

NATURAL RESOURCE PROGRAM ASSESSMENT
HORSESHOE BEND NATIONAL MILITARY PARK

COMPILED BY:

Roger Brown, Graeme Lockaby, Art Chappelka
School of Forestry and Wildlife Sciences
210 M. White Smith Hall
Auburn University
Auburn, AL 36849

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Executive Summary

This report provides an assessment of the current natural resource management program at Horseshoe Bend National Military Park (HOBE) including recommendations for program improvement and change. In general, the natural resource conditions in the Park are very good and the cultural and ecological resources there are deemed to be highly sustainable through continued application of the current management program.

1. Current Natural Resource Management Program

Cultural, heritage, and ecological considerations drive management decisions and, consequently, the current natural resource management program at the Park is the basis for maintenance of cultural and ecological features.

Primary natural resource management objectives:

- I. Preserve and improve condition of natural resources in the park;
- II. Ensure, where possible, that natural resource management program fits with broader mission of HOBE, i.e. creating a lasting cultural legacy for future generations.

Secondary natural resource management objectives:

- I. Return vegetation and landscape to conditions reflective of the early 1800's;
- II. Restore and improve damaged ecosystems;
- III. Minimize demands on Park staff and budget.

Grass mowing regimes

Grassy areas around the visitor center are mowed as needed. Many of the grassed areas are under contract for hay production and are mowed three times per year and fertilized once each year.

Wildlife management activities

Fishing and horseback riding are permitted in some areas of the Park while hunting is prohibited. Fishing is allowed along the banks of the Tallapoosa River except in the tour areas. Horseback riding is permitted in designated areas throughout most of the Park. Game species are not actively managed (e.g. no feed plots). All wild species are not disturbed except in special circumstances (e.g. removal of poisonous snakes from picnic areas). Domestic animals (e.g. dogs) are captured and removed from the park in the custody of animal control.

Fertilizer / chemical uses

Pests (e.g. Southern pine beetles) are sometimes managed with limited herbicide use (e.g. basal bark application). Herbicide use in such cases is outlined in the Park's Pest Management Plan.

Forestry activities

Commercial timber harvests are not practiced within the Park. Natural resource managers remove the occasional tree in order to open view sheds (e.g. along the river at the Tohopeka Village site) or eliminate hazards (e.g. dead trees near the picnic areas).

Prescribed burning

Upon approval, the Fire Management Plan (2003) will permit fire management in the Park to expand operations beyond immediate and total suppression to include prescribed burning. Both hardwood and longleaf pine ecosystems are expected to benefit significantly from prescribed fire treatments. Implementation of the plan was scheduled to begin in January 2004.

2. Current Natural Resource Condition

Water Resources

Those data (Figures 1-4) that are currently available do not indicate threats to water resources at this time. Park personnel have indicated that a much more comprehensive survey of water quality indicators in the Tallapoosa River near the Park will be performed by the US Geologic Survey in the near future.

Non-Native Species

The most obvious presence of invasive, non-native vegetative species is associated with vegetation type 2 (Figure 8), mixed hardwood and pine floodplain. Chinese privet (*Ligustrum sinense*) is very common in understories there. For control of non-native species, see attached information "Nonnative Invasive Plants of Southern Forests".

Stream Banks

All observed stream and river banks within the Park are minimally disturbed with various degrees of natural stream bank erosion (sloughing). The stream bank along the river at the Tohopeka Village site appears less stable than other areas and this may possibly be related to removal of streambank trees there.

Air Quality

Available data (Figure 9, Tables 1-2) do not indicate threats to air quality at this time. However, due to many factors ozone concentrations are rather low in 2004 for the Southern US. Because of increased expansion and urbanization of the metro-Birmingham area (Figure 9) ozone has the potential to be a problem in the future. Based on data provided from Table 1, emissions of toxic pollutants in the area around the Park are in the mid-range in the US. For more information refer to the following: <http://airgrades.net/airquality.htm>, www.epa.gov/air/data.

Forest Health

Forest health in general, appears to be good. However, two potential problems were noticed: 1) southern pine beetle. Several areas with dead and dying pines due to southern pine beetle were observed, 2) A few areas with pines (whole trees) leaning or fallen over were observed. The pattern appeared circular in nature. This is indicative of Annosus root rot. For information regarding identification and recommendations for control regarding these two pests refer to the following: <http://www.na.fs.fed.us/spfo/pubs/fidls/annosus/fidl-ann.htm>; http://www.na.fs.fed.us/spfo/pubs/fidls/so_pine_beetle/so_pine.htm.

Soil Resources

Soil variation within the Park boundaries is strongly associated with two topographic features, i.e. ridgetops and / or slopes and floodplains (Figure 6). Ridgetops and most slopes are dominated by the Pacolet series and associated soil complexes which are moderately eroded and well drained. Slopes south of the Tallapoosa River exhibit Wickham series soils which are similar in many practical respects to the Pacolet. According to the USDA-National Resource

Conservation Service, Pacolet and Wickham soils are moderately productive for tree species such as loblolly pine and yellow poplar but are associated with erosion hazards on slopes greater than 15%. Presently, these soils support stands of upland pine, hardwood, and mixed pine / hardwood (Figure 8).

Toccoa soils are generally found on most of the floodplains within the Park. These soils are well drained although occasionally flooded. Productivity for tree species such as loblolly pine, yellow poplar, and sweetgum is quite high. Vegetation communities found on these soils include mixed hardwood north of the River and mixed pine – hardwood to the south.

3. Potential Natural Resource Condition

In general, the natural resource conditions in the Park are very good and the cultural and ecological resources there are deemed to be highly sustainable through continued application of the current management program.

4. Recommendations

- Streambank stabilization may require attention in some areas (e.g. near the Tohopeka Village site). While trees may be removed in some instances to enhance views, bank sloughing can be stimulated as well. However, there are stabilization methods that protect streambanks without obstructing views. The USDA – National Resource Conservation Service would be an appropriate agency to contact for technical information.
- Monitor trees for presence of insect pests, most notably southern pine beetle. If possible remove infested trees.
- If pines are thinned or harvested, treat fresh stumps with a fungicide or Borax to prevent spread of Annosus root rot. If removal of pine occurs, these operations should be conducted during the summer months.
- Monitor vegetation for presence of foliar ozone injury. Also, establishment of bioindicator gardens such as those used in other NPS units (<http://www.nps.gov/grsm/pksite/index.htm>) may be an option.
- Given the level of interest in longleaf pine, there currently is little information available regarding site suitability and potential productivity for that species in the Park. Additional information of that nature would be highly useful.
- Five permanent forest inventory plots were established in the course of this project and may be used on a continuing basis to monitor the general health, mortality, and regeneration conditions in the Park. Species and inventory data, along with GIS coordinates for each plot, are provided in this report (Tables 3 and 4).

