E.B. glade (Gadsden County) with black bogrush in foreground Photo by Ann F. Johnson

Upland Glade

Description: Upland glade is a largely herbaceous community with woody inclusions that occurs on thin soils over limestone outcrops on steep topography in Jackson and Gadsden counties. It is found in small openings ranging from 0.1 to 2 acres in size within an otherwise forested landscape. Open portions of upland glade are dominated by black bogrush (*Schoenus nigricans*) and/or other graminoids, such as poverty dropseed (*Sporobolus vaginiflorus*), hairawn muhly (*Muhlenbergia capillaris*), the stoloniferous form of little bluestem (*Schizachyrium scoparium*), spreading beaksedge (*Rhynchospora divergens*), and cypress witchgrass (*Dichanthelium dichotomum*), with variable amounts of limestone rock exposed. Other characteristic herbs include Cherokee sedge (*Carex cherokeensis*), lanceleaf tickseed (*Coreopsis lanceolata*), Boykin's milkwort (*Polygala boykinii*), false garlic (*Nothoscordum bivalve*), and starrush whitetop (*Rhynchospora colorata*). Areas of thinner soil or bare rock support diamondflowers (*Stenaria nigricans*), Gulf spike-moss (*Selaginella apoda* var. *ludoviciana*), and bluegreen algae (*Nostoc* sp.). A set of limestone-loving shrubs and trees occur on deeper soil within the glade, or on the edges, forming a shrubby transition to upland hardwood forest. Characteristic woody species include red cedar (*Juniperus virginiana*), eastern redbud (*Cercis canadensis*), sugarberry (*Celtis laevigata*), roughleaf dogwood (*Cornus asperifolia*), white ash (*Fraxinus americana*), yaupon (*Ilex vomitoria*), and winged elm (*Ulmus alata*). Rattan vine (*Berchemia scandens*) is commonly found scrambling over these shrubs and small trees.

Upland glade was first mapped in the course of a survey of the Apalachicola ravines in Gadsden County (Leonard and Baker 1982). More glades have recently been mapped in Jackson County. In Gadsden County upland glade occurs on limestone outcrops of the Miocene Chattahoochee Formation (Rupert 1990; Means, pers. comm. 2007) primarily between the 90 and 120 foot contour lines. In Jackson County upland glade is found primarily on Oligocene Marianna Limestone (Moore 1955; Means, pers. comm. 2007) between the 130 and 150 foot contours.

Upland glade usually occupies areas too small to be distinguished at the scale of county soil survey maps. They may occasionally be shown as rock outcrop symbols within the matrix of the surrounding forest soils. In Gadsden County these matrix soils are Binnsville soils or Cuthbert, Boswell and Susquehanna soils on moderate to steep slopes (Thomas et al. 1961). In Jackson County the matrix soils are the Oktibbeha variant rock outcrop complex (Duffee et al. 1979).

Characteristic Set of Species: black bogrush, poverty dropseed, diamondflowers, hairawn muhly, Boykin's polygala, red cedar

Rare Species: Ten northern species that are listed as rare in Florida, but range widely outside the state, occur on upland glades: green milkweed (*Asclepias viridiflora*), poppy mallow (*Callirhoe papaver)*, small-toothed sedge (*Carex microdonta*), Carolina larkspur (*Delphinium carolinianum*), shootingstar (*Dodecatheon meadia*), eastern purple coneflower (*Echinacea purpurea*), little-people (*Lepuropetalon spathulatum*), pinnate-lobed coneflower (*Rudbeckia triloba* var. *pinnatiloba*), nettle-leaved sage (*Salvia urticifolia*), and shade betony (*Stachys crenata*). Eleven other species on upland glades that are rare in Florida but have widespread distributions outside the state also are being considered for listing by FNAI: meadow garlic (*Allium canadense* var. *mobilense*), sideoats gramma (*Bouteloua curtipendula*), smooth oxeye (*Heliopsis helianthoides* var. *gracilis*), Small's ragwort (*Packera anonyma*), narrowleaf mountain-mint (*Pycnanthemum tenuifolium*), pinnate prairie coneflower (*Ratibida pinnata*), poverty dropseed (*Sporobolus vaginiflorus*), western silver aster (*Symphyotrichum sericeum* var. *microphyllum*), Short's aster (*Symphyotrichum shortii*), smooth blue aster (*S. laeve*), and hairyjoint meadowparsnip (*Thaspium barbinode*). Other possible candidates for listing include purple meadowparsnip (*Thaspium trifoliatum*) and golden alexanders (*Zizia aurea*).

Range: Upland glade is found only in Florida and adjacent Decatur County, Georgia (Ward and Gholson 1987) in two clusters about 30 miles apart. One cluster is in a four square mile area northwest of the town of Marianna in Jackson County, totaling 9 sites and 8.5 acres, and the other is an eighteen square mile area south and east of the town of Chattahoochee in Gadsden County, totaling 13 sites and 14.5 acres. New sites continue to be found within these areas.

