizomes, usually forming clumps ca. 10–20 cm in diameter. **Culms** (150–) 180–210 (–230) cm tall, 3.0–4.5 mm in diameter, glabrous, slightly to evidently glaucous, internodes purplish-tinged, the branches few, slender, straight, erect to ascending. **Leaf sheaths** smooth, bluish, glaucous, ca. 12–15 cm long. **Ligule** membranaceous, ca. 1.0 mm long, margin erose, without conspicuous cilia. **Leaf blades** green on upper surface, bluish-glaucous on lower surface, glabrous except for a few long (4–7 mm) cilia on lower blade margins, 40–65 cm long, 3–4 mm wide, spreading to somewhat ascending, drying brownish-purple. **Inflorescence** slender, ca. 60–80 cm long and 10–15 cm wide, the branches erect, maximum branch order 2–3; inflorescence units (6–) 8–10 (–12) per culm, inflorescence axis glabrous, long-exserted from vegetative sheaths at inflorescence maturity. **Raceme sheaths** 6.5–8.0 cm long, ca. 1 mm wide, all exserted from the vegetative sheaths. **Peduncles** 125–156 mm long, long-exserted from the raceme sheaths, each with two rames. **Rames** (35–) 45–55 (–62) mm long, all long-exserted at maturity. **Sessile spikelets** 6–7 (–7.5) mm long; callus hairs dense, 1–2 mm long; first glume firm, flat, keeled, the keels ciliate-scabrous, particularly above the middle, the surface minutely scabridulous, with 2–3 rather distinct nerves between the keels; lemma awns (13–) 15–16 (–18) mm long, slightly twisted at base; rachis internode pubescence concentrated near apex of internode, the hairs near the base relatively sparse and 1–2 mm long, the hairs near the apex dense, 3–4 mm long. **Pedicellate spikelets** vestigial, 2–3 mm long, scabrous. **Anthers** red, ca. 2 mm long. Figures 5 and 7.

Endemic to pine rockland savannas in extreme southern Florida, in Miami-Dade and Monroe counties, where it can be a fall aspect dominant after burning.

Andropogon miamiensis is characterized by its large clumps of tall culms and its bluish-glaucous leaves. To our knowledge, no other entities in the *A. ternarius* complex have conspicuously and strongly glaucous foliage. Presence or absence of glaucous foliage has often been used as a taxonomic character in *Andropogon* (i.e., as in *A. glaucopsis*, *A. capillipes*, *A. dealbatus*). The populations of the *A. ternarius* complex with glaucous foliage seem to be restricted to pine rockland savannas in extreme southern Florida, such as Long Pine Key in Everglades National Park and Big Pine Key of the Florida Keys. This geographic restriction, coupled with the apparent absence of *A. cabanisii* (sensu stricto) from this region, supports treating this entity at the species level. The presence of this unusual *Andropogon* was first brought to our attention by Dr. Bill Platt of LSU, who had noticed that the plant identified as *A. cabanisii* in vegetation sampling in Everglades National Park was noticeably different from the *A. cabanisii* at Avon Park Air Force Range.

Andropogon miamiensis is the tallest (over 1.8 m) aspect-dominant grass in frequently burned pine rockland savannas of Long Pine Key in Everglades National Park, co-occurring with the much shorter-statured *Schizachyrium semiberbe*. In wetter transitions between well-drained pine rockland savannas and the adjacent marly grasslands, *A. miamiensis* is absent, being replaced by *Schizachyrium*



Figure 5. *Andropogon miamiensis* (from Orzell & Bridges 26400). A. Whole plant, dried (scalebars in mm). B. Vegetative shoot. C. Rames. D. Dispersal unit. E. Dispersal unit, scalebar not shown, sessile spikelet, rachis joint (bottom), and pedicellate spikelet (top). Photos by James Cheak.

rhizomatum, *A. longiberbis*, and *A. tenuispatheus* (*A. glomeratus* var. *pumilus*). In previous studies of the vegetation and ecology of the pine rocklands, it has been referred to as *A. cabanisii*, but some authors have described its unique morphology and biology. Craighead (1971), in describing pine rockland savannas, noted that "A most interesting plant of the pineland is a grass locally called fire grass (*Andropogon cabanisii*). This abundant grass develops as numerous gray-green tufts in the tiny pits and crevices of the gray limestone. It remains in the vegetative stage until a fire flashes over the clumps. Soon they begin to develop flower stalks, which reach 5 to 8 feet in height, forming a dense understory that when mature suggests a wheat field ready for harvest." The leaf color, plant height, and rapid flowering response after fire leave no doubt the plant referred to is *A. miamiensis*.

The following key can be used to distinguish the species of *Andropogon* sect. *Leptopogon* in the southeastern USA with long-peduncled rames exerted from both the stem sheaths and raceme sheaths, except for *A. brachystachyus*, which has very short rames (1–2 cm) and a large, diffuse flexuous inflorescence. All other species in sect. *Leptopogon* in the southeastern USA have inflorescences that are much more congested in appearance, either due to the shortening of the peduncles, stem internodes, or both. This key was included within the key to species of *Andropogon* in Weakley (2015), based on an advance copy of this manuscript, in which *A. cumulicola* is keyed as "A. species 1", and *A. miamiensis* is keyed as "A. species 2." The reader is referred to the excellent treatment of *Andropogon* in Weakley (2015) to place this section of the key in the context of the genus within the southeastern USA.