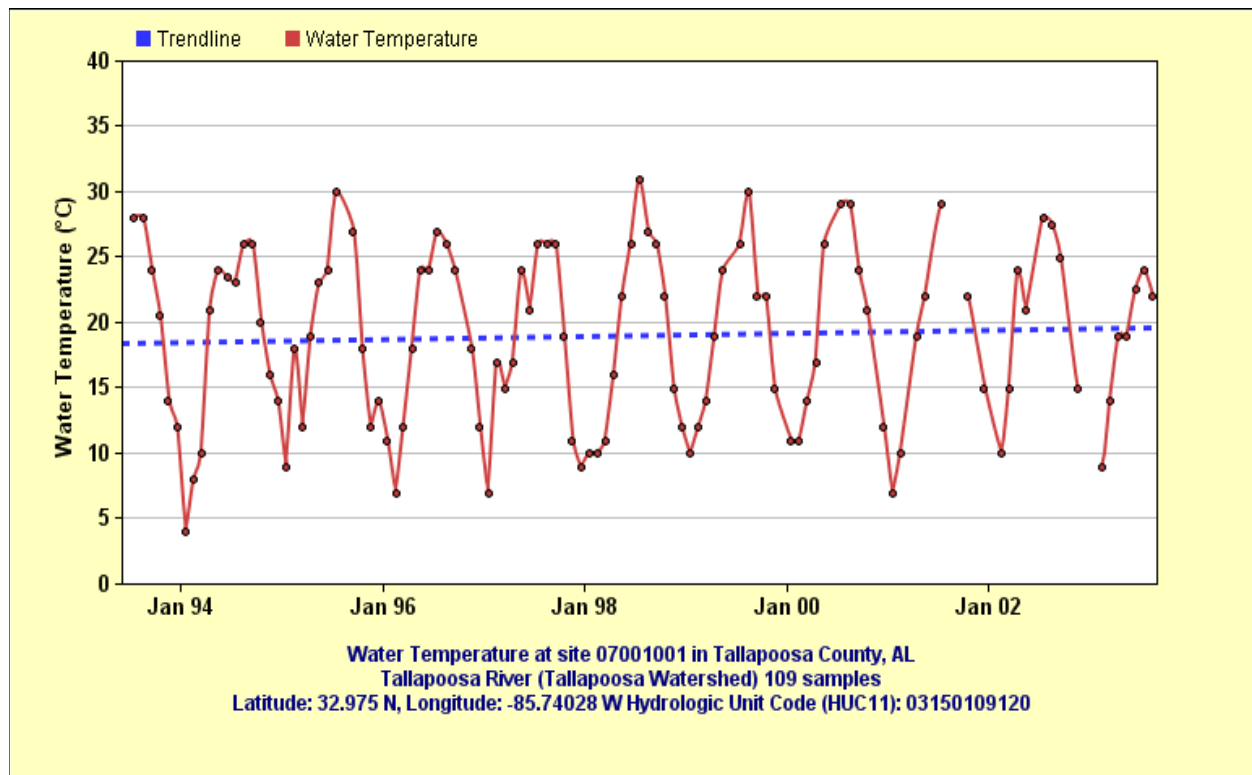


Figure 1: Water temperatures in the Tallapoosa River at site near the Horseshoe Bend National Military Park.

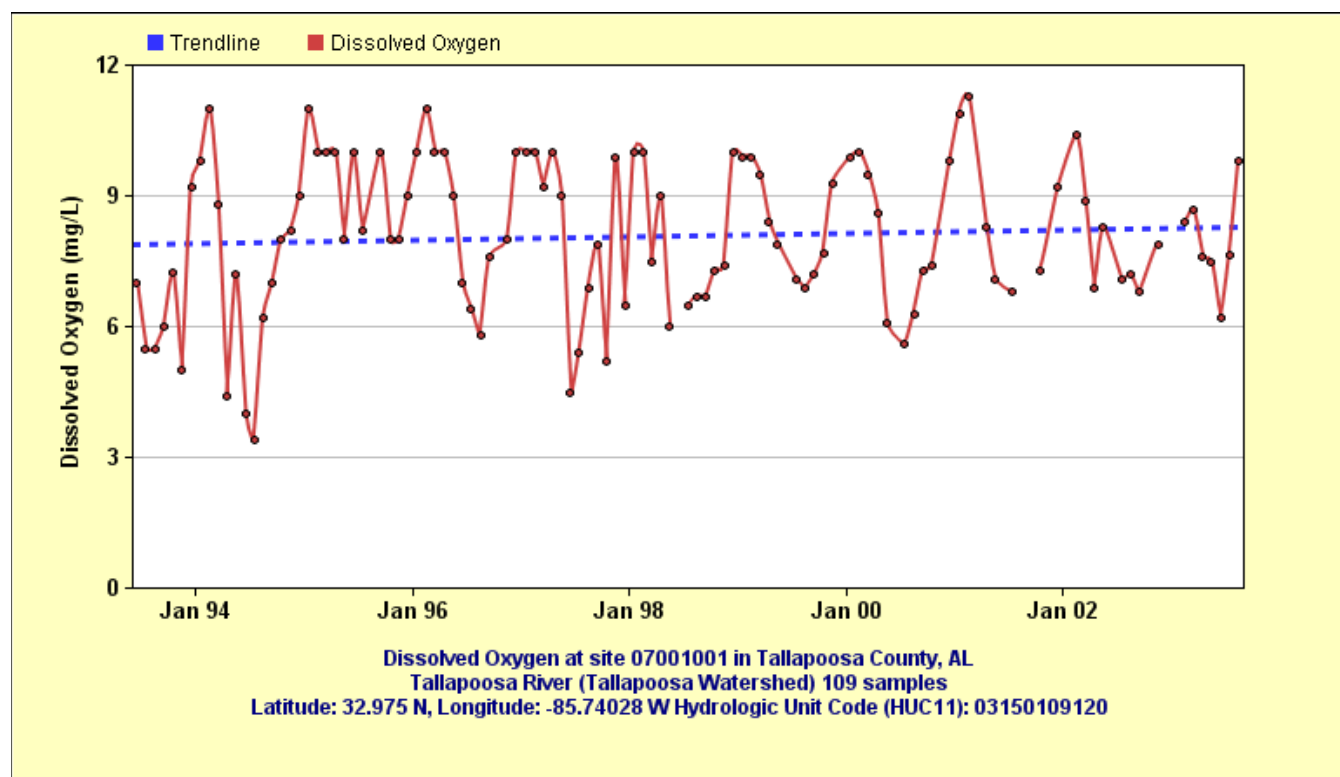


Figure 2: Dissolved oxygen within Tallapoosa River collected at a site near the Horseshoe Bend National Military Park.

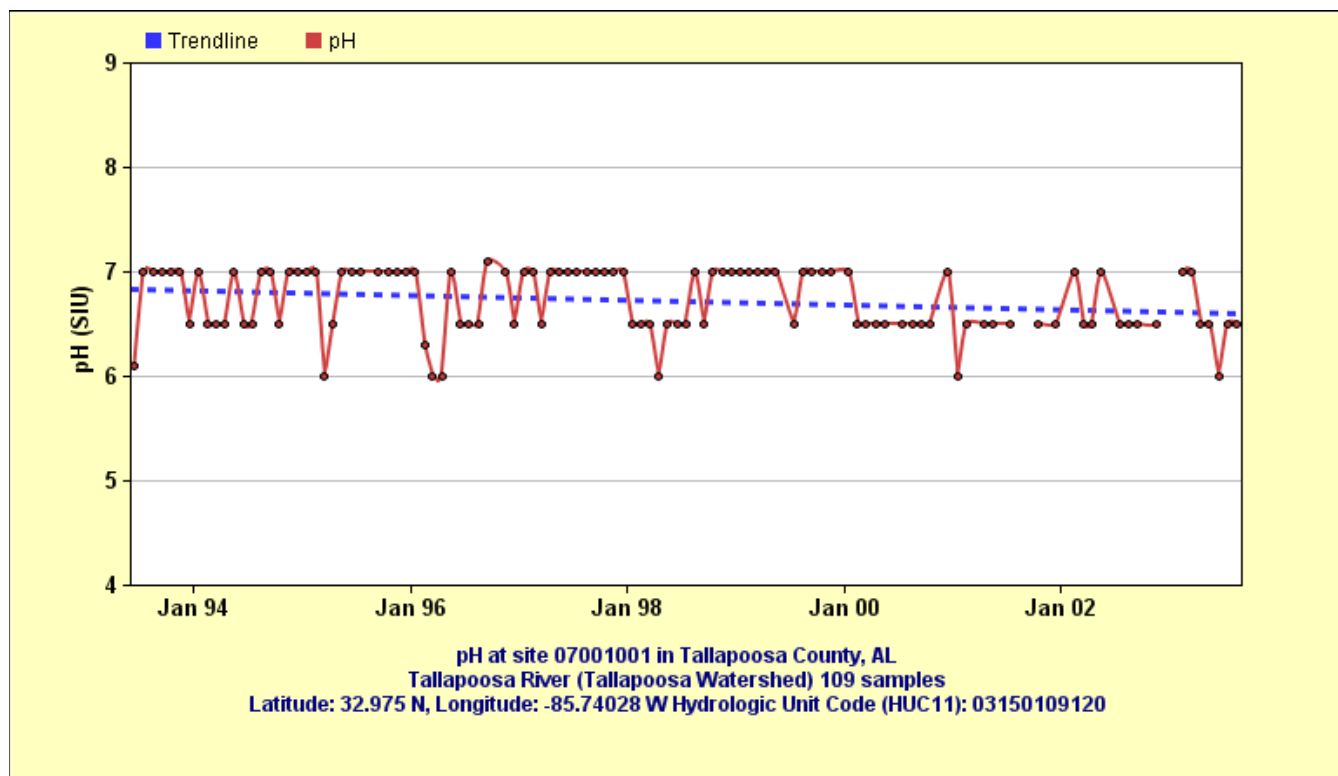


Figure 3: Tallapoosa River pH data collected at a site near the Horseshoe Bend National Military Park.

