Pine Savannah HSIs For Project Impacts

Since WVAs have not been developed for pine savannah habitats, the Habitat Suitability Index (HSI) modeling approach was selected to assess project impacts. The RCW HSI was selected for this project to quantify impacts to pine savannah habitats. HSI models are species specific models that evaluate habitat quality and identify and quantify the relationship between key environmental variables and habitat suitability on a scale from 0 to 1. The HSI value of 0.0 represents totally unsuitable habitat and a value of 1.0 represents optimum habitat. Each model contains multiple environmental variables important to the associated species and HSI scores are calculated independently for each of these variables. A weighting scheme is then used to combine the SI for individual variables to determine an overall SI score.

Described below are the assumptions used to determine pine savannah baseline conditions and FWOP and FWP projections for the proposed project area for direct and indirect impacts.

General Assumptions

The period of analysis expands from 2031 (TY0) to 2082 (TY50), with TY0 representing baseline conditions. In determining future with-project conditions, all project-related direct (construction) impacts were assumed to occur in Target Year 1.

Both direct and indirect impacts to pine savannah habitat, as a result of project construction, are anticipated and were evaluated and quantified. Direct temporary impact (staging) areas are not proposed within pine savannah habitat. A summary of the number of model runs associated with the type of impact anticipated is provided in Table 1.

Low quality pine savannah habitat currently dominates lands to be impacted by the proposed project that are located off of Big Branch Marsh National Wildlife Refuge. Due to the lack of pine savannah management on these lands a dense hardwood midstory/understory is present. Future pine savannah management (i.e., prescribed burns, thinnings, herbicide treatment, etc.) is not expected to occur on these areas in the future.

All currently managed (or soon to be managed) impacted pine savannah habitat within the project area currently occurs on Big Branch Marsh National Wildlife Refuge (Figure 1); therefore, under the FWOP scenario, it is assumed that all future pine savannah habitation management would be conducted by that refuge. Because construction of the proposed levee and associated structures are not compatible with the refuge's Congressionally mandated wildlife conservation goals the USACE would be required to conduct a land swap for the lands that are impacted on the refuge. In other words, the USACE would purchase land and donate those properties to the refuge to replace the land lost due to construction of the proposed project. The USACE would then own the direct project impact areas. Since the land swap only compensates the refuge for lands taken, USACE would still be required to mitigate for the loss of pine savannah habitat present within the impact area.

Target Years (TYs) for pine savannah impacts under both FWP and FWOP scenarios include TY0, TY1, TY18, TY35 and TY50.

Land Loss/ Sea Level Rise Effects

An inherent assumption used to determine future impacts to pine savannah with Relative Sea Level Rise (RSLR) is that persistent flooding of pine sites will cause the pine to convert to another habitat type resulting in loss of pine savannah acres in the lower elevation persistently flooded zones.

In accordance with the USACE EC-1165-2-212, RSLR was determined using USACE's Sea-Level Calculator (SLC) at the Lake Pontchartrain at Mandeville gauge (Aug 1957 to July 2002, gauge number 85575). The low, intermediate, and high SLR curve (gauge 85575) were used as appropriate for all SLR estimates. Based on the USACE's SLC, an estimated subsidence rate of 4.9 mm/yr from the Lake Pontchartrain at Mandeville (gauge 85575) was used for RSLR estimates. The eustatic sea level rise was assumed to be 1.7 mm/yr.

LIDAR data was obtained for the pine savannah direct and indirect sites to determine the average annual baseline elevation, which was assumed to be equivalent to the forest floor. The LIDAR data in combination with the RSLR was used to determine future pine savannah acres. A reduction in pine savannah acres assumes some acres are lost to persistent flooding and have likely converted to open water or marsh.

RCW HSI – Pine Savannah

Tirpak, J.M., D.T. Jones-Farrand, F.R. Thompson, III, D.J. Twedt, and W.B. Uihlein, III. 2009. Multiscale Habitat Suitability Index Models for Priority Landbirds in the Central Hardwoods and West Gulf Coastal Plain/Ouachitas Bird Conservation Regions. U.S. Department of Agriculture, Forest Service Northern Research Station General Technical Report NRS-49, Washington, D.C., USA. 201pp.

Because the pine savannah habitat on Big Branch Marsh NWR is known to be inhabited by the endangered RCW, this species was selected to quantify habitat impacts. RCWs roost and forage year-round and nest seasonally (i.e., April through July) in open, park-like stands of mature pine trees containing little hardwood component, a sparse midstory, and a well-developed herbaceous understory. RCWs can tolerate small numbers of overstory and midstory hardwoods at low densities found naturally in many southern pine forests, but they are not tolerant of dense midstories resulting from fire suppression or from overstocking of pine. Trees selected for cavity excavation are generally at least 60 years old, although the average stand age can be younger. RCW foraging habitat is located within one-half mile of the cluster and is comprised of pine and pine-hardwood stands (i.e., 50 percent or more of the dominant trees are pines) that are at least 30 years of age and have a moderately low average basal area (i.e., 40 – 80 square feet per acre is preferred).

The HSI model for the RCW includes eight variables: landform, landcover, successional age class, forest patch size, pine basal area, hardwood basal area, connectivity, and large pine (> 35 cm dbh) density (Tirpak et al 2009).