Upland glade in Florida shares many species with other areas to the north and west where limestone is at or near the surface. These include the cedar glades on limestone outcrops in Tennessee and northern Alabama (Baskin and Baskin 1999), the shallow-soil Black Belt prairies on Selma Chalk in Alabama and Mississippi (Schotz 2005), and various outcrop and prairie communities in southeastern Texas (Bridges et al. 1989). None of these areas, however, have black bogrush as the dominant species. In the United States

this species is found only in Florida, Texas, California and Nevada; it also occurs in western Europe, South Africa, the West Indies and Mexico (Sparling 1968). The cedar glades of Tennessee and northern Alabama are dominated by the annual grass, poverty dropseed (Quarterman 1950; Baskin and Baskin 1999) and the Black Belt Prairies of Alabama and Mississippi by little bluestem (Schotz 2005). Both these species may also dominate portions of upland glade in Florida. The Black Belt Prairies are the closest source of many calcium-loving species on Florida upland glades, being less than 100 miles distant from Jackson County. Species rare in Florida that are also found on the Black Belt Prairies include green milkweed, small-toothed sedge, Carolina larkspur, pinnate prairie coneflower, nettle-leaved sage, and western silver aster (Schotz 2005).

Natural Processes: Soil depth is cited as the factor inhibiting tree and shrub colonization of herbaceous portions of limestone glades in Tennessee and Alabama (Quarterman 1950; Quarterman et al. 1993; Baskin and Baskin 1999). A small study measuring soil depth and pH on transects across three of the Gadsden County glades (Coultas 1983) lends support to this hypothesis for the Florida upland glades. Soil depth to hard limestone ranged from 4 to 14 inches in 13 samples taken along transects on the open herbaceous portions of three glades, with most samples falling in the 6 to 8 inch range. These figures are similar to soil depths measured on open glades in Tennessee (Baskin and Baskin 1999). Depth to limestone in four samples from the forest immediately surrounding the glades ranged from 21 to over 60 inches (Coultas 1983). Soils on the open glade were more alkaline **(**pH 7.5-7.6) than soil of the surrounding forest (pH 4.8-6.4; Coultas 1983). An additional stress on plants on glades is the alternation between wet and dry soils. Soils on the herbaceous portion of the glades are often wet and "mushy" in early spring and become nearly completely dry by fall.

Fire may have swept through upland glades at irregular intervals, especially those that were bordered by longleaf pine-dominated upland pine or sandhill communities that would have naturally tended to burn frequently.

Community Variations: Although upland glades in Jackson and Gadsden counties share dominant and many characteristic species, there is a set of characteristic species that serve to differentiate them. Present on Gadsden, but not Jackson County glades are poppy mallow, small-toothed sedge, littlehip hawthorn (*Crataegus spathulata*), orange coneflower (*Rudbeckia fulgida*), Gulf spike-moss, western silver aster, and Florida bully (*Sideroxylon reclinatum*). Present on Jackson but not Gadsden County glades are *Coreopsis* sp. (narrow, glabrous leaves), Carolina woollywhite (*Hymenopappus scabiosaeus*), Small's ragwort, pinnate-lobed coneflower, and gum bully (*Sideroxylon lanuginosum*). Two species are more common in one or the other county: Florida maple (*Acer saccharum* var. *floridanum*) is more common around glades in Gadsden County; chinquapin oak (*Quercus muehlenbergii*) is more common around glades in Jackson County.

Associated Communities: The woody component of upland glade can be distinguished from the adjacent upland hardwood forest by the presence of red cedar, the concentration of other calciphilic species, and the short stature of the trees and shrubs. Upland glade can be distinguished from mesic flatwoods, which sometimes also has black bogrush in the ground layer where limestone is near the surface, by the presence of green milkweed

and other characteristic northern calciphiles and the absence of saw palmetto (*Serenoa repens*), gallberry (*Ilex glabra*) and a pine canopy. Occasionally glade-like areas occur within the upland hardwood forest community where limestone is close to, but not at, the surface. These may be small grassy areas with a few of the characteristic glades herbs but without either black bogrush or the other short graminoid species as dominants.

Management Considerations: Although the ecology of the upland glade community has not been studied, it seems a reasonable working hypothesis that soil depth prevents woody colonization on the rockier portions of the glades, such as those areas dominated by diamond flowers and poverty dropseed, as has been proposed for areas of similar vegetation in the Tennessee glades (Quarterman 1950). Portions of the glades supporting taller grasses such as Gulf hairawn muhly and little bluestem may be more susceptible to woody encroachment, since increases in cover of red cedar have been observed at some glades over the course of several decades. Thus it may be that infrequent fires play a role in preventing woody species from shading out the characteristic graminoid dominants, particularly in those glades bordered by pine communities. Occasional droughts may also play a similar role in retarding woody growth on the glade. Casual observation of one burn on a glade indicated that the herbaceous species recovered to pre-burn levels of cover within a year or two, but the question of natural fire interval for this community needs more research.

