

Table 2. Desired stand conditions for bottomland hardwood forests within the Mississippi Alluvial Valley. Hillside Refuge (10,520 total 3,000 wet 7,520 dry)

Forest variables ¹	Desired stand structure	Conditions that may warrant management
Primary Management Factors		
Overstory canopy cover	60 – 70 % 33% of plots	>80% 56 % of plots
Midstory cover	25 – 40 % 71% of plots	<20% or >50%
Basal area	60 – 70 ft ² / acre with ≥25% in older age classes ²	>90ft ² / acre 84 BA or ≥60% in older age classes
Tree stocking	60 – 70 % 70	<50% or >90%
Secondary Management Factors		
Dominant trees ³	>2 / acre 3.7/acre	<1 / acre
Understory cover	25 – 40% 35 % of plots	<20% 55% of plots
Regeneration ⁴	30 – 40% of area 263/acre	<20% of area
Coarse woody debris (>10 inch diameter)	≥200 ft ³ / acres 5.1 logs/acre ave. 14.3" dbh	<100ft ³ / acre 108 cu.ft./acre
Small cavities (<10 inch diameter)	>4 visible holes / acre or >4 "snag" stems ≥4 inch dbh or ≥2 stems >20 inch dbh	<2 visible holes / acre or <2 snags ≥4 inch dbh or <1 stem ≥20 inch dbh
Den trees/large cavities ⁵ (>10 inch diameter)	1 visible hole / 10 acres or ≥2 stems ≥26 inch dbh (≥8 ft ² BA ≥26 inch dbh) 4.5 culls/acre ave. 26" dbh 10.9 % of trees dens/cavities	0 visible holes / 10 acres or <1 stem ≥26 inch dbh (<4 ft ² BA ≥ 26 inch dbh)

Standing dead and/or stressed trees ⁵	>6 stems / acre \geq 10 inch dbh or \geq 2 stems \geq 20 inch dbh (>4 ft ² BA \geq 10 inch dbh) 5 snags/acre ave. 15.4" dbh	<4 stems \geq 10 inch dbh / acre or <1 stem \geq 20 inch dbh < 1 recently dead tpa (<2 ft ² BA \geq 10 inch dbh)
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¹ Promotion of species and structural diversity within stands is the underlying principle of management. Management should promote vines, cane, and Spanish moss within site limitations.

² "Older age class" stems are those approaching biological maturity, (i.e., senescence). We do not advocate aging individual trees but use of species-site-size relationships as a practical surrogate to discern age.

³ Dominants (a.k.a. emergents) should have stronger consideration on more diverse sites, such as ridges and first bottoms.

⁴ Advanced regeneration of shade-intolerant trees in sufficient numbers (circa 400/acre) to ensure their succession to forest canopy. Areas lacking canopy (i.e., group cuts) should be restricted to $<20\%$ of stand area.

⁵ Utilizing BA parameters allows the forest manager to maintain this variable in size classes that are most suitable for the stand instead of using specific size classes noted.

Percent of Refuge by Overstory Midstory Understory and presence of Vines and Cane

Hillside Refuge

Overstory Canopy	Midstory Canopy	Understory Canopy	Vine Coverage	Cane
56 % > 80	19 % > 60	10 % > 60	33 % sparse	89 % none
33 % 50-80	71 % 25-60	35 % 25-60	38 % moderate	8 % sparse
11 % <50	10 % < 25	55 % < 25	29 % heavy	2 % heavy
Target 60-70	Target 25-40	Target 25-40		

Trees Per Acre:	Sawtimber	18.1
	Pulpwood	64.5
	Cull	4.5
	Total	87.1
	Snags	5.0
	Logs	5.1

Basal Area:	Sawtimber	36.62
	Pulpwood	30.77
	Cull	16.90
	Total	84.29

Ave. dbh of sawtimber 19.3", ave. dbh of pulpwood 9.4"

Volume: 2,712 bd. ft. volume of sawtimber/acre
8 cords of pulpwood/acre

Species: See cruise summarization sheet...