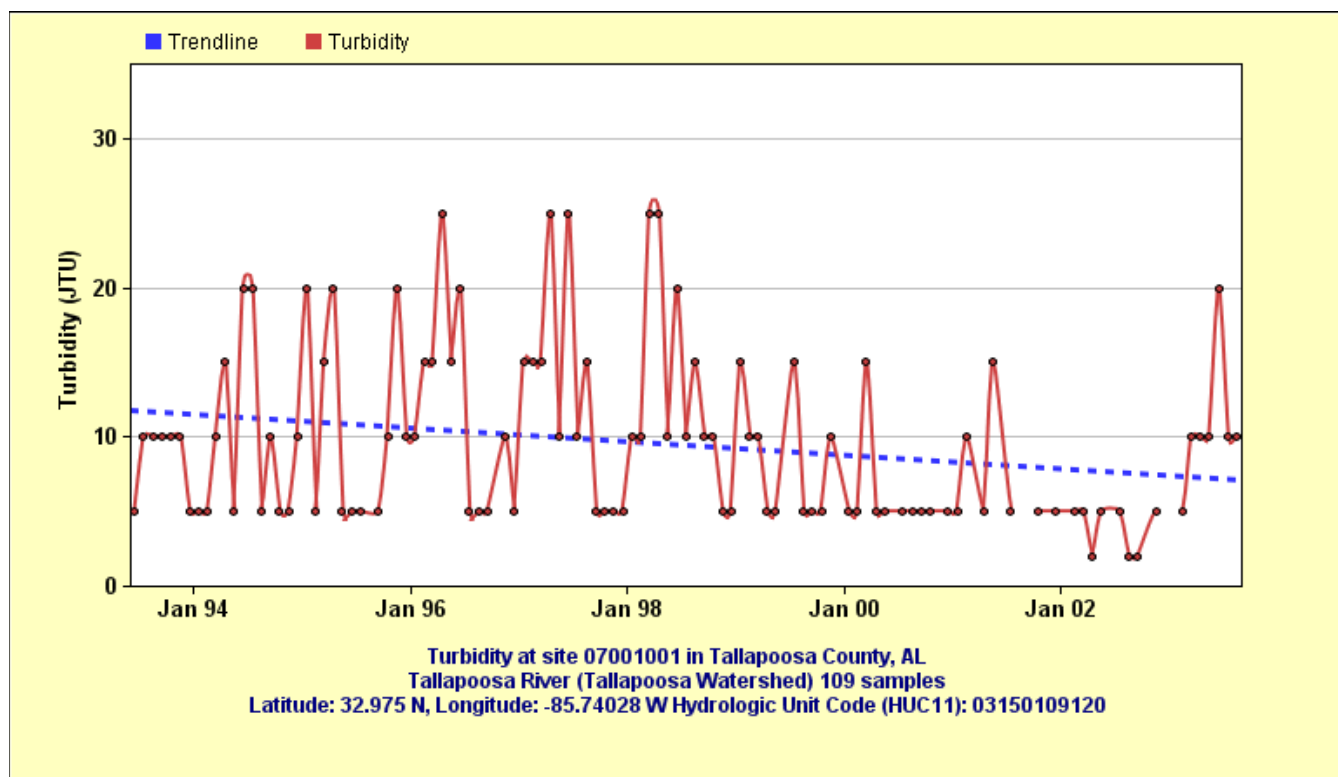


Figure 4: Turbidity measured in the Tallapoosa River at site near the Horseshoe Bend National Military Park.



Figure 5: Aerial Photograph. Horseshoe Bend National Military Park. 1997.
Source: ArcGIS 2003.

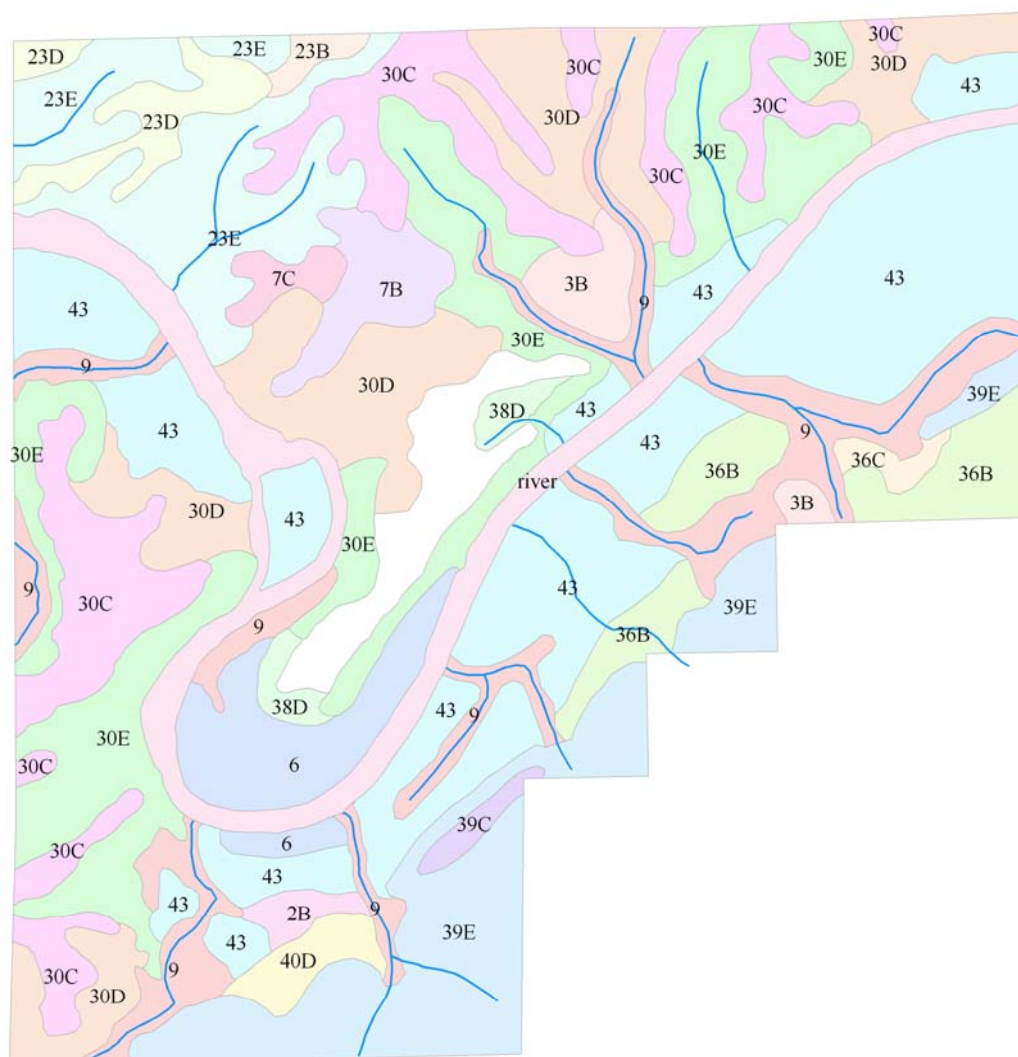


Figure 6: Map of Soils on the Horseshoe Bend National Military Park. 2004.
Source: USDA – Natural Resource Service.

Soil Map Legend – Figure 6

Map Symbol	Soil Name
2B	Altavista sandy loam, 2 to 6 percent slopes, rarely flooded
3B	Hard labor sandy loam, 2 to 6 percent slopes
3C	Hard labor sandy loam, 6 to 10 percent slopes
4	Kinston-iuka complex, 0 to 1 percent slopes, frequently flooded
6	Buncombe loamy sand, 0 to 2 percent slopes, frequently flooded
7B	Cecil sandy loam, 2 to 6 percent slopes, moderately eroded
7C	Cecil sandy loam, 6 to 10 percent slopes, moderately eroded
9	Chewacla, cartecay, and tocooa soils, 0 to 1 percent slopes, frequently flooded
11B	Cowarts loamy sand, 2 to 5 percent slopes
11C	Cowarts loamy sand, 5 to 8 percent slopes
11D	Cowarts gravelly sandy loam, 8 to 15 percent slopes
11E	Cowarts-uchee complex, 15 to 25 percent slopes
15A	Greenville sandy loam, 0 to 2 percent slopes
15B	Greenville sandy loam, 2 to 5 percent slopes
17D	Gwinnett-lloyd complex, 6 to 15 percent slopes, eroded
17E	Gwinnett-agricola complex, 6 to 15 percent slopes, eroded
18B	Hiwassee loam, 2 to 6 percent slopes, eroded
20B	Enon-wynott complex, 2 to 6 percent slopes
21D	Louisburg-rion-rock outcrop complex, 6 to 15 percent slopes, very bouldery
21E	Louisburg-rion-rock outcrop complex, 15 to 35 percent slopes, very bouldery
23B	Madison fine sandy loam, 2 to 6 percent slopes
23D	Madison-fine sandy loam, 6 to 15 percent slopes, moderately eroded