Threats to upland glades are primarily physical disturbance, since to non-botanists they appear indistinguishable from an artificial clearing in the forest. Only three of the twenty-two known glades are on public lands. Known glades have been lost to road widening, plowing for a game food plot, and limestone mining. In the past, others were probably destroyed by clearing, dumping, and disturbance from being used for parking logging machinery and as staging areas for timber operations. When the soil is disturbed, glades are vulnerable to being colonized by a dense sward of the exotic centipede grass (*Eremochloa ophiuroides*) which effectively precludes re-colonization by native glades species. Other exotics invading disturbed glades include Formosa firethorn (*Pyracantha koidzumii*) and Chinese and glossy privets (*Ligustrum sinense, L. lucidum*).

Reference Sites: The best developed glades are on private lands (Chalky, Brickyard, and E.B. glades in Gadsden County and Brooks 1 in Jackson County). Only a few glades are on public lands: one small glade in Florida Caverns State Park (Jackson County), and several small glades on lands of the Florida Department of Corrections south of US 90, about one mile east of Chattahoochee; the latter are not specifically managed for protection of their natural resources.

Global and State Rank: G1/S1

Crosswalk and Synonyms:

SAF	73/Southern Redcedar

Other synonyms: cedar glades (Baskin and Baskin 1999); limestone glades (Bridges and Orzell 1986)

References:

Baskin, J.M., and C.C. Baskin. 1999. Cedar glades of the southeastern United States. Pages 206-219 in R.C. Anderson, J.S. Fralish, and J.M. Baskin, editors. Savannas, Barrens, and Rock Outcrop Plant Communities of North America. Cambridge University Press, Cambridge.

Bridges, E.L., and S.L. Orzell. 1986. Distribution patterns of the non-endemic flora of Middle Tennessee limestone glades. Association of Southeastern Biologists Bulletin 33:155-166.

Bridges, E.L., S.L. Orzell, and L.C. Anderson. 1989. *Carex microdonta* Torr. & Hook. (Cyperaceae) new to Florida. Sida 13:379-381.

Coultas, C.L. 1983. Examination of soils associated with four small "limestone glade communities" surrounded by forest in the hills of western Gadsden County. Florida Natural Areas Inventory, Tallahassee.

Duffee, E.M., W.J. Allen, and H.C. Ammons. 1979. Soil survey of Jackson County, Florida. United States Department of Agriculture, Soil Conservation Service in cooperation with the University of Florida Institute of Food and Agricultural Sciences, Agricultural Experiment Stations, Soil Science Department, Gainesville, Florida.

Leonard, S.W., and W.W. Baker. 1982. Biological survey of the Apalachicola Ravines biotic region of Florida. Report to the Florida state office of The Nature Conservancy and to the Florida Natural Areas Inventory, Tallahassee, Florida.

Means, H. Geologist with the Florida Geological Survey, Tallahassee. Personal Communication. 2007

Moore, W.E. 1955. Geology of Jackson County. Florida: Florida Geological Survey Bulletin 37:1-101.

Quarterman, E. 1950. Major plant communities of Tennessee Cedar Glades. Ecology 31:234-254.

Quarterman, E., M.P. Burbanck, and D.J. Shure. 1993. Rock outcrop communities: limestone, sandstone, and granite. Pages 35-86 in W.H. Martin, S.G. Boyce, and A.C. Echternacht, editors. Biodiversity of the Southeastern United States: Upland Terrestrial Communities. John Wiley and Sons, Inc., New York.

Rupert, F.R. 1990. Geology of Gadsden County, Florida. Florida Geological Survey, Tallahasseem Florida.

Schotz, A. 2005. A checklist of vascular flora in the Black Belt Prairies of Alabama. Alabama Natural Heritage Program, Montgomery, Alabama.

Sparling, J.H. 1968. Biological flora of the British Isles: *Schoenus nigricans* L. (*Chaetospora nigricans* Kunth). Journal of Ecology 56:883-899.

Thomas, B.P., H.H. Weeks, and M.W. Hazen, Jr. 1961. Soil Survey of Gadsden County, Florida. United States Department of Agriculture, Soil Conservation Service in cooperation with the University of Florida Institute of Food and Agricultural Sciences, Agricultural Experiment Stations, Soil Science Department, Gainesville, Florida.

Ward, D.B., and A.K. Gholson. 1987. The hidden abundance of *Lepuropetalon spathulatum* (Saxifragaceae) and its first reported occurrence in Florida. Castanea 52:59-67.