<u>Direct Permanent Impacts - BBMNWR</u>

Variable V1: Relationship between landform, landcover type, age class, and suitability scores for red-cockaded woodpecker habitat

V_1 = Landform, landcover type, and successional age class

		Successional age class				
Landform	Landcover Type	Grass-forb	Shrub-seedling	Sapling	Pole	Saw
Floodplain-valley	Low-density residential	0	0	0	0	0
	Transitional-shrubland	0	0	0	0	0
	Deciduous	0	0	0	0	0
	Evergreen	0	0	0.2	0.6	0.8
	Mixed	0	0	0.2	0.4	0.4
	Orchard-vineyard	0	0	0	0	0
	Woody wetlands	0	0	0	0	0
Terrace-mesic	Low-density residential	0	0	0	0	0
	Transitional-shrubland	0	0	0	0	0
	Deciduous	0	0	0	0	0
	Evergreen	0	0	0.2	0.6	0.8
	Mixed	0	0	0.2	0.4	0.4
	Orchard-vineyard	0	0	0	0	0
	Woody wetlands	0	0	0	0	0
Xeric-ridge	Low-density residential	0	0	0	0	0
	Transitional-shrubland	0	0	0	0	0
	Deciduous	0	0	0	0	0
	Evergreen	0	0	0.2	0.6	0.8
					-0.7	-1
	Mixed	0	0	0.2	0.4	0.4
	Orchard-vineyard	0	0	0	0	0
	Woody wetlands	0	0	0	0	0

Landcover Type Definitions:

Floodplain Valley – land adjacent to a river which stretches from the banks of its channel to the base of the enclosing valley walls, and which experiences flooding during periods of high discharge

Terrace Mesic – infrequently flooded (flooding for only a very short period). This ecological system is found in limited upland areas, including ravines and side slopes, of the Gulf Coastal Plain west of the Mississippi River. These areas are topographically isolated from historically fire-prone, pine-dominated uplands in eastern Texas, western Louisiana, and southern Arkansas.

Xeric-Ridge – excessively drained, sandy uplands in gentle terrain. Historically, this type has had frequent fires. The overstory is rather open, and ericaceous shrubs commonly form the understory.

Successional Age Class Definitions:

Young Timber – 5-8.99 inches dbh
Saw Timber – ≥9.0 inches dbh
https://www.fs.usda.gov/srsfia/php/tpo_2009/tpo_docs/DEFINITIONS.htm

FWP

While current conditions (2021) consist of degraded pine savannah stands with a dense hardwood midstory/understory component a goal of the refuge is to manage and protect threatened and endangered species. Big Branch Marsh is within the Gulf Coast Prairies and Marshes Ecoregion of the Red-cockaded Woodpecker (RCW) Recovery Plan, second revision (U.S. Fish and Wildlife Service 2003). The refuge population is the only one existing in this ecoregion and while it is not considered a recovery unit, it is designated as a significant support population for the recovery of the species. The refuge's role is to maintain the RCW's intrinsic value, conserve genetic resources, represent variations in habitats occupied by the species, and serve as immigrants for core, recoverable populations. Because of the importance of pine savannah habitat to the RCW and the refuge's commitment to manage for this species, thinnings, burns, herbicide treatments, etc. are anticipated throughout the project life. With implementation of these management techniques the quality of pine savannah habitat is expected to increase. By TY1 (2032) we assume that all or a combination of these management techniques have been initiated.

TY0:

Floodplain Valley
Mixed
Saw Timber

0.4 SI

TY1-TY50: All forested habitat will be removed for levee construction. Grasses will dominate the levee once construction is complete.

0 SI

FWOP

TY0:
Floodplain Valley
Mixed
Saw Timber

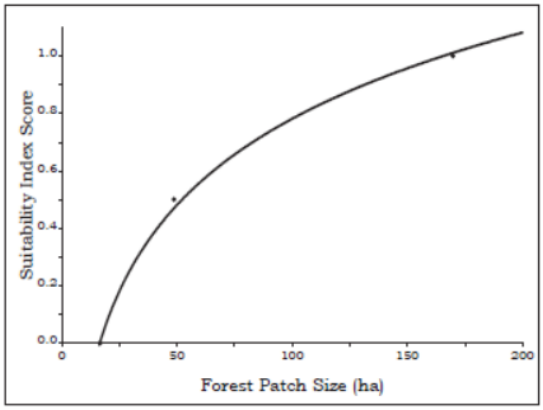
0.4 SI

TY1-TY50:
Floodplain Valley
Evergreen
Saw Timber

0.8 SI

<u>Variable V2:</u> Relationship between forest patch size and SI

RCWs have large home ranges, thus the SI increases as the size of contiguous forested habitat increases.



FWP

Acreage of pine savannah habitat within the levee footprint is removed at TY1 due to the permanent loss of this habitat.

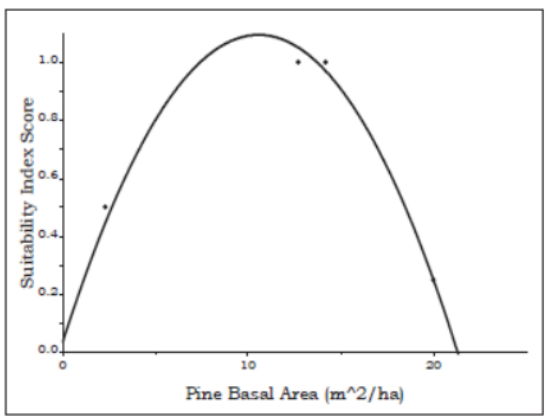
TY0: 248.2 ha
TY1: 239.9 ha
TY18: 210.9 ha
TY35: 155.3 ha
TY50: 65.3 ha

FWOP

TY0: 248.2 ha
TY1: 248.2 ha
TY18: 216.8 ha
TY35: 158.7 ha
TY50: 65.9 ha

<u>Variable V3:</u> Relationship between basal area of pines and SI

Pine basal area is an important component of RCW habitat and basal areas that are either too high or too low are of poor quality.



A pine ingrowth spreadsheet was developed and used to predict tree growth for individual trees from plots. This spreadsheet projects individual tree dbh and project site basal area over time. It is important to note that while there is currently a hardwood component in each of our sample plots, only the pine tree field measurements were entered into the ingrowth spreadsheet because this variable strictly relates to the pine basal area component of the stand.