Figure 6 – Soil Map Legend continued

23E	Madison-louisa complex, 15 to 30 percent slopes, moderately eroded
23F	Louisa loam, 30 to 50 percent slopes
24B	Marvyn loamy sand, 1 to 3 percent slopes
25B	Mecklenburg clay loam, 2 to 6 percent slopes, eroded
25D	Mecklenburg clay loam, 6 to 10 percent slopes, eroded
29D	Springhill sandy loam, 5 to 15 percent slopes
30C	Pacolet gravelly sandy loam, 3 to 8 percent slopes, moderately eroded
30D	Pacolet-rion complex, 6 to 15 percent slopes, moderately eroded, stony
30E	Pacolet-rion complex, 15 to 30 percent slopes, moderately eroded, stony
35	Wehadkee silt loam, 0 to 1 percent slopes, frequently flooded
36A	Wickham loam, 0 to 2 percent slopes, rarely flooded
36B	Wickham sandy loam, 2 to 6 percent slopes
37D	Wynott-winnsboro complex, 6 to 15 percent slopes
37E	Wynott-wilkes complex 15 to 35 percent slopes, very stony
38C	Wedowee gravelly sandy loam, 3 to 6 percent slopes, eroded
38D	Wedowee gravelly sandy loam, 6 to 15 percent slopes, eroded
38E	Wedowee very gravelly sandy loam, 3 to 10 percent slopes
39C	Tallapoosa-fruithurst complex, 3 to 10 percent slopes
39E	Tallapoosa-fruithurst complex, 15 to 40 percent slopes
40B	Badin-tatum-tallapoosa complex, 2 to 6 percent slopes, moderately eroded
40D (39D)	Tallapoosa-badin-fruithurst complex, 6 to 15 percent slopes, moderately eroded
42	Pits, borrow areas
43	Toccoa fine sandy loam, gently undulating, occasionally flooded
44B	Greenville-urban land complex, 0 to 15 percent slopes
45	Urban area
46A	Eunola sandy loam, 0 to 2 percent slopes
47B	Lloyd-urban land complex, 2 to 6 percent slopes
50	Fluvaquents, ponded
107B	Cecil-urban land complex, 2 to 6 percent slopes
117B	Lloyd loam, 2 to 6 percent slopes, eroded
130D	Pacolet sandy loam, 6 to 15 percent slopes, very cobbly
130E	Pacolet sandy loam, 15 to 30 percent slopes, very cobbly
138C	Wedowee-saw complex, 2 to 10 percent slopes, very bouldery

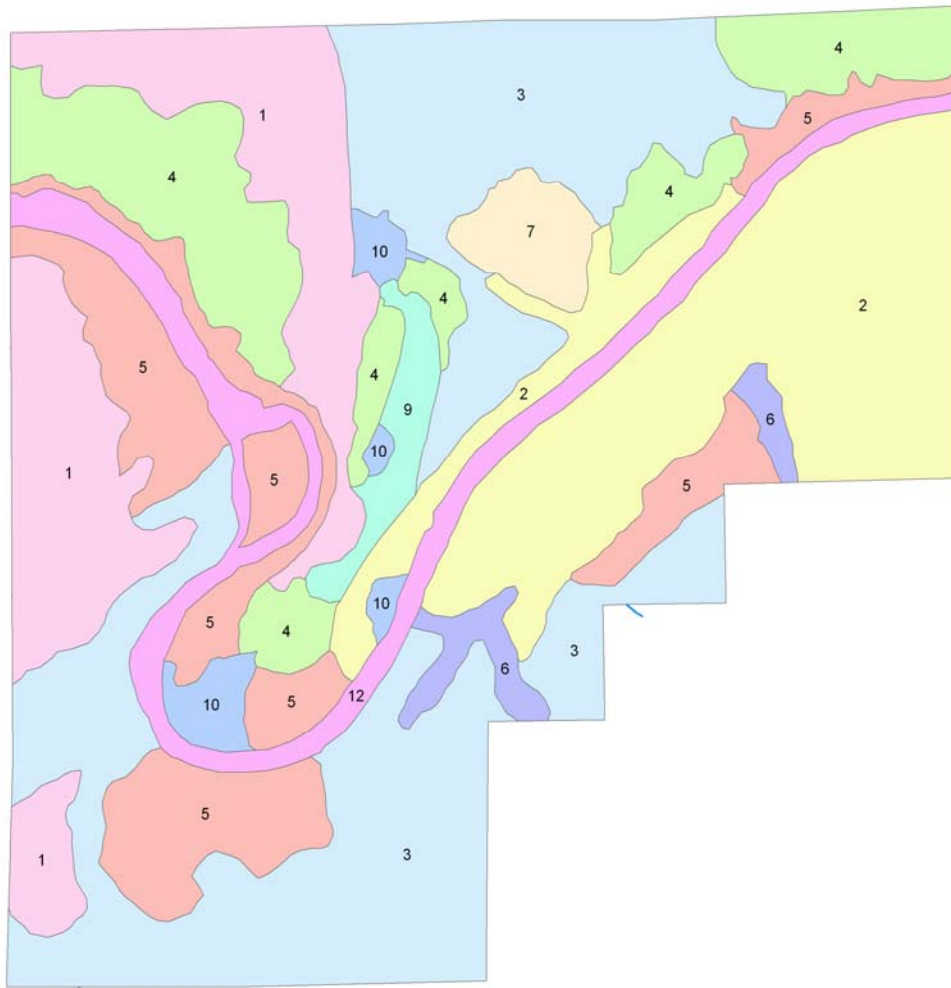


Figure 8: Map of General Vegetation Community Types at Horseshoe Bend National Military Park. 2004. Source: Data collected – this project.

LEGEND

1. Mixed pine / hardwood (upland)
2. Mixed hardwood / pine (floodplain)
3. Mixed pine (upland)
4. Mixed hardwood (upland)
5. Mixed hardwood (broad floodplain)
6. Mixed hardwood (minor floodplain; i.e. cove type sites)
7. Young mixed pine (closed canopy but perhaps regenerated < 30 years ago)
8. Young mixed hardwood
9. Grassy area
10. Scattered trees with grass underneath
11. Other

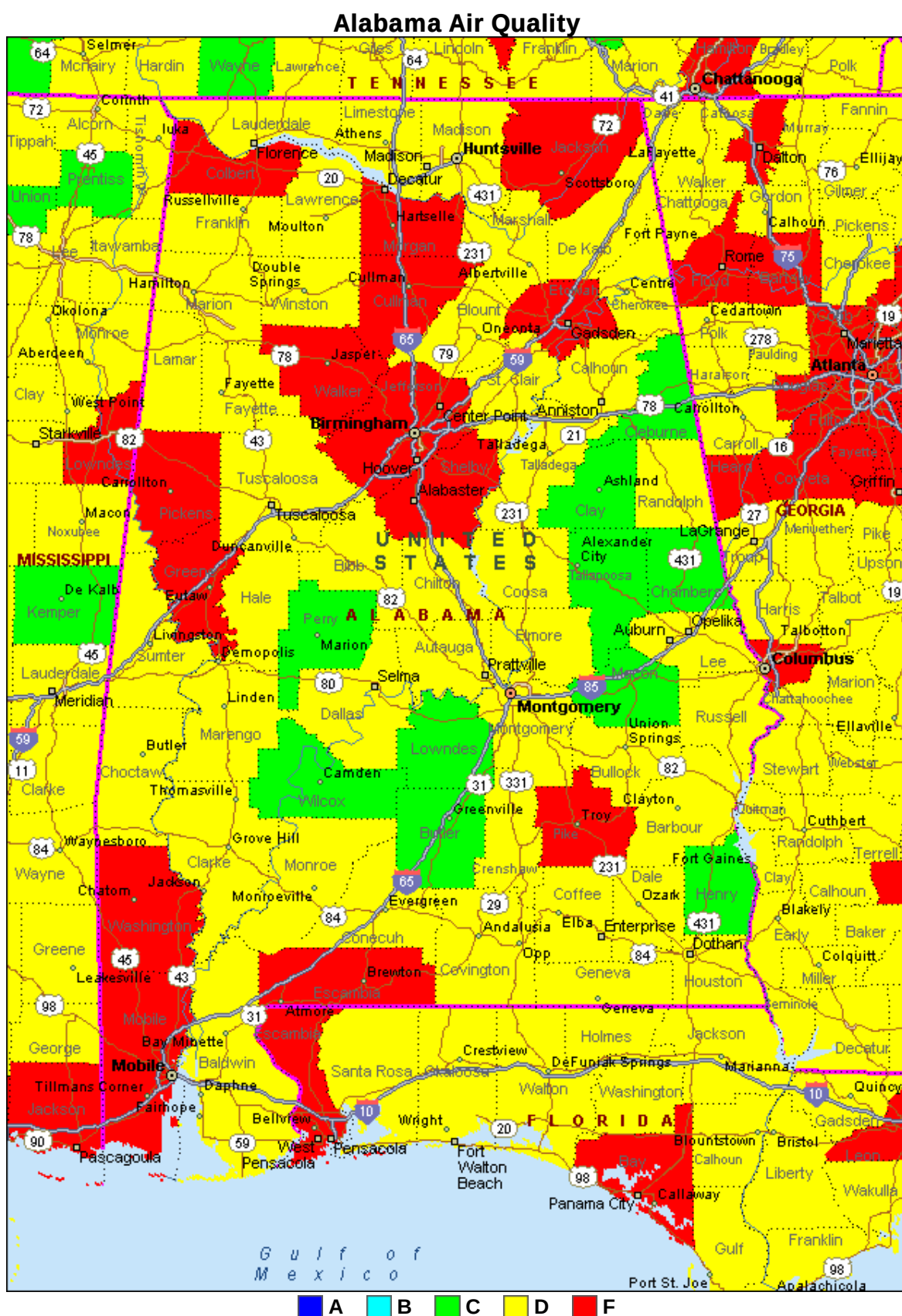


Figure 9. Map showing overall air quality in Alabama.