Percent of Forest Type on Each Refuge Based on the 2008 Timber Cruise

Hydrologic Forest Type	Yazoo	Panther Swamp	Morgan Brake	Hillside	Mathews Brake
Swamp Forest (ie. b.cyp/w. tup)	50	12	19	14	30
Wet Bottomland (oo-bp,bw,rm)	8	24	27	22	20
Moist Bottomland (sb-elm-ash,oak-elm-ash,oak-gum)	35	61	38	44	30
Dry Bottomland (cbo,zco,post oak,blackgum)	4	1	10	5	15
Levee Forest (cw/syc, s.pec/box)	3	2	6	15	5

Table 2. Desired stand conditions for bottomland hardwood forests within the Mississippi Alluvial Valley. Yazoo Refuge (5,686 total forest w/ 2,965 wet , 2,721 dry)

Forest variables ¹	Desired stand structure	Conditions that may warrant management
Primary Management Factors		
Overstory canopy cover	60 – 70 %	>80% 67% of plots
Midstory cover	25 – 40 % 76% of plots	<20% or >50%
Basal area	60 – 70 ft ² / acre with ≥25% in older age classes ²	>90ft ² / acre 114 BA or ≥60% in older age classes
Tree stocking	60 – 70 %	<50% or >90% 85
Secondary Management Factors		
Dominant trees ³	>2 / acre 5/acre	<1 / acre
Understory cover	25 – 40%	<20% 79% of plots
Regeneration ⁴	30 – 40% of area 159/acre	<20% of area
Coarse woody debris (>10 inch diameter)	≥200 ft ³ / acres	<100ft ³ / acre 36cu.ft./acre 2.6 logs/acre ave. 12" dbh
Small cavities (<10 inch diameter)	>4 visible holes / acre or >4 "snag" stems ≥4 inch dbh or ≥2 stems >20 inch dbh	<2 visible holes / acre or <2 snags ≥4 inch dbh or <1 stem ≥20 inch dbh
Den trees/large cavities ⁵ (>10 inch diameter)	1 visible hole / 10 acres or ≥2 stems ≥26 inch dbh (≥8 ft ² BA ≥26 inch dbh) 6 culls/acre ave. 25" dbh 9.4% of trees dens/cavities	0 visible holes / 10 acres or <1 stem ≥26 inch dbh (<4 ft ² BA ≥ 26 inch dbh)

Standing dead and/or stressed trees ⁵	>6 stems / acre ≥ 10 inch dbh or ≥ 2 stems ≥ 20 inch dbh (>4 ft ² BA ≥ 10 inch dbh)	<4 stems ≥ 10 inch dbh / acre or <1 stem ≥ 20 inch dbh 2.2 snags/acre ave. 17" dbh 0 recorded recently dead tpa (<2 ft ² BA ≥ 10 inch dbh)
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² "Older age class" stems are those approaching biological maturity, (i.e., senescence). We do not advocate aging individual trees but use of species-site-size relationships as a practical surrogate to discern age.

³ Dominants (a.k.a. emergents) should have stronger consideration on more diverse sites, such as ridges and first bottoms.

⁴ Advanced regeneration of shade-intolerant trees in sufficient numbers (circa 400/acre) to ensure their succession to forest canopy. Areas lacking canopy (i.e., group cuts) should be restricted to $<20\%$ of stand area.

⁵ Utilizing BA parameters allows the forest manager to maintain this variable in size classes that are most suitable for the stand instead of using specific size classes noted.

Percent of Refuge by Overstory Midstory Understory and presence of Vines and Cane

Yazoo Refuge

Overstory Canopy	Midstory Canopy	Understory Canopy	Vine Coverage	Cane
67 % > 80	9 % > 60	0 % > 60	21 % sparse	82 % none
33 % 50-80	76 % 25-60	21 % 25-60	32 % moderate	12 % sparse
0 % < 50	15 % < 25	79 % < 25	47 % heavy	6 % heavy
Target 60-70	Target 25-40	Target 25-40		

Trees Per Acre:	Sawtimber	21.9
	Pulpwood	63.9
	Cull	6.1
	Total	92
	Snags	2.2
	Logs	2.6

Basal Area:	Sawtimber	53.47
	Pulpwood	38.82
	Cull	21.79
	Total	114

Ave. dbh of sawtimber 21", ave. dbh of pulpwood 9"

Volume: 3,959 bd. ft. volume of sawtimber/acre
8 cords of pulpwood/acre

Species: See cruise summarization sheet...