FWP

Permanent loss of habitat would occur at TY1

TY0: 34.3 m^2/ha

TY1: 0 m^2/ha
TY18: 0 m^2/ha
TY35: 0 m^2/ha
TY50: 0 m^2/ha

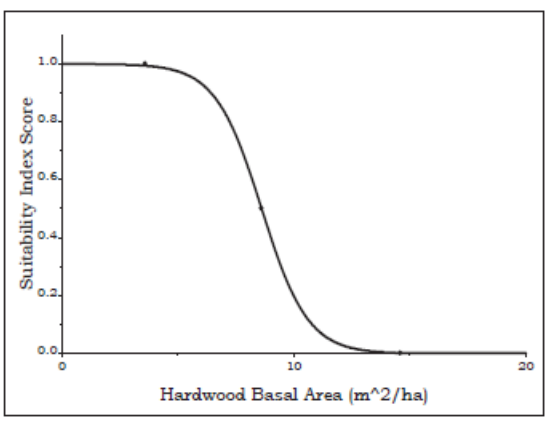
FWOP

Because normal forestry practices on Big Branch Marsh include possible thinnings every 10 years, we are assuming a thinning operation at TY1 (2032). The refuge typically thins pine stands in these lower elevations to approximately 80 ft^2/acre BA. Pines in these areas are slower growing then pines in more upland sites and reducing the BA below 80 ft^2/acre would increase the risk of windthrow.

TY0: 34.3 m^2/ha
TY1: 18.4 m^2/ha
TY18: 18.4 m^2/ha
TY35: 18.4 m^2/ha
TY50: 18.4 m^2/ha

Variable V4: Relationship between basal area of hardwoods (m^2/ha) and SI

Overstory and midstory hardwoods reduce habitat suitability for RCWs.



The hardwood ingrowth spreadsheet was used to predict tree growth for individual trees from plots. This spreadsheet projects individual tree dbh and project site basal area over time. It is important to note that only the hardwood tree field measurements were entered into this ingrowth spreadsheet because this variable strictly relates to the hardwood basal area component of the stands. The pine basal area component of the stands was assessed under V3.

FWP

Permanent loss of habitat would occur at TY1

TY0: 19.8 m^2/ha

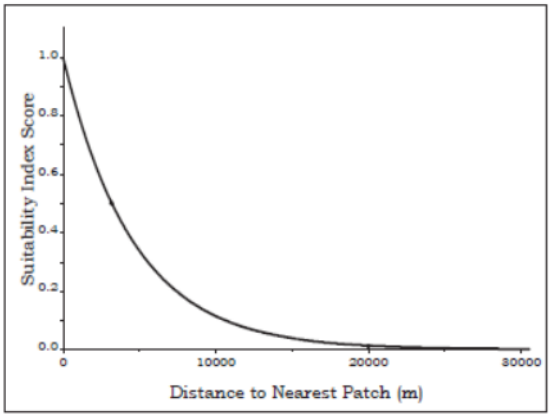
TY1: 0 m^2/ha
TY18: 0 m^2/ha
TY35: 0 m^2/ha
TY50: 0 m^2/ha

FWOP

Pine savannah management practices (e.g., thinnings, burns, herbicide treatments, etc.) would reduce the density of overstory and midstory hardwoods to an approximate basal area of 5 ft^2/acre. This is comparable to other stands on the refuge that are actively being managed for RCWs.

TY0: 19.8 m^2/ha
TY1: 1.1 m^2/ha
TY18: 1.1 m^2/ha
TY35: 1.1 m^2/ha
TY50: 1.1 m^2/ha

Variable V5: Relationship between distance to nearest habitat patch and SI



The project footprint is adjacent to pine savannah habitat under both the FWP and FWOP scenarios.

FWP

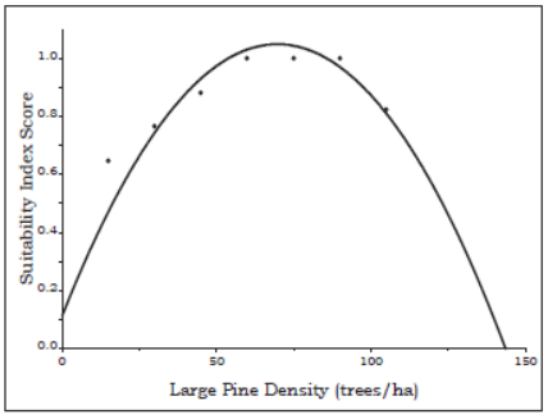
TY0-TY50: 0m

FWOP

TY0-TY50: 0m

Variable V6: Relationship between large pine (> 35 cm dbh) density (trees/ha) and SI

RCWs use large diameter pines for both foraging and nesting and are, therefore, a necessary component of suitable habitat.



The pine ingrowth spreadsheet was used to determine the number of large pines present at each TY.

FWP

Permanent loss of habitat would occur at TY1

TY0: 21.4 (trees/ha)
TY1: 0 (trees/ha)
TY18: 0 (trees/ha)
TY35: 0 (trees/ha)
TY50: 0 (trees/ha)

FWOP

TY0: 21.4 (trees/ha)
TY1: 22.2 (trees/ha)
TY18: 24.7 (trees/ha)
TY35: 53.5 (trees/ha)
TY50: 25.5 (trees/ha)

Direct Permanent Impacts – Private Land

Variable V1: Relationship between landform, landcover type, age class, and suitability scores for red-cockaded woodpecker habitat

FWP

TY0:

Floodplain Valley
Mixed
Saw Timber

0.4 SI

TY1-TY50: All forested habitat will be removed for levee construction. Grasses will dominate the levee once construction is complete.

0 SI

FWOP

TY0:

Floodplain Valley
Mixed
Saw Timber

0.4 SI

Due to past and ongoing fire suppression, it is assumed that pine savannah habitat management will not be conducted in the future on private lands; therefore, mixed pine/hardwood stands are expected.