1. Sessile spikelets 4–5 mm long; lemma awns mostly 5–10 mm long; rachis internode pubescence more or less evenly distributed along the internode; inflorescence peduncles mostly less than 9 cm long.
 2. Basal leaf sheaths and upper surface of basal leaf blades appressed-pubescent, often appearing silvery-silky; basal leaf blades mostly 5–6 mm wide; culms 2.5–4.5 mm in diameter; inflorescence units usually more than 30 per culm, each with 2–4 rames
..... **Andropogon arctatus**
 2. Basal leaf sheaths moderately to densely villous, but not silvery-silky; basal leaf blades glabrous to sparsely pubescent with spreading hairs, 2–2.5 mm wide; culms 1.5–2.0 mm in diameter; inflorescence units usually less than 15 per culm, all with 2 rames
..... **Andropogon cumulicola**
1. Sessile spikelets 5–7 mm long; lemma awns mostly 10–25 mm long; rachis internode with longest hairs concentrated towards its apex; inflorescence peduncles 10–17 cm long.
 3. First glume nerveless and glabrous or nearly so between the keels; raceme internodes with longest hairs 8–9 mm long, somewhat obscuring the spikelets; lemma awns mostly more than 18 mm long; pedicellate spikelet vestigial, 1–2 mm long **Andropogon ternarius**
 3. First glume 2–3-nerved between the keels, its surface moderately to densely scabridulous; raceme internodes with longest hairs 3–6 mm long, not obscuring the spikelets; lemma awns mostly less than 18 mm long; pedicellate spikelets evident, 2–4 mm long.
 4. Basal leaf sheaths and lower surface of basal leaf blades bluish-glaucous; culm internodes slightly to evidently glaucous; culms mostly over 180 cm tall, usually with 10 or fewer inflorescence units per culm **Andropogon miamiensis**
 4. Basal leaf sheaths and lower surface of basal leaf blades green or bluish-green, not glaucous; culm internodes not glaucous; culms mostly 120–170 cm tall, usually with 10–20 inflorescence units per culm **Andropogon cabanisii**

Ecology of the *Andropogon ternarius* complex in Florida

In addition to their morphological and biogeographic differences, there are clear distinctions in habitat preferences between the species discussed in this manuscript. In the process of compilation of site specific floristic lists by habitat in Florida, we have recorded over 5000 occurrences of species of *Andropogon*, including almost 1000 occurrences of the species in this group, of at least 24 taxa. In addition, we have recorded one or more of these species in at over 500 quantitative vegetation sampling plots. This data provided us a clear picture of the habitats of each of these, at least within Florida. Since three of these species are endemic to Florida and one (*A. arctatus*) has at least 95% of its known occurrences within Florida, this enabled us to describe the habitats and degree of habitat overlap for all of these except *A. ternarius*, for which we will focus only on its Florida occurrences.

Andropogon arctatus is an obligate wetland plant found in a narrow set of habitats in the Florida Panhandle and adjacent southeastern Alabama, with a disjunct location in a similar habitat in Clay County, Florida. All of these are either in hillside seepage slopes or wetland pine savannas or wet grasslands between pine savannas and forested wetlands. It is a characteristic species of these habitats in the Apalachicola National Forest (Bridges 2005) and is a frequent and often co-dominant species there and in other parts of the Florida Panhandle. Species of *Andropogon* which often co-occur with *A. arctatus* include *A. dealbatus*, *A. glomeratus*, *A. glaucopsis*, *A. perangustatus*, *A. virginicus* "Smooth variant", and particularly *A. mohrii*, another species nearly restricted to these habitats.

Andropogon cumulicola is a characteristic species of Florida scrubby pinelands (i.e., "scrubby flatwoods") in central Florida. These are habitats with dry, sandy soils but a seasonally high water table, from the presence of a spodic horizon in the soil which perches the water table during the summer wet season. It is not found in either true Florida scrub on excessively drained white sands, or in well-developed sandhill woodland-savannas on yellow sand entisols. In scrubby pinelands it occurs with a mixture of species characteristic of poorly drained pine savannas and better drained sandhill and scrub. Other species of *Andropogon* often co-occurring with *A. cumulicola* include *A. brachystachyus*, *A. capillipes*, *A. gyrans*, *A. cabanisii*, and less commonly *A. floridanus* and *A. virginicus* var. *decipiens*. Of these, only *A. cabanisii* is within the group of species discussed in this manuscript. The habitat of *A. cumulicola* overlaps the dry end of the habitat range of *A. cabanisii*, and they are clearly distinct when sympatric.