Source: <http://airgrades.net/airquality/alabama.htm>

Table 1. Emission gradesheet including Tallapoosa County, Al.

Source: <http://airgrades.net/airquality/alabama.htm>

St-	County	Square	County	CO	Pb	NO _x	VOC	PM ₁₀	PM _{2.5}	NH ₃	SO ₂	HAP	Die-	Acro-	Am-
ate		Miles	map	self									sel	lein	bient
AL	MONTGOMERY	799.8	D	D	D	C	D	D	D	C	D	D	D	D	C
AL	MORGAN	599.1	F	F	D	C	D	F	D	D	D	F	D	D	C
AL	PERRY	724.1	C	C	C	A	B	B	C	C	C	C	B	B	C
AL	PICKENS	890.1	F	F	D	B	F	D	C	D	C	B	C	C	C
AL	PIKE	672.1	F	F	D	D	C	D	C	D	C	D	C	C	F
AL	RANDOLPH	584.1	D	D	C	B	D	C	C	B	D	C	C	C	C
AL	RUSSELL	647.4	D	D	D	C	D	D	C	D	B	D	D	C	C
AL	SHELBY	809.5	F	F	D	C	F	D	D	D	B	F	D	D	D
AL	ST. CLAIR	653.6	D	D	D	B	D	C	C	C	C	C	C	C	C
AL	SUMTER	913.3	D	C	C	B	C	C	C	C	C	B	B	C	C
AL	TALLADEGA	760.2	D	D	D	C	D	D	D	D	C	D	D	C	C
AL	TALLAPOOSA	766.2	C	C	C	B	C	C	C	C	B	C	C	C	C
AL	TUSCALOOSA	1351.2	D	D	D	B	D	D	C	C	C	D	D	D	D
AL	WALKER	805.3	F	F	C	C	D	C	D	C	C	F	D	C	C
AL	WASHINGTON	1088.5	F	F	C	C	D	C	C	C	B	F	D	B	C
AL	WILCOX	907.5	C	C	C	B	C	C	C	C	B	C	C	C	C
AL	WINSTON	631.9	D	C	C	B	C	C	C	C	C	C	C	C	C

Key: The emission gradesheets compare US counties for eleven air pollutant emissions. These include carbon monoxide (CO), lead compounds (Pb), nitrogen oxides (NO_x), volatile organic compounds (VOC), particulate matter (two sizes, PM₁₀ and PM_{2.5} μ m), ammonia (NH₃), sulfur dioxide (SO₂), hazardous air pollutants (HAP, air toxics, etc.), diesel emissions, and acrolein. The grades are based on emission densities of pollutant tons per square mile.

Grade	CO	Pb	NO _x	VOC	PM ₁₀	PM _{2.5}	NH ₃	SO ₂	HAP	Diesel	Acrolein
A $\leq$	2.2	0.0000157	0.52	0.51	1.72	0.48	0.20	0.035	0.081	0.0182	0.00075
B $\leq$	9.1	0.00020	2.3	1.96	4.6	1.25	0.69	0.30	0.37	0.066	0.0031
C $\leq$	38	0.0026	9.8	7.6	12.0	3.3	2.5	2.6	1.70	0.24	0.0126
D $\leq$	158	0.033	43	30	32	8.7	8.9	22	7.8	0.085	0.052
F >	158	0.033	43	30	32	8.7	8.9	22	7.8	0.085	0.052

The grade "A" represents the Best/Cleanest emission densities in the US, and "F" the Worst/Dirtiest in the US. The grades reflect the statistical distribution

of base-10 logarithms of the measured emission densities for all US counties,

Table 2. Percent ozone injury for selected indicator species in Horseshoe Bend National Military Park (data collected August 6, 2004). Source: Data collected from this project.

Species	Scientific name	# of plants examined	% ozone injury
Sweetgum	<i>Liquidambar styraciflua</i>	82	0
Crownbeard	<i>Verbesina occidentalis</i>	40	0
Winged Sumac	<i>Rhus copallina</i>	1	0
Yellow poplar	<i>Liriodendron tulipifera</i>	4	0
Black cherry	<i>Prunus serotina</i>	7	0

Table 3. Forest vegetation inventory plots installed at Horseshoe Bend National Military Park – July 2004 (plot numbers and GIS coordinates included).

plot 50	plot 51	plot 52	plot 53	plot 54
16 617939E	16 617518E	16 617747E	16 618180E	16 618743E
3649852N	3648648N	3650507N	3650536W	3649219N
W6584 UTM	W6584 UTM	W6584 UTM	W6584 UTM	W6584 UTM
32°58'50N	32°58'11N	32°59'11N	32°59'12N	32°58'29N
085°44'16W	85°44'33W	085°44'23W	085°44'07W	085°43'46W
NAD27 LAT/LON	NAD27 LAT/LON	NAD27 LAT/LON	NAD27 LAT/LON	NAD27 LAT/LON

Table 4. Forest vegetation inventory plots installed at Horseshoe Bend National Military Park – July 2004.