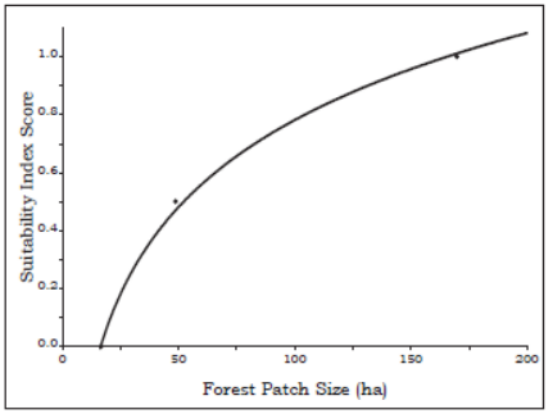
TY1-TY50:

Floodplain Valley
Mixed
Saw Timber

0.4 SI

Variable V2: Relationship between forest patch size and SI

RCWs have large home ranges, thus the SI increases as the size of contiguous forested habitat increases.



FWP

Acreage of pine savannah habitat within the levee footprint is removed at TY1 due to the permanent loss of this habitat.

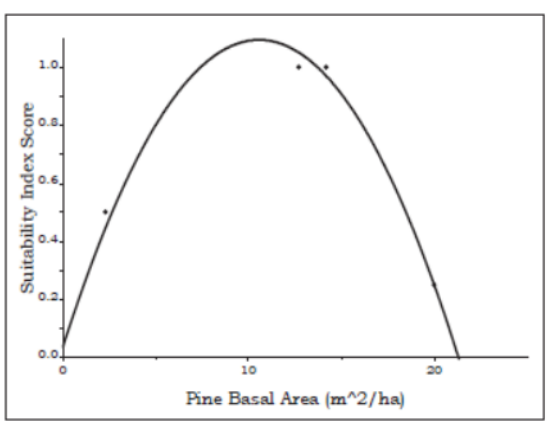
TY0: 3761.3 ha
TY1: 3713.1 ha
TY18: 3713.1 ha
TY35: 3708.6 ha
TY50: 3670.2 ha

FWOP

TY0: 3761.3 ha
TY1: 3761.3 ha
TY18: 3761.3 ha
TY35: 3753.2 ha
TY50: 3717.4 ha

<u>Variable V3:</u> Relationship between basal area of pines and SI

Pine basal area is an important component of RCW habitat and basal areas that are either too high or too low are of poor quality.



A pine ingrowth spreadsheet was developed and used to predict tree growth for individual trees from plots. This spreadsheet projects individual tree dbh and project site basal area over time.

FWP

Permanent loss of habitat would occur at TY1

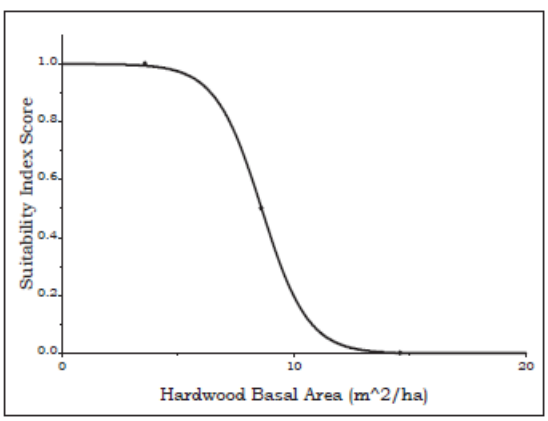
TY0: 50.7 m^2/ha
TY1: 0 m^2/ha
TY18: 0 m^2/ha
TY35: 0 m^2/ha
TY50: 0 m^2/ha

FWOP

TY0: 50.7 m^2/ha
TY1: 51.7 m^2/ha
TY18: 69.2 m^2/ha
TY35: 91.1m^2/ha
TY50: 83.3 m^2/ha

Variable V4: Relationship between basal area of hardwoods (m^2/ha) and SI

Overstory and midstory hardwoods reduce habitat suitability for RCWs.



The hardwood ingrowth spreadsheet was used to predict tree growth for individual trees from plots. This spreadsheet projects individual tree dbh and project site basal area over time.

FWP

Permanent loss of habitat would occur at TY1

TY0: 16.3 m^2/ha

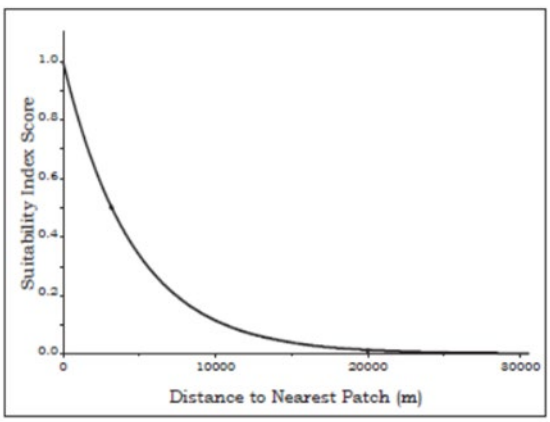
TY1: 0 m^2/ha
TY18: 0 m^2/ha
TY35: 0 m^2/ha
TY50: 0 m^2/ha

FWOP

Lack of pine savannah management practices (e.g., thinnings, burns, herbicide treatments, etc.) would increase the density of overstory and midstory hardwoods over time.

TY0: 16.3 m^2/ha
TY1: 17.8 m^2/ha
TY18: 56.2 m^2/ha
TY35: 74.2 m^2/ha
TY50: 93.0 m^2/ha

Variable V5: Relationship between distance to nearest habitat patch and SI



The project footprint is adjacent to pine savannah habitat, albeit low quality habitat, under both the FWP and FWOP scenarios.

FWP

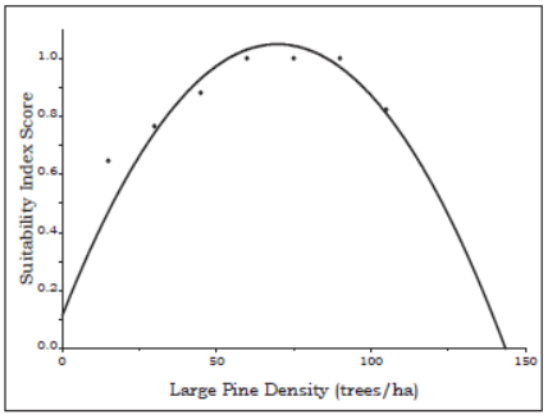
TY0-TY50: 0m

FWOP

TY0-TY50: 0m

Variable V6: Relationship between large pine (> 35 cm dbh) density (trees/ha) and SI

RCWs use large diameter pines for both foraging and nesting and are, therefore, a necessary component of suitable habitat.