Andropogon cabanisii is primarily a species of pine savannas and open hyperseasonal grasslands and pine savanna of central Florida, rarely found northward to the central Florida Panhandle and south to Collier County. The vast majority of our site-specific records of *A. cabanisii* are from poorly drained spodosols or soils with spodic horizons, from scrubby pinelands only seasonally saturated to the surface to wet grasslands with several weeks or surface inundation during the wet season. It is present in most examples of mesic, wet-mesic, and wet longleaf pine savannas in central Florida and is more occasional in these habitats at least northward to Clay County and west to Franklin County, Florida. Species of *Andropogon* often co-occurring with *A. cabanisii* include *A. brachystachyus*, *A. capillipes*, *A. dealbatus*, *A. subtenuis* (often known as the "tenuous form" of *A. gyrans*), *A. hirsutior*, and *A. virginicus* var. *decipiens*. In disturbed habitats it can sometimes be found with *A. glaucopsis*, and at the wetter end of its habitat range it overlaps the habitats of *A. perangustatus* and *A. virginicus* "Smooth variant." In many of its habitats, it is part of a plant community which often has 4 or 5 species of *Andropogon* within a single square meter and up to 10 species of *Andropogon* within a single natural community at a site.

In contrast, *Andropogon ternarius* within the Florida portion of its range appears to be restricted to well-drained sandhill woodlands and occasional scrub in central Florida. It is rather widespread and common in northern Florida, being found in a wide range of well-drained sandy



Figure 6. *Andropogon cumulicola*. A. Single cespitose clump. B. Rames. C. Culm and leaf base. D. Basal leaves. Photos in the field in Polk (A & C) and Highlands (B & D) counties, Florida.



Figure 7. A. *Andropogon arctatus* basal leaves (Gulf County, Florida). B and C. *Andropogon cabanisii* rames (B) and culm leaves (C), photos by Dave Briley (Highlands County, Florida). D - F. *Andropogon miamiensis* basal leaves (D), habit (E), and leaf base (F) (Miami-Dade County, Florida).

habitats, including open woodlands, longleaf pine sandhill savannas, old fields, and roadsides through these habitats. In central peninsular Florida, most records that are definitively placed within *A. ternarius* are from remnants of longleaf pine sandhill savannas on yellow sands, which are increasingly uncommon in this region of the state. Species of *Andropogon* often co-occurring with *A. ternarius* in central Florida include *A. gyrans*, *A. floridanus*, *A. tracyi*, and *A. virginicus* "Old Field Variant." *Andropogon ternarius* and *A. cabanisii* are found in close proximity at some locations but there they are separated by habitat, with *A. ternarius* in the better drained parts of the site; no intermediates have been seen.

Finally, *Andropogon miamiensis* is restricted to pine rockland savannas of extreme southern Florida, where it is very common in frequently burned examples, to the point of having had a unique local common name ("firegrass") long before it was recognized as a distinct species. These habitats have a fluctuating water table, and this species must be capable of tolerating both extreme droughts and occasional soil saturation to the surface. It is most commonly found in small cracks, crevices, and depressions in limestone, in contrast to the mostly acidic sandy habitats of the other species in this group. Given this habitat restriction, it is unlikely to be found further north than Miami-Dade and Monroe counties, Florida.

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Appendix 1. Specimens examined