stand	plot	tree	species	name	diameter		height	
					inch	cm	feet	m
mxpihdup	50	102	Loblolly pine	Pinus taeda	11.8	30.0	64.0	19.5
mxpihdup	50	103	Black cherry	Prunus serotina	4.0	10.2	36.4	11.1
mxpihdup	50	104	Loblolly pine	Pinus taeda	5.9	15.0	36.7	11.2
mxpihdup	50	105	Flowering dogwood	Cornus florida	4.9	12.4	34.4	10.5
mxpihdup	50	106	Loblolly pine	Pinus taeda	4.5	11.4	47.2	14.4
mxpihdup	50	107	Short-leaf pine	Pinus echinata	4.2	10.7	40.0	12.2
mxpihdup	50	108	Loblolly pine	Pinus taeda	16.4	41.7	83.7	25.5
mxpihdup	50	109	Yellow-poplar	Liriodendron tulipifera	4.5	11.4	44.6	13.6
mxpihdup	50	110	Loblolly pine	Pinus taeda	3.8	9.7	27.9	8.5
mxpihdup	50	111	Loblolly pine	Pinus taeda	2.7	6.9	27.2	8.3
mxpihdup	50	112	Loblolly pine	Pinus taeda	10.8	27.4	73.2	22.3
mxpihdup	50	113	Yellow-poplar	Liquidambar styraciflua	2.3	5.8	26.6	8.1
mxpihdup	50	114	Hawthorn	Crataegus sp.	3.0	7.6	21.7	6.6
mxpihdup	50	115	Loblolly pine	Pinus taeda	5.6	14.2	44.3	13.5
mxpihdup	50	116	Loblolly pine	Pinus taeda	3.4	8.6	41.3	12.6
mxpihdup	50	117	Water oak	Quercus nigra	2.6	6.6	34.4	10.5
mxpihdup	50	118	Loblolly pine	Pinus taeda	4.5	11.4	34.4	10.5
mxpihdup	50	119	Black gum	Nyssa sylvatica	2.0	5.1	26.9	8.2
mxpihdup	50	120	Short-leaf pine	Pinus echinata	8.7	22.1	62.7	19.1
mxpihdup	50	121	Sourwood	Oxydendrum arboreum	2.2	5.6	25.6	7.8
mxpihdup	50	122	Yellow-poplar	Liriodendron tulipifera	2.9	7.4	36.1	11.0
mxpihdup	50	123	Yellow-poplar	Liriodendron tulipifera	3.8	9.7	46.3	14.1
mxpihdup	50	124	Sweetgum	Liquidambar styraciflua	5.2	13.2	50.2	15.3
mxpihdup	50	125	Sweetgum	Liquidambar styraciflua	11.2	28.4	75.5	23.0
mxpihdup	50	126	Loblolly pine	Pinus taeda	5.0	12.7	41.7	12.7
mxpihdup	50	127	Loblolly pine	Pinus taeda	14.3	36.3	86.3	26.3
mxpihdup	50	128	Loblolly pine	Pinus taeda	8.6	21.8	59.1	18.0
mxpihdup	50	129	Black gum	Nyssa sylvatica	3.0	7.6	23.6	7.2
mxpihdup	50	130	Loblolly pine	Pinus taeda	3.3	8.4	40.7	12.4
mxpihdup	50	131	Yellow-poplar	Liriodendron tulipifera	2.0	5.1	30.2	9.2
mxpihdup	50	132	Loblolly pine	Pinus taeda	4.3	10.9	51.2	15.6
mxpihdup	50	133	Loblolly pine	Pinus taeda	4.5	11.4	45.3	13.8
mxpihdup	50	134	Sweetgum	Liquidambar styraciflua	4.9	12.4	51.5	15.7
mxpihdup	50	135	Loblolly pine	Pinus taeda	12.6	32.0	83.3	25.4
mxpihdup	50	136	Loblolly pine	Pinus taeda	3.1	7.9	32.8	10.0
mxpihdup	50	137	Loblolly pine	Pinus taeda	4.3	10.9	42.0	12.8
mxpihdup	50	138	Yellow-poplar	Liriodendron tulipifera	8.3	21.1	70.2	21.4
mxpihdup	50	139	Red maple	Acer rubrum	6.0	15.2	55.4	16.9
mxpihdup	50	140	Sweetgum	Liquidambar styraciflua	2.9	7.4	25.9	7.9
mxpihdup	50	141	Sweetgum	Liquidambar styraciflua	2.2	5.6	25.3	7.7
mxpihdup	50	142	Southern red oak	Quercus falcata	2.4	6.1	18.0	5.5
mxpihdup	50	143	Loblolly pine	Pinus taeda	5.4	13.7	50.5	15.4
mxpihdup	50	144	Yellow-poplar	Liriodendron tulipifera	7.1	18.0	52.8	16.1
mxpihdup	50	145	Loblolly pine	Pinus taeda	3.9	9.9	36.7	11.2
mxpihdup	50	146	Ironwood	Carpinus caroliniana	2.0	5.1	18.0	5.5
mxpihdup	50	147	Loblolly pine	Pinus taeda	13.9	35.3	80.7	24.6
mxpihdup	50	148	Loblolly pine	Pinus taeda	4.4	11.2	38.4	11.7
mxpihdup	50	149	Loblolly pine	Pinus taeda	16.9	42.9	88.6	27.0
mxpihdup	50	150	Yellow-poplar	Liriodendron tulipifera	2.4	6.1	28.2	8.6
mxpihdup	50	151	Loblolly pine	Pinus taeda	3.1	7.9	18.7	5.7

mxpihdup	50	152	Sweetgum	Liquidambar styraciflua	6.3	16.0	52.8	16.1
mxpihdup	50	153	Loblolly pine	Pinus taeda	3.4	8.6	33.5	10.2
mxpihdup	50	154	Loblolly pine	Pinus taeda	6.1	15.5	45.3	13.8
mxpihdup	50	155	Black gum	Nyssa sylvatica	3.6	9.1	43.0	13.1
mxpihdup	50	156	Loblolly pine	Pinus taeda	3.8	9.7	37.1	11.3
mxpihdup	50	157	Loblolly pine	Pinus taeda	8.7	22.1	52.5	16.0
mxpihdup	50	158	Loblolly pine	Pinus taeda	5.9	15.0	57.4	17.5
mxpihdup	50	159	Sparkleberry	Vaccinium arboreum	3.2	8.1	18.0	5.5
mxpihdup	50	160	Yellow-poplar	Liriodendron tulipifera	2.7	6.9	36.1	11.0
mxpihdup	50	161	Loblolly pine	Pinus taeda	3.1	7.9	34.1	10.4
mxhrdbfl	51	162	Water oak	Quercus nigra	8.0	20.3	45.3	13.8
mxhrdbfl	51	163	Red mulberry	Morus rubra	2.1	5.3	27.9	8.5
mxhrdbfl	51	164	Willow oak	Quercus phellos	9.0	22.9	82.3	25.1
mxhrdbfl	51	165	Ironwood	Carpinus caroliniana	4.4	11.2	42.0	12.8
mxhrdbfl	51	166	Ironwood	Carpinus caroliniana	3.7	9.4	37.1	11.3
mxhrdbfl	51	167	Ironwood	Carpinus caroliniana	4.6	11.7	33.8	10.3
mxhrdbfl	51	168	Water oak	Quercus nigra	11.5	29.2	85.0	25.9
mxhrdbfl	51	169	Ironwood	Carpinus caroliniana	4.2	10.7	44.3	13.5
mxhrdbfl	51	170	Sweetgum	Liquidambar styraciflua	4.3	10.9	45.6	13.9
mxhrdbfl	51	171	Sweetgum	Liquidambar styraciflua	9.5	24.1	68.2	20.8
mxhrdbfl	51	172	Water oak	Quercus nigra	14.0	35.6	88.9	27.1
mxhrdbfl	51	173	Winged elm	Ulmus alata	4.7	11.9	50.2	15.3
mxhrdbfl	51	174	Beech	Fagus grandifolia	3.3	8.4	28.5	8.7
mxhrdbfl	51	175	Sourwood	Oxydendrum arboreum	3.8	9.7	33.8	10.3
mxhrdbfl	51	176	Ironwood	Carpinus caroliniana	3.0	7.6	28.9	8.8
mxhrdbfl	51	177	Southern sugar maple	Acer saccharum floridanum	2.7	6.9	10.8	3.3
mxhrdbfl	51	178	Southern red oak	Quercus falcata	32.2	81.8	117.5	35.8
mxhrdbfl	51	179	Red mulberry	Morus rubra	4.8	12.2	38.4	11.7
mxhrdbfl	51	180	Red mulberry	Morus rubra	11.0	27.9	91.9	28.0
mxhrdbfl	51	181	Southern sugar maple	Acer saccharum floridanum	9.2	23.4	44.9	13.7
mxhrdbfl	51	182	Mockernut hickory	Carya tomentosa	7.9	20.1	31.5	9.6
mxhrdbfl	51	183	Ironwood	Carpinus caroliniana	5.8	14.7	41.0	12.5
mxhrdbfl	51	184	Beech	Fagus grandifolia	3.2	8.1	19.4	5.9
mxhrdbfl	51	185	Sweetgum	Liquidambar styraciflua	8.4	21.3	68.2	20.8
mxhrdbfl	51	186	Black cherry	Prunus serotina	5.2	13.2	51.2	15.6
mxhrdbfl	51	187	Mockernut hickory	Carya tomentosa	2.6	6.6	21.0	6.4
mxhrdbfl	51	188	Mockernut hickory	Carya tomentosa	5.7	14.5	49.5	15.1
mxhrdbfl	51	189	Water oak	Quercus nigra	9.6	24.4	69.6	21.2
mxhrdbfl	51	190	Sweetgum	Liquidambar styraciflua	7.0	17.8	65.9	20.1
mxhrdbfl	51	191	Red mulberry	Morus rubra	3.1	7.9	24.0	7.3
mxhrdbfl	51	192	Red mulberry	Morus rubra	2.5	6.4	10.2	3.1
mxhrdbfl	51	193	Red mulberry	Morus rubra	2.0	5.1	19.4	5.9
mxhrdbfl	51	194	Hop hornbeam	Ostrya virginiana	2.3	5.8	20.0	6.1
mxhrdbfl	51	199	Redbud	Cercis canadensis	3.0	7.6	25.3	7.7
mxhrdup	52	195	Sweetgum	Liquidambar styraciflua	2.8	7.1	30.8	9.4
mxhrdup	52	196	Sourwood	Oxydendrum arboreum	4.9	12.4	34.4	10.5
mxhrdup	52	197	Southern red oak	Quercus falcata	6.3	16.0	72.2	22.0
mxhrdup	52	198	Sourwood	Oxydendrum arboreum	5.3	13.5	44.6	13.6
mxhrdup	52	200	Post oak	Quercus stellata	32.4	82.3	109.9	33.5
mxhrdup	52	1	Pignut hickory	Carya glabra	7.3	18.5	50.9	15.5
mxhrdup	52	2	Sweetgum	Liquidambar styraciflua	8.9	22.6	98.1	29.9
mxhrdup	52	3	Sourwood	Oxydendrum arboreum	2.4	6.1	22.6	6.9
mxhrdup	52	4	Sweetgum	Liquidambar styraciflua	8.4	21.3	76.8	23.4