The pine ingrowth spreadsheet was used to determine the number of large pines present at each TY.

FWP

Permanent loss of habitat would occur at TY1

TY0: 11.7 (trees/ha)
TY1: 0 (trees/ha)
TY18: 0 (trees/ha)
TY35: 0 (trees/ha)
TY50: 0 (trees/ha)

FWOP

TY0: 11.7 (trees/ha)
TY1: 13.6 (trees/ha)
TY18: 65.4 (trees/ha)
TY35: 59.9 (trees/ha)
TY50: 31.5 (trees/ha)

Indirect Impacts - BBMNWR Flood/Unprotected Side

Variable V1: Relationship between landform, landcover type, age class, and suitability scores for red-cockaded woodpecker habitat

FWP and FWOP

Under both the FWP and FWOP scenarios the indirect impact area will be managed for RCWs over the project life.

TY0:

Floodplain Valley
Mixed
Saw Timber

0.4 SI

TY1-TY50:

Floodplain Valley
Evergreen
Saw Timber

0.8 SI

Variable V2: Relationship between forest patch size and SI

Under the FWP scenario the impact area would be subjected to longer periods of inundation resulting in the loss of pine savannah habitat over time.

FWP

TY0: 248.2 ha
TY1: 239.9 ha
TY18: 210.9 ha
TY35: 155.3 ha
TY50: 65.3 ha

FWOP

TY0: 248.2 ha
TY1: 248.2 ha
TY18: 216.8 ha
TY35: 158.7 ha
TY50: 65.9 ha

Variable V3: Relationship between basal area of pines and SI

A pine ingrowth spreadsheet was developed and used to predict tree growth for individual trees from plots. This spreadsheet projects individual tree dbh and project site basal area over time. When the spreadsheet showed that basal area would fall below 80 ft^2/acre (i.e., the current management practice) at a specific TY, that basal area was input into the model to account for loss of pines as a result of increased inundation.

FWP

TY0: 33.8 m^2/ha
TY1: 18.4 m^2/ha
TY18: 18.4 m^2/ha
TY35: 18.4 m^2/ha
TY50: 11.3 m^2/ha

FWOP

TY0: 33.8 m^2/ha
TY1: 18.4 m^2/ha
TY18: 18.4 m^2/ha
TY35: 18.4 m^2/ha
TY50: 15.5 m^2/ha

Variable V4: Relationship between basal area of hardwoods (m^2/ha) and SI

FWP and FWOP

Under both the FWP and FWOP scenarios pine savannah management practices (e.g., thinnings, burns, herbicide treatments, etc.) would reduce the density of overstory and midstory hardwoods to an approximate basal area of 5 ft^2/acre.

TY0: 17.7 m^2/ha
TY1: 1.2 m^2/ha
TY18: 1.2 m^2/ha
TY35: 1.2 m^2/ha
TY50: 1.2 m^2/ha

Variable V5: Relationship between distance to nearest habitat patch and SI

The indirect impact area is adjacent to pine savannah habitat under both the FWP and FWOP scenarios.

FWP and FWOP

TY0-TY50: 0m

Variable V6: Relationship between large pine (> 35 cm dbh) density (trees/ha) and SI

The pine ingrowth spreadsheet was used to determine the number of large pines present at each TY.

FWP

TY0: 20.6 (trees/ha)
TY1: 18.9 (trees/ha)
TY18: 23.01 (trees/ha)
TY35: 23.9 (trees/ha)
TY50: 10.7 (trees/ha)

FWOP

TY0: 20.6 (trees/ha)
TY1: 21.4 (trees/ha)
TY18: 24.7 (trees/ha)
TY35: 29.7 (trees/ha)
TY50: 23.9 (trees/ha)

Indirect Impacts - Private Lands Flood/Unprotected Side

Variable V1: Relationship between landform, landcover type, age class, and suitability scores for red-cockaded woodpecker habitat

FWP and FWOP

Under both the FWP and FWOP scenarios habitat conditions will continue to be mixed pine/hardwood saw timber stands. Due to the lack of fire suppression on private lands, a dense hardwood midstory/understory would be present in this area over the project life.

TY0-TY50:
Floodplain Valley
Mixed
Saw Timber

0.4 SI

Variable V2: Relationship between forest patch size and SI

Under the FWP scenario the impact area would be subjected to longer periods of inundation resulting in the loss of pine savannah habitat over time.

FWP

TY0: 3713.1 ha
TY1: 3713.1ha
TY18: 3713.1 ha
TY35: 3708.6 ha
TY50: 3670.2 ha

FWOP

TY0: 3761.3 ha
TY1: 3761.3 ha
TY18: 3759.5 ha
TY35: 3738.5 ha
TY50: 3687.2 ha

Variable V3: Relationship between basal area of pines and SI

A pine ingrowth spreadsheet was developed and used to predict tree growth for individual trees from plots. This spreadsheet projects individual tree dbh and project site basal area over time.

FWP

TY0: 50.7 m^2/ha
TY1: 52.2 m^2/ha
TY18: 81.4 m^2/ha
TY35: 86.6 m^2/ha
TY50: 64.9 m^2/ha

FWOP

TY0: 50.7 m^2/ha
TY1: 52.8 m^2/ha
TY18: 81.7 m^2/ha
TY35: 87.7 m^2/ha
TY50: 65.9 m^2/ha

Variable V4: Relationship between basal area of hardwoods (m^2/ha) and SI

A bottomland hardwood ingrowth spreadsheet was developed and used to predict tree growth for individual trees from plots. Fire suppression on private lands is assumed to continue over the life of the project; therefore, a reduction of bottomland hardwoods is not anticipated over time.