ANDROPOGON CUMULICOLA. **Florida.** Alachua Co.: Flatwoods, Fairbanks, 25 Oct 1927, *Weber & West 144* (FLAS) [questionably this species, could be a small *A. ternarius*]. Brevard Co.: *Fredholm 6110* (US). Charlotte Co.: Pine-palmetto flatwoods, Caloosa Forest, west replacement pasture, Sec. 31, T42S, R26E, 18 Oct 1963, *Lewis 107* (US). Clay Co.: Open, sandy ground, Penny Farms, 15 Nov 1938, *Swallen 5599* (NY). Collier Co.: Pine flatwoods, 21 Oct 1967, *Lakela 31145* (DUKE, USF). Hardee Co.: Scrub on white sand, 10 Nov 1978, *Hansen 4921* (USF). Highlands Co.: Avon Ridge Lower (HIGH 73); Lake Arbuckle SE 7.5 Quad., Sec 5/6, T34S, R31E, Sec 31/32, T33S, R31E, Avon Park Air Force Range, 21 Oct 1986, *Huck 4657* (FLAS, USF); Avon Ridge North (HIGH 15), Lake Arbuckle SE 7.5 Quad., Sec 18, T33S, R31E, Avon Park Bombing Range, 22 Oct 1986 *Huck 4617* (FLAS); *Campbell 4118* (GH); Scrubby pinelands W of Sandy Hill Grade, ca. 0.7 air mi S of Submarine Lake, Avon Park Air Force Range, SEQ, SEQ, Sec. 19, T33S, R31E, 27°35'20" N, 81°15'30" W, 29 Oct 2002, *Orzell & Bridges 26055* (BRIT, FLAS, GH, MO, NCU, NY, TEX, USF); Frequently burned high-quality *Pinus palustris* sandhill savanna, ca. 0.2 mi E of Echo Springs Rd at a point ca. 1.2 mi N of jct South Fence East Rd, Avon Park Air Force Range, SEQ, SEQ, Sec. 31, T33S, R31E, 27°33'37" N, 81°15'28" W, 6 Nov 1994, *Orzell & Bridges 23393* (FLAS, USF), same location, 7 Nov 2002, *Orzell & Bridges 26061* (USF), same location, 23 Oct 2007, *Orzell & Bridges 26302* (FLAS, NCU, USF); Burned scrubby pinelands, in Echo Range, ca. 0.75 air mi SE of jct Echo Springs Rd and Long Cypress Cut, Avon Park Air Force Range, 27°34'13" N, 81°15'14" W, NWQ, NWQ, NWQ, Sec. 32, T33S, R31E, 7 Nov 2002, *Orzell & Bridges 26064* (FLAS, USF, US); Oak scrub with xeric sandy barrens, in primitive camping area of Highlands Hammock State Park, ca. 0.4 mi SSW of jct CR634 and CR635 at park entrance, ca. 6.5 mi W of Sebring, SEQ, NEQ, Sec. 4, T35S, R28E, 27°27'56" N, 81°31'04" W, 15 Oct 1994, *Orzell & Bridges 23307* (USF). Hillsborough Co.: Tampa, Oct 1877, *Garber s.n.* (NY) [note - not all sheets distributed by Garber with this collection data are *A. cumulicola* - some are *A. cabanisii*, and some are mixed sheets with culms of both species]; Dry sandy soil, 13 Oct 1904, *Fredholm 6423* (NY); Sandhill with open stand of live oak, dominated by grasses, southeastern sector of USF campus, Tampa, 13 Nov 1963, *O. Lakela 26667* (FLAS); Dry sandy palmetto flatwoods with scattered stunted live oaks, 25 Nov 1975, *Shuey 1507* (USF); Less than a dozen plants in open patches of sand, signs of recent fire, 16 Oct 2008, *Dickman s.n.* (USF); Scrub/scrubby flatwoods, 10 Nov 2009, *Dickman and Lambright s.n.* (USF). Manatee Co.: Pine woods, Bradenton, 30 Oct 1916, *Cuthbert 1454* (FLAS - 2 sheets). Osceola Co.: Small sand-pine scrub, 14 Oct 1960, *Ray et al. 10490* (GH, US USF); 14 Oct 1960 *Ray et al. 10496* (USF). Polk Co.: Indian Head Estates (Polk 41), Dundee 7.5 Quad., Sec 17, T28S, R28E, from intersection of SR 544 and Jim Edwards Rd, turn (?W) on Jim Edwards Rd 0.3 mi., 9 Oct 1986, *Huck 4400* (FLAS); Trailer park and remnant scrub, Camp Mack Rd North (Polk 72), Hesperides 7.5 Quad., Sec 30, T29S, R29E, Home by Robert Cadwell, 7855 Camp Mack Rd, 15 Oct 1986, *Huck 4550* (FLAS); Old Bravo Rd North, Sec 25/26, T32S, R30E., APAFR, *Huck 4622* (FLAS); Indian Head Estates, *Huck 4400* (FLAS); Trailer park and remnant scrub, 15 Oct 1986, *Huck 4532* (USF); Old Bravo Rd North, Avon Park Bombing Range (Polk 74); Lake Arbuckle 7.5 Quad., Sec 25/26, T32S, R30E, 21 Oct 1986, *Huck 4622* (FLAS); Camp Mack Rd (Polk 72), Hesperides 7.5 Quad., Sec 30, T24S, R29E. Home by Robert Cadwell, 7855 Camp Mack Rd. Trailer Park and remnant scrub, 15 Oct 1986, *Huck 4538* (FLAS) [mixed sheet of *Andropogon cabanisii* and *Andropogon cumulicola*, one culm of each on sheet!]; Open, fire-maintained *Pinus palustris* sandhill savanna, ca. 0.45 mi SSW of jct Frostproof Rd and Arnold Hammock Rd, NWQ, SEQ, SEQ, Sec. 11, T32S, R29E, 27°42'30" N, 81°23'11" W, 16 Oct 2003, *Orzell & Bridges 26192* (BRIT, FLAS, TEX, USF); Burned, typic scrubby pinelands ca. 0.7 mi NW of jct Smith Rd and Old Bravo Rd, Avon Park Air Force Range, SWQ, SEQ, NEQ, Sec. 23, T32S, R30E, 27°41'00" N, 81°17'21" W, 12 Nov 2002, *Orzell & Bridges 26070* (BRIT, FLAS, GH, TEX, USF); Frequently burned scrubby pinelands, in Bravo Range, ca. 0.4 mi E of Billig Rd at a point 0.15 mi N of Bravo Rd, Avon Park Air Force Range, SWQ, SWQ, NEQ, Sec. 16, T32S, R30E, 27°41'18" N, 81°20'02" W, 2 Nov 1998, *Orzell &*

Bridges 25461 (FLAS, NCU, TEX, USF); same location, 20 Oct 2009, *Orzell & Bridges 26405* (FLAS, FSU, MO, NCU, TEX, US, USF); Scrubby pinelands between scrub and mesic pinelands, along Road #4, 0.2 mi W of School Bus Rd at a point 4.1 mi S of entrance gate at jct Rucks Dairy Rd, ca. 0.8 mi NW of FL 64, ca. 7 air mi NE of Avon Park, Arbuckle Tract - Lake Wales Ridge State Forest, SWQ, SEQ, Sec. 27, T32S, R29E, 27°39'45" N, 81°24'13" W, 16 Oct 1994, *Orzell & Bridges 23314* (BRIT, FLAS, TEX, USF) [note - Type locality for *Rhynchospora megaplumosa*]. Putnam Co.: Sec 22, T10S, R24E, along C-315, ca 2 km S of jct with FL 20 at Interlachen, sand scrub with *Pinus palustris*, *Quercus leavis*, *Garberia frutescens*, *Ceratiola ericoides* and *Quercus geminata*, 30 Oct 1982, *Skean 879* (FLAS) [identification tentative, not conclusive].