mxhrdup	52	5	Beech	Fagus grandifolia	2.9	7.4	10.2	3.1
mxhrdup	52	6	Sweetgum	Liquidambar styraciflua	4.1	10.4	42.0	12.8
mxhrdup	52	7	Sourwood	Oxydendrum arboreum	8.8	22.4	85.3	26.0
mxhrdup	52	8	Sourwood	Oxydendrum arboreum	2.8	7.1	27.2	8.3
mxhrdup	52	9	Sweetgum	Liquidambar styraciflua	8.4	21.3	86.0	26.2
mxhrdup	52	10	Beech	Fagus grandifolia	2.3	5.8	14.4	4.4
mxhrdup	52	11	Sourwood	Oxydendrum arboreum	6.6	16.8	60.4	18.4
mxhrdup	52	12	Sourwood	Oxydendrum arboreum	3.8	9.7	57.7	17.6
mxhrdup	52	13	Beech	Fagus grandifolia	2.3	5.8	14.1	4.3
mxhrdup	52	14	Sweetgum	Liquidambar styraciflua	18.1	46.0	112.2	34.2
mxhrdup	52	15	Sourwood	Oxydendrum arboreum	6.0	15.2	48.6	14.8
mxhrdup	52	16	Sweetgum	Liquidambar styraciflua	12.4	31.5	103.7	31.6
mxhrdup	52	17	Beech	Fagus grandifolia	10.7	27.2	82.7	25.2
mxhrdup	52	18	Beech	Fagus grandifolia	3.4	8.6	40.7	12.4
mxhrdup	52	19	Beech	Fagus grandifolia	2.0	5.1	19.0	5.8
mxhrdup	52	20	Turkey oak	Quercus laevis	14.0	35.6	114.8	35.0
mxhrdup	52	21	Sourwood	Oxydendrum arboreum	4.8	12.2	39.4	12.0
mxhrdup	52	22	Sweetgum	Liquidambar styraciflua	11.0	27.9	93.5	28.5
mxhrdup	52	23	Short-leaf pine	Pinus echinata	5.8	14.7	46.6	14.2
mxhrdup	52	24	Beech	Fagus grandifolia	2.0	5.1	19.0	5.8
mxhrdup	52	25	Sourwood	Oxydendrum arboreum	2.4	6.1	25.9	7.9
mxhrdup	52	26	Beech	Fagus grandifolia	4.5	11.4	40.4	12.3
mxhrdup	52	27	Sourwood	Oxydendrum arboreum	9.7	24.6	75.5	23.0
mxhrdup	52	28	Red maple	Acer rubrum	5.1	13.0	60.4	18.4
mxhrdup	52	29	Sweetgum	Liquidambar styraciflua	3.3	8.4	35.4	10.8
mxhrdup	52	30	Flowering dogwood	Cornus florida	3.9	9.9	25.6	7.8
mxhrdup	52	31	Sourwood	Oxydendrum arboreum	3.5	8.9	40.4	12.3
mxhrdup	52	32	Red maple	Acer rubrum	7.2	18.3	65.9	20.1
mxhrdup	52	33	Beech	Fagus grandifolia	2.2	5.6	25.6	7.8
mxhrdup	52	34	Beech	Fagus grandifolia	3.3	8.4	32.2	9.8
mxhrdup	52	35	Turkey oak	Quercus laevis	12.6	32.0	115.2	35.1
mxhrdup	52	36	Beech	Fagus grandifolia	11.8	30.0	87.6	26.7
mxhrdup	52	37	Beech	Fagus grandifolia	8.8	22.4	71.5	21.8
mxhrdup	52	38	Beech	Fagus grandifolia	3.9	9.9	27.2	8.3
mixpinup	53	39	Loblolly pine	Pinus taeda	5.4	13.7	38.4	11.7
mixpinup	53	40	Sourwood	Oxydendrum arboreum	2.6	6.6	24.6	7.5
mixpinup	53	41	Sweetgum	Liquidambar styraciflua	7.1	18.0	50.5	15.4
mixpinup	53	42	Sweetgum	Liquidambar styraciflua	5.2	13.2	40.7	12.4
mixpinup	53	43	Sweetgum	Liquidambar styraciflua	2.4	6.1	22.3	6.8
mixpinup	53	44	Loblolly pine	Pinus taeda	6.3	16.0	61.7	18.8
mixpinup	53	45	Sweetgum	Liquidambar styraciflua	2.5	6.4	11.8	3.6
mixpinup	53	46	Sweetgum	Liquidambar styraciflua	10.4	26.4	60.7	18.5
mixpinup	53	47	Short-leaf pine	Pinus echinata	6.7	17.0	40.4	12.3
mixpinup	53	48	Loblolly pine	Pinus taeda	13.0	33.0	80.1	24.4
mixpinup	53	49	Loblolly pine	Pinus taeda	3.2	8.1	24.3	7.4
mixpinup	53	50	Sourwood	Oxydendrum arboreum	7.8	19.8	30.8	9.4
mixpinup	53	51	Sweetgum	Liquidambar styraciflua	6.1	15.5	43.6	13.3
mixpinup	53	52	Loblolly pine	Pinus taeda	4.6	11.7	40.7	12.4
mixpinup	53	53	Loblolly pine	Pinus taeda	3.9	9.9	39.4	12.0
mixpinup	53	54	Loblolly pine	Pinus taeda	20.5	52.1	99.4	30.3
mixpinup	53	55	Sourwood	Oxydendrum arboreum	5.5	14.0	36.7	11.2
mixpinup	53	56	Sweetgum	Liquidambar styraciflua	2.9	7.4	29.5	9.0
mixpinup	53	58	Sourwood	Oxydendrum arboreum	2.8	7.1	30.5	9.3
mixpinup	53	59	Loblolly pine	Pinus taeda	7.0	17.8	52.5	16.0
mixpinup	53	60	Red maple	Acer rubrum	6.6	16.8	41.0	12.5