FWP

TY0: 16.3 m^2/ha
TY1: 17.8 m^2/ha
TY18: 55.2 m^2/ha
TY35: 71.7 m^2/ha
TY50: 88.1 m^2/ha

FWOP

TY0: 16.3m^2/ha
TY1: 17.8 m^2/ha
TY18: 55.7 m^2/ha
TY35: 74.8 m^2/ha
TY50: 95.9 m^2/ha

Variable V5: Relationship between distance to nearest habitat patch and SI

The indirect impact area is adjacent to pine savannah habitat under both the FWP and FWOP scenarios.

FWP and FWOP

TY0-TY50: 0m

Variable V6: Relationship between large pine (> 35 cm dbh) density (trees/ha) and SI

The pine ingrowth spreadsheet was used to determine the number of large pines present at each TY.

FWP

TY0: 11.7 (trees/ha)
TY1: 13.6 (trees/ha)
TY18: 63.0 (trees/ha)
TY35: 59.9 (trees/ha)
TY50: 32.1 (trees/ha)

FWOP

TY0: 11.7 (trees/ha)
TY1: 13.6 (trees/ha)
TY18: 65.5 (trees/ha)
TY35: 59.9 (trees/ha)
TY50: 32.1 (trees/ha)

Indirect Impacts - Private Lands Protected Side

Variable V1: Relationship between landform, landcover type, age class, and suitability scores for red-cockaded woodpecker habitat

FWP and FWOP

Under both the FWP and FWOP scenarios habitat conditions will continue to be mixed pine/hardwood saw timber stands. Due to fire suppression on private lands, a dense hardwood midstory/understory would be present in this area over the project life.

TY0-TY50:

Floodplain Valley
Mixed
Saw Timber

0.4 SI

Variable V2: Relationship between forest patch size and SI

Under the FWP scenario the impact area would be subjected to longer periods of inundation resulting in the loss of pine savannah habitat over time.

FWP

TY0: 3713.1 ha
TY1: 3713.1ha
TY18: 3713.1 ha
TY35: 3708.6 ha
TY50: 3670.2 ha

FWOP

TY0: 3761.3 ha
TY1: 3761.3 ha
TY18: 3759.5 ha
TY35: 3738.5 ha
TY50: 3687.2 ha

Variable V3: Relationship between basal area of pines and SI

A pine ingrowth spreadsheet was developed and used to predict tree growth for individual trees from plots. This spreadsheet projects individual tree dbh and project site basal area over time.

FWP

TY0: 50.7 m^2/ha
TY1: 52.8 m^2/ha
TY18: 81.8 m^2/ha
TY35: 87.7 m^2/ha
TY50: 65.8 m^2/ha

FWOP

TY0: 50.7 m^2/ha
TY1: 52.8 m^2/ha
TY18: 82.0 m^2/ha

TY35: 88.1 m^2/ha
TY50: 66.2 m^2/ha

Variable V4: Relationship between basal area of hardwoods (m^2/ha) and SI

A bottomland hardwood ingrowth spreadsheet was developed and used to predict tree growth for individual trees from plots. Fire suppression on private lands is assumed to continue over the life of the project; therefore, a reduction of bottomland hardwoods is not anticipated.

FWP

TY0: 16.3 m^2/ha
TY1: 17.8 m^2/ha
TY18: 55.9 m^2/ha
TY35: 74.6 m^2/ha
TY50: 95.1 m^2/ha

FWOP

TY0: 16.3 m^2/ha
TY1: 17.8 m^2/ha
TY18: 56.3 m^2/ha
TY35: 76.1 m^2/ha
TY50: 97.9 m^2/ha

Variable V5: Relationship between distance to nearest habitat patch and SI

The indirect impact area is adjacent to pine savannah habitat under both the FWP and FWOP scenarios.

FWP and FWOP

TY0-TY50: 0m

Variable V6: Relationship between large pine (> 35 cm dbh) density (trees/ha) and SI

The pine ingrowth spreadsheet was used to determine the number of large pines present at each TY.

FWP

TY0: 11.7 (trees/ha)
TY1: 13.6 (trees/ha)
TY18: 65.5 (trees/ha)
TY35: 59.9 (trees/ha)
TY50: 32.1 (trees/ha)

FWOP

TY0: 11.7 (trees/ha)
TY1: 13.6 (trees/ha)
TY18: 66.7 (trees/ha)
TY35: 59.9 (trees/ha)
TY50: 32.1 (trees/ha)

Pine Warbler HSI – Pine Savannah

Schroeder, R. L. 1982. Habitat suitability index models: pine warbler. U.S. Dept. Int., Fish Wildl. Serv. FWS/OBS-82/10.28. 8 pp.

Pine warblers are found mainly in pine forests. They are year-round residents throughout the Southeast and are breeding residents in the northcentral and northeastern States. The pine warbler is one of the few breeding species that are generally restricted to pines.

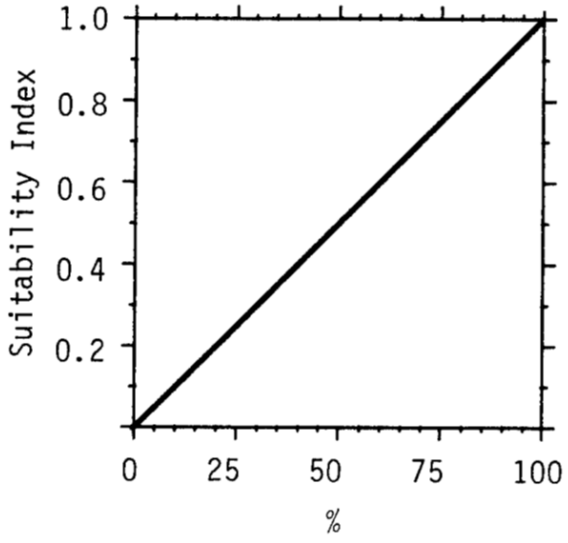
Optimal cover and reproductive (nesting) habitat for the pine warbler is provided by pure, dense, mature stands of pine (excluding white, pond, and sand pine) lacking a tall deciduous understory. A forest comprised totally of deciduous trees or white, pond, or sand pine is considered unsuitable for the pine warbler.