ANDROPOGON ARCTATUS. **Alabama.** Baldwin Co.: Hillside streamhead seepage herb bog on S side of US 90, ca. 2.2 mi W of Seminole, ca. 0.5 air mi SW of Seminole Church, ca. 3.9 mi W of Perdido River and Florida state line, Elsanor 7.5' Quad., EH, SWQ, SEQ, NWQ, Sec. 18, T6S, R6E, 30°31'31" N; 87°30'30" W, 24 Aug 1994, *Orzell & Bridges 22913* (BRIT, MO, USF). Covington Co.: Sandy savanna, ca. 12 mi S of Andalusia, 3 Oct 1971, *Kral 44749* (VDB); Loblolly pine-water oak-galberry wet flatwoods on creek floodplain terrace, burned earlier this year, FS332 SE of Salt Pond, N side of Camp Creek, Conecuh National Forest, 15 Oct 1996, *Sorrie 9087* (NCU). Geneva Co.: Savannah area along powerline, occasional, with nearby *Andropogon liebmannii*, 12 Nov 1999, *MacDonald 13672* (TROY). **Florida.** Bay Co.: Open wiregrass bog, near Sandy Creek, W of Wewahitchka, by Fla. Rte 22, 17 Oct 1978, *Godfrey 76774* (FLAS, FSU); Frequent in moist loamy sand of *Hypericum chapmanii* - *Ilex myrtifolia* depression in flatwoods, 29 Nov 2001, *Anderson 20117* (FSU). Calhoun Co.: Clear-cut pine flatwoods, 1.4 mi S of Blountstown, by Fla. Rte 71, 1 Nov 1980, *Godfrey 78243* (FLAS, FSU, TTRS); Frequent in pitcher plant bog, 1 Nov 1980, *Godfrey 78252* (FLAS, FSU). Clay Co.: Burned seepy ecotone above acid seep forest at head of unnamed tributary W of Yellow Water Creek, ca. 0.8 air mi S of Duval Co. line, ca. 2.2 air mi NE of Long Branch Ch, ca. 7.6 air mi NNW of Middleburg, Jennings Forest - Black Creek WMA, Fiftone 7.5' Quad., SWQ, SWQ, Sec. 5, T4S, R24E, 30°10'29" N, 81°55'55" W, 16 Oct 1992, *Orzell & Bridges 21141* (FLAS, FTG, USF); Burned seepage slope at headwaters of tributary NE of North Fork Black Creek, S of Long Branch Rd, 0.7 mi SE of State Forest entrance, ca. 7 air mi NW of Middleburg, Jennings SF - Black Creek WMA; Fiftone 7.5' Quad.; NWQ, NEQ, Sec. 18, T4S, R24E; 30°09'23" N, 81°56'33" W, 12 Sep 1999, *Orzell & Bridges 25588* (FLAS, FSU, USF). Escambia Co.: in low pineland, 20 Nov 1983, *Wilhelm 11935* (USF); flatwoods beside Rte 292, 3.5 mi E of jct. C-293, 5 Nov 1977, *Campbell 3944* (NY). Franklin Co.: St. Georges Island, Sep 1867, *Saurman s.n.* (NY); Disturbed titi swamp, essentially clearcut, ca. 4.2 mi N of jct of Fla. 65 and US 98-319, to w of road, S34, 2 Nov 1981, *McDaniel 24744* (FLAS); Wet pineland, clearcuts and chopped with heavy machinery, by Fla. Rte 65, 11.4 mi N of its jct. with US Rte 98 E of East Point and 4.6 mi S on Rte 65 from boundary of Apalachicola National Forest, generally S of Sumatra, 6 Nov 1985, *Godfrey 81962* (FSU, TTRS, USF); Abundant in boggy, open pineland which had been control-burned in summer 1988, by Hickory Landing Road, SW of Sumatra, Apalachicola National Forest, 16 Nov 1988, *Godfrey et al. 82972* (FLAS, TTRS); Scattered, old titi swamp now planted with pines, 2 mi E of Fla. 65 on Bucks Siding Road, Sec. 9, T7S, R7W, Oct 1976, *Conde s.n.* (FLAS). Gulf Co.: Lower slope quaking deep muck poor fen (seepage bog) on W side of Little Sandy Creek (= Alligator Creek), ca. 0.6 air mi NE of creek crossing at Bay Co. line, ca. 13 air mi W of Wewahitchka, Sandy Creek Bogs CARL; Allanton 7.5' Quad., NWQ, SWQ, NEQ, Sec. 31, T4S, R11W, 30°05'43" N; 85°22'54" W, 11 Oct 1992, *Orzell & Bridges 21053* (FLAS, USF), *21055B* (USF); Flatwoods, 9 Oct 1989, *Johnson & White 8652* (FSU). Holmes Co.: Seepage areas in burned upland longleaf pine savanna E of Bealia Rd and W of Sun Lake, ca. 0.6 mi N of County Line Rd and 0.7 mi W of FL 79, 1.0 air mi SW of jct FL 79 and I-10, ca. 2.7 air mi SW of Bonifay; Sun Lake Longleaf Savanna, Poplar Head (& Bonifay) 7.5' Quad.; NWQ, SWQ, Sec. 13, T4N, R15W; 30°45'05" N; 85°41'47" W, 29 Sep 1992, *Orzell & Bridges 20865* (BRIT, FLAS, FTG, MO, NCU, NY, TEX, USF, US). Jackson Co.: Grassy bank under powerline, 2.2 mi E of Arrowhead Campground on Rte 90, 4 Nov 1977, *Campbell 3937* (NY,