Percent of Forest Type on Each Refuge Based on the 2008 Timber Cruise

Hydrologic Forest Type	Yazoo	Panther Swamp	Morgan Brake	Hillside	Mathews Brake
Swamp Forest (ie. b.cyp/w. tup)	50	12	19	14	30
Wet Bottomland (oo-bp,bw,rm)	8	24	27	22	20
Moist Bottomland (sb-elm-ash,oak-elm-ash,oak-gum)	35	61	38	44	30
Dry Bottomland (cbo,zco,post oak,blackgum)	4	1	10	5	15
Levee Forest (cw/syc, s.pec/box)	3	2	6	15	5

Table 2. Desired stand conditions for bottomland hardwood forests within the Mississippi Alluvial Valley. Panther Swamp Refuge (22,334 total: 2,798 wet 19,536 dry)

Forest variables ¹	Desired stand structure	Conditions that may warrant management
Primary Management Factors		
Overstory canopy cover	60 – 70 % 72% of plots	>80%
Midstory cover	25 – 40 % 60% of plots	<20% or >50%
Basal area	60 – 70 ft ² / acre 77 BA with ≥25% in older age classes ²	>90ft ² / acre or ≥60% in older age classes
Tree stocking	60 – 70 % 65	<50% or >90%
Secondary Management Factors		
Dominant trees ³	>2 / acre 2.4/acre	<1 / acre
Understory cover	25 – 40% 36% of plots	<20% 44% of plots
Regeneration ⁴	30 – 40% of area 261/acre	<20% of area
Coarse woody debris (>10 inch diameter)	≥200 ft ³ / acres 135cu.ft./acre 4.7 logs/acre ave. 16" dbh	<100ft ³ / acre
Small cavities (<10 inch diameter)	>4 visible holes / acre or >4 "snag" stems ≥4 inch dbh or ≥2 stems >20 inch dbh	<2 visible holes / acre or <2 snags ≥4 inch dbh or <1 stem ≥20 inch dbh
Den trees/large cavities ⁵ (>10 inch diameter)	1 visible hole / 10 acres or ≥2 stems ≥26 inch dbh (≥8 ft ² BA ≥26 inch dbh) 4.3 culls/acre ave. 25" dbh 11 % of trees dens/cavities	0 visible holes / 10 acres or <1 stem ≥26 inch dbh (<4 ft ² BA ≥ 26 inch dbh)

Standing dead and/or stressed trees ⁵	>6 stems / acre ≥ 10 inch dbh or ≥ 2 stems ≥ 20 inch dbh (>4 ft ² BA ≥ 10 inch dbh) 8.5 snags/acre ave. 18" dbh 1.2 recently dead tpa	<4 stems ≥ 10 inch dbh / acre or <1 stem ≥ 20 inch dbh (<2 ft ² BA ≥ 10 inch dbh)
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² "Older age class" stems are those approaching biological maturity, (i.e., senescence). We do not advocate aging individual trees but use of species-site-size relationships as a practical surrogate to discern age.

³ Dominants (a.k.a. emergents) should have stronger consideration on more diverse sites, such as ridges and first bottoms.

⁴ Advanced regeneration of shade-intolerant trees in sufficient numbers (circa 400/acre) to ensure their succession to forest canopy. Areas lacking canopy (i.e., group cuts) should be restricted to <20% of stand area.

⁵ Utilizing BA parameters allows the forest manager to maintain this variable in size classes that are most suitable for the stand instead of using specific size classes noted.

Percent of Refuge by Overstory Midstory Understory and presence of Vines and Cane

Panther Swamp Refuge

Overstory Canopy	Midstory Canopy	Understory Canopy	Vine Coverage	Cane
26 % > 80	10 % > 60	20 % > 60	28 % sparse	100 % none
72 % 50-80	60 % 25-60	36 % 25-60	44 % moderate	0 % sparse
2 % <50	30 % < 25	44 % < 25	28 % heavy	0 % heavy
Target 60-70	Target 25-40	Target 25-40		

Trees Per Acre:

Sawtimber	15.6
Pulpwood	55.6
Cull	4.3
Total	75.5
Snags	8.5
Logs	4.7

Basal Area:

Sawtimber	34.2
Pulpwood	27.42
Cull	15.12
Total	77

Ave. dbh of sawtimber 20", ave. dbh of pulpwood 9"

Volume: 2,413 bd. ft. volume of sawtimber/acre
7 cords of pulpwood/acre

Species: See cruise summarization sheet...