The HSI model for the pine warbler includes three variables: Percent tree canopy closure of overstory pines, successional stage of stand, and percent of dominant canopy pines with deciduous understory in the upper 1/3 layer.

<u>Direct Permanent Impacts - BBMNWR</u>

Variable V1: Percent tree canopy closure of overstory pines (excluding white, sand, or pond pine)

Optimal pine warbler habitat contains 100% tree canopy closure of overstory pines, and that suitability will decrease to zero as the percent of overstory pine approaches zero.



FWP

Permanent loss of habitat would occur at TY1

TY0: 41.7 %
TY1: 0%
TY18: 0%
TY35: 0%
TY50: 0%

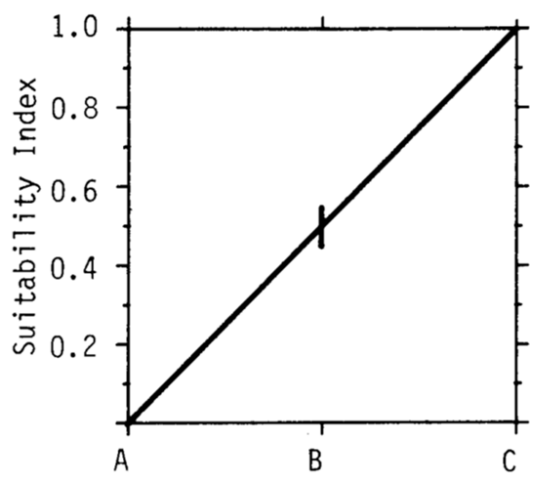
FWOP

It is assumed that thinning and burning to reduce vegetative density (to increase habitat quality for RCWs) of the pine savannah habitat present at TY0 would result in a decrease of pine canopy closure.

TY0: 41.7 %
TY1: 25%
TY18: 25%
TY35: 25%
TY50: 25%

Variable V2: Successional stage of stand

Mature or old growth forests are assumed to be optimal, while pole-sapling aged forests are unsuitable.



A = pole or sapling
B = young
C = mature or old growth

FWP

Permanent loss of habitat would occur at TY1

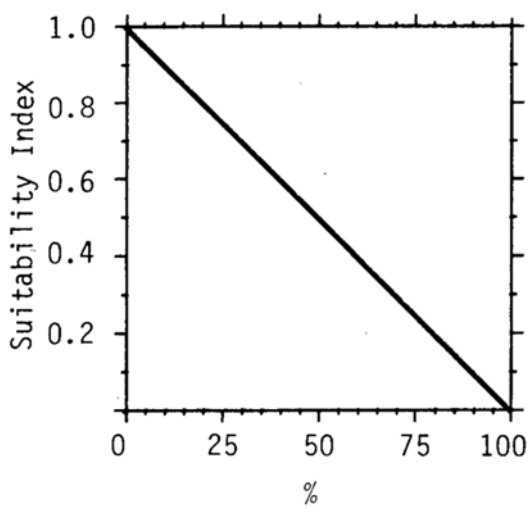
TY0: 1 SI
TY1: 0 SI
TY18: 0 SI
TY35: 0 SI
TY50: 0 SI

FWOP

TY0: 1 SI
TY1: 1 SI
TY18: 1 SI
TY35: 1 SI
TY50: 1 SI

Variable V3: Percent of dominant canopy pines with deciduous understory in the upper 1/3 layer

Pine forests with a deciduous understory reaching into the top 1/3 layer of the dominant pines provide poor habitat. It is assumed that optimal conditions exist when no such deciduous understory is present and that habitats with 100% of the dominant pine layer containing a tall deciduous understory will be unsuitable.



FWP

Permanent loss of habitat would occur at TY1

TY0: 53.3 %
TY1: 0%
TY18: 0%
TY35: 0%
TY50: 0%

FWOP

It is assumed that pine savannah management practices (e.g., thinnings, burns, herbicide treatments, etc.) would reduce the density of overstory and midstory hardwoods, thereby reducing the percent of dominant canopy pines with deciduous understory in the upper 1/3 layer.

TY0: 53.3 %
TY1: 5%
TY18: 5%
TY35: 5%
TY50: 5%

Direct Permanent Impacts – Private Land

Variable V1: Percent tree canopy closure of overstory pines (excluding white, sand, or pond pine)

Optimal pine warbler habitat contains 100% tree canopy closure of overstory pines, and that suitability will decrease to zero as the percent of overstory pine approaches zero.

FWP

Permanent loss of habitat would occur at TY1

TY0: 71.3%
TY1: 0%
TY18: 0%
TY35: 0%
TY50: 0%

FWOP

Due to fire suppression on private lands, it is assumed that vegetative density of overstory pines would decrease over time as hardwoods encroach the canopy.

TY0: 71.3%
TY1: 71.3%
TY18: 61.3%

TY35: 61.3 %
TY50: 56.3 %

Variable V2: Successional stage of stand

Mature or old growth forests are assumed to be optimal, while pole-sapling aged forests are unsuitable.

FWP

Permanent loss of habitat would occur at TY1

TY0: 1 SI
TY1: 0 SI
TY18: 0 SI
TY35: 0 SI
TY50: 0 SI

FWOP

TY0: 1 SI
TY1: 1 SI
TY18: 1 SI
TY35: 1 SI
TY50: 1 SI

Variable V3: Percent of dominant canopy pines with deciduous understory in the upper 1/3 layer

Pine forests with a deciduous understory reaching into the top 1/3 layer of the dominant pines provide poor habitat. It is assumed that optimal conditions exist when no such deciduous understory is present and that habitats with 100% of the dominant pine layer containing a tall deciduous understory will be unsuitable.

FWP

Permanent loss of habitat would occur at TY1

TY0: 30.0%
TY1: 0%
TY18: 0%
TY35: 0%
TY50: 0%

FWOP

It is assumed that in the absence of pine savannah management the percent of hardwood midstory and understory would increase over time, thereby increasing the percent of dominant canopy pines with deciduous understory in the upper 1/3 layer.