USF); Wiregrass bog, 14 Oct 1978, *Godfrey et al.* 76736 (FSU); Wiregrass bog, near Fla. Rte 280, ca. 3/4 mi N of I-10, S of Sneads, 1 Nov 1980, *Godfrey* 78245 (FLAS, FSU); Open bog, power line transect, 1.5 mi S of I-10, S of Sneads, 1 Nov 1980, *Godfrey* 78249 (FLAS, FSU). Liberty Co.: Longleaf pine flat bordering open savanna, soil loamy, 16 Oct 1975, *Clewell s.n.* (FSU); Wet flatwoods site, clearcut and recently planted to slash pine, 1.7 mi E of Hosford, S side of Fla. Rte 20, 9 Nov 1976, *Godfrey* 75788 (FSU, TTRS); In a very large area of pine flatwoods that had been clearcut, 3.5 mi S of Telogia by Fla. Rte 65, 21 Oct 1981, *Godfrey* 79231 (FLAS, FSU, TTRS); Longleaf pine savanna, by Forest Road 123 off to SW of Co. rd 379, NW of Sumatra, Apalachicola National Forest, 24 Oct 1985, *Godfrey et al.* 81959 (FLAS, FSU, TTRS, USF); Seasonally wet pine flatwoods, abundant where clear-cut and where soil mechanically much disturbed in preparation for planting slash pine, 2 mi N of Sumatra, 18 Oct 1975, *Godfrey* 74577 (FLAS, FSU, TTRS); Frequent in a large area of flatwoods clearcut, site-prepared, and planted to slash pine, probably 1-2 years ago, 4 mi N of Sumatra by Fla. Rte 65, 1 Nov 1977, *Godfrey* 76112 (FLAS, FSU, TTRS); Longleaf pineland, controlled-burned 30 Apr 1990, with entirely herbaceous groundflora, by Fla. Rd 379, 15.6 mi S of its jct with Co Rd 12, and generally NW of Sumatra, 3 Oct 1990, *Godfrey & Gholson* 84000 (FLAS, NY, TTRS); Damp sandy soil along upper margin of savannah in edge of longleaf pine - wiregrass woods, burned during spring or early summer of 1985, S side of FS Rd 123, 0.2 mi W of jct with State Rte 379, N of Sumatra, Apalachicola National Forest, 24 Oct 1985, *Gholson* 11528 (FLAS); 2 year old pine plantation, Rte 65, 4 mi N of Sumatra [Franklin Co on label, but this location must be in Liberty Co], 1 Nov 1977, *Campbell* 3919 (FLAS); Large stand of plants scattered in wiregrass ecotone between flatwoods and pitcher plant bog in Apalachicola National Forest west of FR181, 1.8 mi north of its junction with FR 2, NE of Sumatra, flowering after an April burn, 13 Oct 2013, *Johnson* 10664 (FSU). Okaloosa Co.: Extensive sapric hillside and streamhead seepage bogs ca. 0.4 mi E of State Forest Rd 49, at a point ca. 2 mi N of jct State Forest Rd 50 at Peaden Bridge over Blackwater River, ca. 9 mi ENE of Munson; Blackwater River State Forest; Blackman 7.5' Quad.; SWQ, NWQ, Sec. 27, T5N, R25W; 30°54'27" N; 86°44'08" W, 25 Aug 1994, *Orzell & Bridges* 22931 (F, FLAS, USF); Hillside seepage bogs in longleaf pine savanna ca. 0.8 mi E of State Forest Rd 47 (Beaver Creek Rd) and 1.1 air mi N of FL 4, at head of tributary W of Blackwater River, 6 mi W of Baker, 7.5 mi E of Munson; Blackwater River State Forest; Munson 7.5' Quad.; SWQ, SEQ, NWQ, Sec. 9, T4N, R25W; 30°51'48" N; 86°45'05" W, 29 Aug 1994, *Orzell & Bridges* 23074 (BRIT, FLAS, FTG, MO, NY, TEX, USF). Santa Rosa Co.: Recently burned wetland savanna S of unimproved rd 0.6 mi W of FL 281, ca. 0.6 air mi NW of jct I-10 and FL 281, ca. 0.5 air mi N of Avalon Beach, ca. 6 air mi SW of Milton; Milton South 7.5' Quad.; Sec. 6, T1S, R28W; 30°32'15" N; 87°05'45" W, 3 Oct 1992, *Orzell & Bridges* 21003 (BRIT, FLAS, MO, NCU, TEX, USF). Walton Co.: Damp pine barrens near Argyle, 2 Oct 1901, *Curtiss* 6924 (NY); NW Walton Co, 4 Nov 1939, *Hume s.n.* (FLAS); High streamhead seepage herb bog with quaking mats on tributary to Little Alaqua Creek, 0.4 air mi S of jct Eglin Range Rds 210 and 200, ca. 0.7 air mi SW of New Home, ca. 10 air mi SW of De Funiak Springs; Eglin Air Force Base; Portland 7.5' Quad.; SEQ, SWQ, SWQ, Sec. 3, T1N, R20W; 30°36'15" N; 86°13'51" W, 19 Sep 1993, *Orzell & Bridges* 22446 (BRIT, DUKE, FLAS, TEX, USF). **North Carolina.** Pamlico Co.: Moist soil along ditch, marsh land, Hobucken, 13 Jul 1922, *Randolph & Randolph* 871 (GH) [specimen not seen, but reported and discussed by LeBlond and Sorrie (2001)]