mixpinup	53	61	Black gum	Nyssa sylvatica	5.2	13.2	22.3	6.8
mixpinup	53	62	Flowering dogwood	Cornus florida	3.7	9.4	28.5	8.7
mixpinup	53	63	Loblolly pine	Pinus taeda	6.4	16.3	50.9	15.5
mixpinup	53	64	Sweetgum	Liquidambar styraciflua	2.5	6.4	25.3	7.7
mixpinup	53	65	Sourwood	Oxydendrum arboreum	2.2	5.6	20.7	6.3
mixpinup	53	66	Sourwood	Oxydendrum arboreum	4.3	10.9	27.9	8.5
mixpinup	53	67	Red maple	Acer rubrum	5.9	15.0	45.3	13.8
mixpinup	53	68	Loblolly pine	Pinus taeda	6.0	15.2	46.3	14.1
mixpinup	53	69	Sourwood	Oxydendrum arboreum	2.2	5.6	22.0	6.7
mixpinup	53	70	Sourwood	Oxydendrum arboreum	4.1	10.4	36.1	11.0
mixpinup	53	71	Sourwood	Oxydendrum arboreum	5.3	13.5	38.1	11.6
mixpinup	53	72	Loblolly pine	Pinus taeda	14.0	35.6	93.5	28.5
mixpinup	53	73	Sourwood	Oxydendrum arboreum	2.2	5.6	26.6	8.1
mixpinup	53	74	Yellow-poplar	Liriodendron tulipifera	3.6	9.1	40.4	12.3
mixpinup	53	75	Sourwood	Oxydendrum arboreum	3.8	9.7	34.8	10.6
mixpinup	53	76	Yellow-poplar	Liriodendron tulipifera	3.3	8.4	38.7	11.8
mixpinup	53	78	Sweetgum	Liquidambar styraciflua	5.2	13.2	49.2	15.0
mixpinup	53	79	Sweetgum	Liquidambar styraciflua	7.4	18.8	56.1	17.1
mixpinup	53	80	Loblolly pine	Pinus taeda	12.4	31.5	63.3	19.3
mixpinup	53	81	Sourwood	Oxydendrum arboreum	3.3	8.4	39.4	12.0
mixpinup	53	82	Sourwood	Oxydendrum arboreum	3.1	7.9	31.5	9.6
mixpinup	53	83	Black cherry	Prunus serotina	2.8	7.1	28.2	8.6
mixpinup	53	84	Sourwood	Oxydendrum arboreum	2.5	6.4	29.5	9.0
mixpinup	53	85	Sourwood	Oxydendrum arboreum	2.4	6.1	24.0	7.3
mixpinup	53	86	Sourwood	Oxydendrum arboreum	4.3	10.9	37.1	11.3
mixpinup	53	87	Sourwood	Oxydendrum arboreum	5.3	13.5	44.3	13.5
mixpinup	53	88	Loblolly pine	Pinus taeda	6.9	17.5	27.2	8.3
mixpinup	53	89	Loblolly pine	Pinus taeda	7.8	19.8	51.5	15.7
mixpinup	53	90	Loblolly pine	Pinus taeda	2.4	6.1	27.6	8.4
mixpinup	53	91	Loblolly pine	Pinus taeda	3.5	8.9	34.8	10.6
mixpinup	53	92	Sweetgum	Liquidambar styraciflua	2.8	7.1	26.2	8.0
mixpinup	53	93	Loblolly pine	Pinus taeda	11.8	30.0	82.7	25.2
mixpinup	53	94	Sourwood	Oxydendrum arboreum	5.4	13.7	44.6	13.6
mixpinup	53	95	Loblolly pine	Pinus taeda	15.1	38.4	77.4	23.6
mixpinup	53	96	Sourwood	Oxydendrum arboreum	5.7	14.5	36.7	11.2
mixpinup	53	97	Hawthorn	Crataegus sp.	2.2	5.6	24.0	7.3
mixpinup	53	98	Loblolly pine	Pinus taeda	8.1	20.6	42.7	13.0
mixpinup	53	99	Short-leaf pine	Pinus echinata	14.9	37.8	77.8	23.7
mixpinup	53	100	Sweetgum	Liquidambar styraciflua	5.1	13.0	39.0	11.9
mixpinup	53	1	Long-leaf pine	Pinus palustris	2.2	5.6	27.9	8.5
mixpinup	53	2	Sweetgum	Liquidambar styraciflua	3.6	9.1	30.2	9.2
mixpinup	53	3	Short-leaf pine	Pinus echinata	2.5	6.4	9.8	3.0
mixpinup	53	4	Loblolly pine	Pinus taeda	11.0	27.9	70.2	21.4
mixpinup	53	5	Sourwood	Oxydendrum arboreum	4.0	10.2	26.6	8.1
mixpinup	53	6	Sourwood	Oxydendrum arboreum	4.7	11.9	18.4	5.6
mixpinup	53	7	Loblolly pine	Pinus taeda	15.2	38.6	92.2	28.1
mixpinup	53	8	Sweetgum	Liquidambar styraciflua	6.3	16.0	49.5	15.1
mixpinup	53	9	Sourwood	Oxydendrum arboreum	2.2	5.6	27.6	8.4
mixpinup	53	10	Sourwood	Oxydendrum arboreum	3.8	9.7	31.8	9.7
mixpinup	53	11	Sweetgum	Liquidambar styraciflua	5.1	13.0	43.0	13.1
mixpinup	53	12	Sweetgum	Liquidambar styraciflua	3.8	9.7	35.8	10.9
mixpinup	53	13	Sourwood	Oxydendrum arboreum	2.5	6.4	25.6	7.8
mixpinup	53	14	Sweetgum	Liquidambar styraciflua	4.6	11.7	44.3	13.5
mixpinup	53	15	Sourwood	Oxydendrum arboreum	3.7	9.4	34.8	10.6
mixpinup	53	16	Loblolly pine	Pinus taeda	15.9	40.4	79.1	24.1
mixpinup	53	17	Sweetgum	Liquidambar styraciflua	3.7	9.4	19.7	6.0

mxpihdup	54	18	Yellow-poplar	Liriodendron tulipifera	4.4	11.2	46.9	14.3
mxpihdup	54	19	Sweetgum	Liquidambar styraciflua	2.6	6.6	14.1	4.3
mxpihdup	54	20	Sweetgum	Liquidambar styraciflua	7.6	19.3	60.4	18.4
mxpihdup	54	21	Sweetgum	Liquidambar styraciflua	4.7	11.9	48.2	14.7
mxpihdup	54	22	Yellow-poplar	Liriodendron tulipifera	5.5	14.0	45.6	13.9
mxpihdup	54	23	Sweetgum	Liquidambar styraciflua	4.6	11.7	34.8	10.6
			Southern sugar	Acer saccharum				
mxpihdup	54	24	maple	floridanum	2.6	6.6	24.3	7.4
mxpihdup	54	25	Loblolly pine	Pinus taeda	20.2	51.3	101.7	31.0
mxpihdup	54	26	Yellow-poplar	Liriodendron tulipifera	3.5	8.9	28.9	8.8
mxpihdup	54	27	Sweetgum	Liquidambar styraciflua	3.7	9.4	30.2	9.2
mxpihdup	54	28	Sweetgum	Liquidambar styraciflua	2.7	6.9	22.0	6.7
mxpihdup	54	29	Sweetgum	Liquidambar styraciflua	3.4	8.6	22.6	6.9
mxpihdup	54	30	Loblolly pine	Pinus taeda	17.7	45.0	86.0	26.2
mxpihdup	54	31	Sweetgum	Liquidambar styraciflua	6.3	16.0	50.2	15.3
mxpihdup	54	32	Sweetgum	Liquidambar styraciflua	3.0	7.6	31.5	9.6
mxpihdup	54	33	Sweetgum	Liquidambar styraciflua	3.3	8.4	36.1	11.0
mxpihdup	54	34	Sweetgum	Liquidambar styraciflua	5.4	13.7	27.6	8.4
mxpihdup	54	35	Sweetgum	Liquidambar styraciflua	4.7	11.9	44.3	13.5
mxpihdup	54	36	Loblolly pine	Pinus taeda	19.0	48.3	102.0	31.1
mxpihdup	54	37	Yellow-poplar	Liriodendron tulipifera	2.1	5.3	30.2	9.2
mxpihdup	54	38	Sweetgum	Liquidambar styraciflua	3.0	7.6	16.4	5.0
mxpihdup	54	39	Sweetgum	Liquidambar styraciflua	8.0	20.3	57.1	17.4
mxpihdup	54	40	Loblolly pine	Pinus taeda	24.3	61.7	96.1	29.3
mxpihdup	54	41	Sweetgum	Liquidambar styraciflua	4.8	12.2	42.3	12.9
mxpihdup	54	42	Yellow-poplar	Liriodendron tulipifera	7.0	17.8	64.6	19.7
mxpihdup	54	43	Loblolly pine	Pinus taeda	22.0	55.9	99.7	30.4
mxpihdup	54	44	Sweetgum	Liquidambar styraciflua	4.0	10.2	36.1	11.0
mxpihdup	54	45	Sweetgum	Liquidambar styraciflua	2.8	7.1	25.3	7.7
mxpihdup	54	46	Sweetgum	Liquidambar styraciflua	6.8	17.3	63.0	19.2
mxpihdup	54	47	Loblolly pine	Pinus taeda	12.3	31.2	73.5	22.4
mxpihdup	54	48	Winged elm	Ulmus alata	8.9	22.6	66.9	20.4
mxpihdup	54	49	Short-leaf pine	Pinus echinata	11.9	30.2	83.0	25.3
mxpihdup	54	50	Sweetgum	Liquidambar styraciflua	3.4	8.6	19.7	6.0
mxpihdup	54	51	Sweetgum	Liquidambar styraciflua	8.4	21.3	65.3	19.9
mxpihdup	54	52	Loblolly pine	Pinus taeda	21.3	54.1	89.2	27.2
mxpihdup	54	53	Sweetgum	Liquidambar styraciflua	2.0	5.1	9.8	3.0
mxpihdup	54	54	Sweetgum	Liquidambar styraciflua	4.6	11.7	26.2	8.0
mxpihdup	54	55	Sweetgum	Liquidambar styraciflua	10.0	25.4	76.4	23.3
mxpihdup	54	56	Sweetgum	Liquidambar styraciflua	2.4	6.1	24.9	7.6
mxpihdup	54	57	Sweetgum	Liquidambar styraciflua	8.8	22.4	68.2	20.8
mxpihdup	54	58	Red maple	Acer rubrum	2.5	6.4	34.4	10.5
mxpihdup	54	59	American ash	Fraxinus americana	2.0	5.1	19.4	5.9
mxpihdup	54	60	Red maple	Acer rubrum	2.2	5.6	22.0	6.7
mxpihdup	54	61	Sweetgum	Liquidambar styraciflua	2.1	5.3	9.2	2.8
mxpihdup	54	62	Sweetgum	Liquidambar styraciflua	4.5	11.4	42.0	12.8
mxpihdup	54	63	Sweetgum	Liquidambar styraciflua	2.5	6.4	23.0	7.0

Notes:

mxpihdup	mixed pine hardwood upland
mxhrdbfl	mixed hardwood bottomland floodplain
mxhrdup	mixed hardwood upland
mixpinup	mixed pine upland