Percent of Forest Type on Each Refuge Based on the 2008 Timber Cruise

Hydrologic Forest Type	Yazoo	Panther Swamp	Morgan Brake	Hillside	Mathews Brake
Swamp Forest (ie. b.cyp/w. tup)	50	12	19	14	30
Wet Bottomland (oo-bp,bw,rm)	8	24	27	22	20
Moist Bottomland (sb-elm-ash,oak-elm- ash,oak-gum)	35	61	38	44	30
Dry Bottomland (cbo,zco,post oak,blackgum)	4	1	10	5	15
Levee Forest (cw/syc, s.pec/box)	3	2	6	15	5

Table 2. Desired stand conditions for bottomland hardwood forests within the Mississippi Alluvial Valley. **Morgan Brake Refuge (3,642 total 700 wet 2,942 dry)**

Forest variables ¹	Desired stand structure	Conditions that may warrant management
Primary Management Factors		
Overstory canopy cover	60 – 70 %	>80% 67 % of plots
Midstory cover	25 – 40 % 79% of plots	<20% or >50%
Basal area	60 – 70 ft ² / acre with ≥25% in older age classes ²	>90ft ² / acre 87 BA or ≥60% in older age classes
Tree stocking	60 – 70 % 75	<50% or >90%
Secondary Management Factors		
Dominant trees ³	>2 / acre 3:6/acre	<1 / acre
Understory cover	25 – 40%	<20% 67% of plots
Regeneration ⁴	30 – 40% of area 208/acre	<20% of area
Coarse woody debris (>10 inch diameter)	≥200 ft ³ / acres	<100ft ³ / acre 45 cu.ft./acre 4.6 logs/acre ave. 11" dbh
Small cavities (<10 inch diameter)	>4 visible holes / acre or >4 "snag" stems ≥4 inch dbh or ≥2 stems >20 inch dbh	<2 visible holes / acre or <2 snags ≥4 inch dbh or <1 stem ≥20 inch dbh
Den trees/large cavities ⁵ (>10 inch diameter)	1 visible hole / 10 acres or ≥2 stems ≥26 inch dbh (≥8 ft ² BA ≥26 inch dbh) 5.7 culls/acre ave. 22" dbh 9.9 % of trees dens/cavities	0 visible holes / 10 acres or <1 stem ≥26 inch dbh (<4 ft ² BA ≥ 26 inch dbh)

Standing dead and/or stressed trees ⁵	>6 stems / acre \geq 10 inch dbh or \geq 2 stems \geq 20 inch dbh (>4 ft ² BA \geq 10 inch dbh) 4.6 snags/acre ave. 16.5" dbh	<4 stems \geq 10 inch dbh / acre or <1 stem \geq 20 inch dbh < 1 recently dead tpa (<2 ft ² BA \geq 10 inch dbh)
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² "Older age class" stems are those approaching biological maturity, (i.e., senescence). We do not advocate aging individual trees but use of species-site-size relationships as a practical surrogate to discern age.

³ Dominants (a.k.a. emergents) should have stronger consideration on more diverse sites, such as ridges and first bottoms.

⁴ Advanced regeneration of shade-intolerant trees in sufficient numbers (circa 400/acre) to ensure their succession to forest canopy. Areas lacking canopy (i.e., group cuts) should be restricted to $<20\%$ of stand area.

⁵ Utilizing BA parameters allows the forest manager to maintain this variable in size classes that are most suitable for the stand instead of using specific size classes noted.

Percent of Refuge by Overstory Midstory Understory and presence of Vines and Cane

Morgan Brake Refuge

Overstory Canopy	Midstory Canopy	Understory Canopy	Vine Coverage	Cane
67 % > 80	8 % > 60	0 % > 60	16 % sparse	87 % none
33 % 50-80	79 % 25-60	33 % 25-60	46 % moderate	13 % sparse
0 % <50	13 % < 25	67 % < 25	38 % heavy	0 % heavy
Target 60-70	Target 25-40	Target 25-40		

Trees Per Acre:	Sawtimber	21.5
	Pulpwood	61.7
	Cull	5.7
	Total	88.9
	Snags	4.6
	Logs	4.6

Basal Area:	Sawtimber	39.05
	Pulpwood	31.19
	Cull	17.30
	Total	87.54

Ave. dbh of sawtimber 18.2", ave. dbh of pulpwood 9.6"

Volume: 2,464 bd. ft. volume of sawtimber/acre
7.9 cords of pulpwood/acre

Species: See cruise summarization sheet...