ANDROPOGON TERNARIUS. **Georgia.** Telfair Co.: Xeric longleaf pine / oak sandhill savanna on riverine sand ridge on N side of Horse Creek, ca. 2 mi upstream from the Ocmulgee River, ca. 10 mi SW of Lumber City, 31°50'55" N, 82°48'56" W, 8 Nov 2009, *Orzell & Bridges* 26409 (FLAS, FSU, GA, NCU, USF). **Florida.** Clay Co.: Xeric *Pinus palustris* / *Aristida beyrichiana* - *Ctenium floridanum* savanna, ca. 1 air mi S of Duval Co. line and ca. 0.7 air mi W of Yellow Water Creek, ca. 8.1 air mi NW of Middleburg, Jennings Forest - Black Creek WMA, SEQ, SEQ, SEQ, Sec. 6, T4S, R24E, 30°10'20" N, 81°55'59" W, 16 Oct 1992, *Orzell & Bridges* 21169 (FLAS, FSU, NCU, USF). Hamilton Co.: Typic dry upland burned longleaf pine savanna, ca. 0.8 mi N of FL 6 at a point ca. 0.5

mi E of jct FL 143 at Blue Springs, ca. 2 mi E of Withlacoochee River, ca. 7 air mi SSW of Jennings, SEQ, Sec. 10, T1N, R11E, 30°29'50" N, 83°12'45" W, 5 May 2012, *Orzell & Bridges 26587* (FLAS, FSU, NCU, USF). Lake Co.: Recently burned longleaf pine sandhill savanna, 0.5 mi S of Hartwood Marsh Rd at a point 4.2 mi E of jct US 27, ca. 5 air mi SE of Clermont, NWQ, Sec. 12, T23S, R26E, 28°30'10" N, 81°40'01" W, 22 Oct 2015, *Orzell & Bridges 27042* (FLAS, FSU, NCU, USF). Levy Co.: Sandy roadside through cleared longleaf pine sandhill, at NE corner of jct. FL 24 and NE 112 Ct., ca. 3.5 mi NE of Bronson, opposite "The Church at Sand Hill", SWQ, SEQ, SWQ, Sec. 26, T11S, R17E, 29°29'40" N, 82°35'09" W, 30 Apr 2012, *Orzell & Bridges 26582* (FLAS, FSU, NCU, TEX, USF). Nassau Co.: Cutover xeric sandhill woodland savanna, ca. 0.6 air mi SW of Elbow Landing on St. Marys River, ca. 3.7 air mi NE of Boulogne, ca. 10.5 air mi N of downtown Hillard, SEQ, Sec. 32, T5N, R24E, 30°48'36" N, 81°56'00" W, 17 Oct 1992, *Orzell & Bridges 21207* (BRIT, FLAS, NCU, TEX, USF). Polk Co.: Disturbed sandhill savanna, on N side of Golfview Rd cutoff, just E of Alt Hwy 17 on the north side of Babson Park, SEQ, NEQ, Sec. 29, T30S, R28E, 27°50'30" N, 81°31'56" W, 9 Jun 2011, *Orzell & Bridges 26437* (FLAS, USF); Longleaf pine sandhill woodland on yellow sand, Tiger Creek TNC Preserve E of Babson Park, SEQ, Sec. 2, T31S, R28E, 27°48'39" N, 81°29'12" W, 4 Nov 2011, *Orzell & Bridges 26550* (FLAS, USF); Frequently burned longleaf pine sandhill woodland, E of Billig Rd on Avon Park Air Force Range, NWQ, NWQ, Sec. 4, T32S, R30E, 27°43'50" N, 81°19'49" W, 18 Oct 2012, *Orzell & Bridges 26605* (BRIT, FLAS, FSU, NCU, NY, TEX, USF).