Percent of Forest Type on Each Refuge Based on the 2008 Timber Cruise

Hydrologic Forest Type	Yazoo	Panther Swamp	Morgan Brake	Hillside	Mathews Brake
Swamp Forest (ie. b.cyp/w. tup)	50	12	19	14	30
Wet Bottomland (oo-bp,bw,rm)	8	24	27	22	20
Moist Bottomland (sb-elm-ash,oak-elm- ash,oak-gum)	35	61	38	44	30
Dry Bottomland (cbo,zco,post oak,blackgum)	4	1	10	5	15
Levee Forest (cw/syc, s.pec/box)	3	2	6	15	5

Table 2. Desired stand conditions for bottomland hardwood forests within the Mississippi Alluvial Valley. Mathews Brake Refuge (750 acres of forest)

Forest variables ¹	Desired stand structure	Conditions that may warrant management
Primary Management Factors		
Overstory canopy cover	60 – 70 %	>80% 70 % of plots
Midstory cover	25 – 40 % 80% of plots	<20% or >50%
Basal area	60 – 70 ft ² / acre with ≥25% in older age classes ²	>90ft ² / acre 94 BA or ≥60% in older age classes
Tree stocking	60 – 70 % 75	<50% or >90%
Secondary Management Factors		
Dominant trees ³	>2 / acre 3.4/acre	<1 / acre
Understory cover	25 – 40%	<20% 70% of plots
Regeneration ⁴	30 – 40% of area 163/acre	<20% of area
Coarse woody debris (>10 inch diameter)	≥200 ft ³ / acres 153cu.ft./acre 5 logs/acre ave. 15" dbh	<100ft ³ / acre
Small cavities (<10 inch diameter)	>4 visible holes / acre or >4 "snag" stems ≥4 inch dbh or ≥2 stems >20 inch dbh	<2 visible holes / acre or <2 snags ≥4 inch dbh or <1 stem ≥20 inch dbh
Den trees/large cavities ⁵ (>10 inch diameter)	1 visible hole / 10 acres or ≥2 stems ≥26 inch dbh (≥8 ft ² BA ≥26 inch dbh) 7.3 culls/acre ave. 22" dbh 10.2 % of trees dens/cavities	0 visible holes / 10 acres or <1 stem ≥26 inch dbh (<4 ft ² BA ≥ 26 inch dbh)

Standing dead and/or stressed trees ⁵	>6 stems / acre \geq 10 inch dbh or \geq 2 stems \geq 20 inch dbh (>4 ft ² BA \geq 10 inch dbh) 6.4 snags/acre ave. 17" dbh 2.4 recently dead tpa	<4 stems \geq 10 inch dbh / acre or <1 stem \geq 20 inch dbh (<2 ft ² BA \geq 10 inch dbh)
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² "Older age class" stems are those approaching biological maturity, (i.e., senescence). We do not advocate aging individual trees but use of species-site-size relationships as a practical surrogate to discern age.

³ Dominants (a.k.a. emergents) should have stronger consideration on more diverse sites, such as ridges and first bottoms.

⁴ Advanced regeneration of shade-intolerant trees in sufficient numbers (circa 400/acre) to ensure their succession to forest canopy. Areas lacking canopy (i.e., group cuts) should be restricted to $<20\%$ of stand area.

⁵ Utilizing BA parameters allows the forest manager to maintain this variable in size classes that are most suitable for the stand instead of using specific size classes noted.

Percent of Refuge by Overstory Midstory Understory and presence of Vines and Cane

Mathews Brake Refuge

Overstory Canopy	Midstory Canopy	Understory Canopy	Vine Coverage	Cane
70 % > 80	0 % > 60	0 % > 60	60 % sparse	100 % none
20 % 50-80	80 % 25-60	30 % 25-60	30 % moderate	0 % sparse
10 % <50	20 % < 25	70 % < 25	10 % heavy	0 % heavy
Target 60-70	Target 25-40	Target 25-40		

Trees Per Acre:	Sawtimber	18.2
	Pulpwood	58.2
	Cull	7.3
	Total	83.7
	Snags	6.4
	Logs	5.0

Basal Area:	Sawtimber	41.36
	Pulpwood	34.47
	Cull	18.82
	Total	94.65

Ave. dbh of sawtimber 20", ave. dbh of pulpwood 10"

Volume: 2,748 bd. ft. volume of sawtimber/acre
8.6 cords of pulpwood/acre

Species: See cruise summarization sheet...

Percent of Forest Type on Each Refuge Based on the 2008 Timber Cruise

Hydrologic Forest Type	Yazoo	Panther Swamp	Morgan Brake	Hillside	Mathews Brake
Swamp Forest (ie. b.cyp/w. tup)	50	12	19	14	30
Wet Bottomland (oo-bp,bw,rm)	8	24	27	22	20
Moist Bottomland (sb-elm-ash,oak-elm- ash,oak-gum)	35	61	38	44	30
Dry Bottomland (cbo,zco,post oak,blackgum)	4	1	10	5	15
Levee Forest (cw/syc, s.pec/box)	3	2	6	15	5