ANDROPOGON CABANISII. **Florida.** Clay Co.: Dry-mesic pine pinelands, ca. 1 air mi S of Duval Co. line and ca. 0.7 air mi W of Yellow Water Creek, ca. 8.1 air mi NW of Middleburg, Jennings Forest - Black Creek WMA, SEQ, SEQ, SEQ, Sec. 6, T4S, R24E, 30°10'20" N, 81°55'59" W, 16 Oct 1992, *Orzell & Bridges 21157* (BRIT, F, FLAS, FTG, GH, MO, NCU, NY, TEX, USF, US). Glades Co.: Mesic slash pine savanna, east of Fisheating Creek, ca. 7 mi SW of Venus, NEQ, Sec. 8, T40S, R29E, 27°00'40" N, 81°26'05" W, 6 Aug 2003, *Orzell & Bridges 26108* (FLAS, USF). Highlands Co.: Oak scrub with xeric sandy barrens, in primitive camping area of Highlands Hammock State Park, ca. 0.4 mi SSW of jct CR634 and CR635 at park entrance, ca. 6.5 mi W of Sebring, SEQ, NEQ, Sec. 4, T35S, R28E, 27°27'56" N, 81°31'04" W, 15 Oct 1994, *Orzell & Bridges 23306* (USF); Mesic longleaf pine savanna, ca. 0.1 mi N of Kulhanek Rd, 0.2 mi E of jct Canady Rd, Avon Park Air Force Range, SEQ, SWQ, SWQ, Sec. 34, T33S, R30E, 27°33'31" N, 81°19'02" W, 29 Oct 1999, *Orzell & Bridges 25763* (FLAS, FSU, NCU, USF). Hillsborough Co.: Tampa, Oct 1877, *Garber s.n.* (NY) [note - not all sheets distributed by Garber with this collection data are *A. cabanisii* - some are *A. cumulicola*, and some are mixed sheets with culms of both species]. Okeechobee Co.: Open wet mesic hyperseasonal grassland, in undeveloped subdivision, ca. 4.6 mi N of FL 724, ca. 11.8 air mi W of Fort Drum, SEQ, NWQ, Sec. 11, T34S, R33E, 27°31'54" N, 81°00'14" W, 21 Oct 1994, *Orzell & Bridges 23351* (BRIT, DUKE, FLAS, FTG, MO, NCU, NY, TEX, USF, US); Scrubby pinelands, on E side of US441, just S of NE 342nd Trail, NWQ, SWQ, Sec. 34, T33S, R35E, 27°33'33" N, 80°49'24" W, 3 Nov 2011, *Orzell & Bridges 26548* (FLAS, USF). Polk Co.: Burned wet grasslands E of Morgan Hole Creek, S of Smith Rd and a point ca. 0.5 mi W of jct with Durden Rd, Avon Park Air Force Range, NWQ, NWQ, NWQ, Sec. 26, T32S, R30E, 27°40'29" N, 81°18'09" W, 23 Oct 1993, *Orzell & Bridges 22510* (BRIT, F, FLAS, FTG, GH, MO, NCU, NY, TEX, USF, US); Wet-mesic longleaf pine savanna, S of Eight Mile Rd, ca. 0.4 mi NE of jct Blood Rd and Eight Mile Road, Avon Park Air Force Range, SWQ, NEQ, SEQ, Sec. 17, T32S, R31E, 27°41'36" N, 81°14'23" W, 3 Nov 1994, *Orzell & Bridges 23376* (FLAS, FSU, NCU, USF).

ANDROPOGON MIAMIENSIS. **Florida.** Miami-Dade Co.: Scattered in rocky pineland, mostly near road edge, culms to 2 m high, leaves glaucous, edge of road along east boundary of park, Everglades National Park, 26 Oct 1976, *Avery 1298* (FTG); Long Pine Key, 14 Sep 1962, *Craighead s.n.* (FTG); Everglades National Park, Gate 2 1/2, 29 Sep 1963, *Craighead s.n.* (FTG); Homestead, 11

Nov 1962, *Craighead s.n.* (FTG); Rocky pineland with reddish soil, SW 165 Ave - 304 St., Homestead, plants forming clumps, culms to 1.7 m tall, the pink color of the internodes contrasting with the green or brown of the leaf sheaths to give a barber-pole effect, 15 Oct 1982, *Herndon 654* (FTG); In disturbed soil at edge of pineland, Old Cutler Rd and S 62 Ave, Sec. 13, T55S, R40E, 6 Oct 1968, *Avery 546* (FTG); Locally common in sandy pine rockland/muhly prairie ecotone, Nixon Smiley Pineland Preserve, entrance located 1/4 mi east of SW 137th Ave. along SW 128th St, 25.648 N, 80.410 W, 26 Oct 1999, *Woodmannsee 410* (FTG). Monroe Co.: Scattered clumps in rocky pineland, Big Pine Key – culms moderate purplish-red, leaves and sheath moderate olive green, 15 Oct 1965, *Avery s.n.* (FLAS, FTG).