TY0: 30.0%
TY1: 30.0%
TY18: 41.3%
TY35: 46.3%
TY50: 50.0%

Indirect Impacts – BBMNWR Flood/Unprotected Side

Variable V1: Percent tree canopy closure of overstory pines (excluding white, sand, or pond pine)

Optimal pine warbler habitat contains 100% tree canopy closure of overstory pines, and that suitability will decrease to zero as the percent of overstory pine approaches zero.

Under both FWP and FWOP scenarios, it is assumed that thinning and burning to reduce vegetative density (to increase habitat quality for RCWs) of the pine savannah habitat present at TY0 would result in a decrease of pine canopy closure. An approximate 25% canopy closure would be maintained within the impact area over the project life.

FWP

It is assumed that with increased inundation pine savannah habitats would transition to bottomland hardwoods over time. The pine savannah habitat remaining, however, over the life of the project would be managed for RCWs.

TY0: 41.7%
TY1: 25%
TY18: 25%
TY35: 25%
TY50: 25%

FWOP

TY0: 41.7%
TY1: 25%
TY18: 25%
TY35: 25%
TY50: 25%

Variable V2: Successional stage of stand

Mature or old growth forests are assumed to be optimal, while pole-sapling aged forests are unsuitable.

FWP

A mature stand is expected to be maintained under both the FWP and FWOP scenarios.

TY0: 1 SI
TY1: 1 SI
TY18: 1 SI
TY35: 1 SI
TY50: 1 SI

FWOP

TY0: 1 SI
TY1: 1 SI
TY18: 1 SI
TY35: 1 SI
TY50: 1 SI

Variable V3: Percent of dominant canopy pines with deciduous understory in the upper 1/3 layer

Under both the FWP and FWOP scenarios it is assumed that pine savannah management practices (e.g., thinnings, burns, herbicide treatments, etc.) would reduce the density of overstory and midstory hardwoods, thereby reducing the percent of dominant canopy pines with deciduous understory in the upper 1/3 layer.

FWP

It is assumed that with increased inundation pine savannah habitats would transition to bottomland hardwoods over time. The pine savannah habitat remaining, however, over the life of the project would be managed for RCWs.

TY0: 53.3%
TY1: 5%
TY18: 5%
TY35: 5%
TY50: 5%

FWOP

TY0: 53.3 %

TY1: 5%
TY18: 5%
TY35: 5%
TY50: 5%

Indirect Impacts – Private Land Flood/Unprotected Side

Variable V1: Percent tree canopy closure of overstory pines (excluding white, sand, or pond pine)

Optimal pine warbler habitat contains 100% tree canopy closure of overstory pines, and that suitability will decrease to zero as the percent of overstory pine approaches zero.

FWP

Due to fire suppression on private lands, it is assumed that vegetative density of overstory pines would decrease over time as hardwoods encroach the canopy. It is assumed that there would be an accelerated rate of decrease under the FWP scenario as compared to the FWOP scenario due to increased inundation.

TY0: 71.3%
TY1: 71.3%
TY18: 61.3%
TY35: 51.3%
TY50: 41.3%

FWOP

Due to fire suppression on private lands, it is assumed that vegetative density of overstory pines would decrease over time as hardwoods encroach the canopy.

TY0: 71.3%
TY1: 71.3%
TY18: 66.3%
TY35: 63.5 %
TY50: 56.3 %

Variable V2: Successional stage of stand

Mature or old growth forests are assumed to be optimal, while pole-sapling aged forests are unsuitable.

FWP

A mature stand is expected to be maintained under both the FWP and FWOP scenarios.

TY0: 1 SI
TY1: 1 SI
TY18: 1 SI
TY35: 1 SI
TY50: 1 SI

FWOP

TY0: 1 SI
TY1: 1 SI
TY18: 1 SI
TY35: 1 SI
TY50: 1 SI

Variable V3: Percent of dominant canopy pines with deciduous understory in the upper 1/3 Layer

Due to fire suppression on private lands, it is assumed that the density of hardwoods in the canopy would increase over time.

FWP

It is also assumed that there would be an accelerated rate of increase under the FWP scenario as compared to the FWOP scenario due to lack of pine savannah management (e.g., thinnings, burnings, herbicide treatments, etc.).

TY0: 30.0%
TY1: 30.0%
TY18: 40.0%
TY35: 48.8%
TY50: 57.5%

FWOP

TY0: 30.0%
TY1: 30.0%
TY18: 35.0%
TY35: 40.0%
TY50: 45.0%

Indirect Impacts – Private Land Protected Side

Variable V1: Percent tree canopy closure of overstory pines (excluding white, sand, or pond pine)

Optimal pine warbler habitat contains 100% tree canopy closure of overstory pines, and that suitability will decrease to zero as the percent of overstory pine approaches zero.

FWP

Due to fire suppression on private lands, it is assumed that vegetative density of overstory pines would decrease over time as hardwoods encroach the canopy. It is assumed that there would be an accelerated rate of decrease under the FWP scenario as compared to the FWOP scenario due to increased inundation.

TY0: 71.3%
TY1: 71.3%
TY18: 61.3%
TY35: 51.3%
TY50: 41.3%

FWOP

Due to fire suppression on private lands, it is assumed that vegetative density of overstory pines would decrease over time as hardwoods encroach the canopy.

TY0: 71.3%
TY1: 71.3%
TY18: 66.3%
TY35: 63.5 %
TY50: 56.3 %

Variable V2: Successional stage of stand

Mature or old growth forests are assumed to be optimal, while pole-sapling aged forests are unsuitable.

FWP

A mature stand is expected to be maintained under both the FWP and FWOP scenarios.

TY0: 1 SI
TY1: 1 SI
TY18: 1 SI
TY35: 1 SI
TY50: 1 SI

FWOP

TY0: 1 SI
TY1: 1 SI

TY18: 1 SI
TY35: 1 SI
TY50: 1 SI

Variable V3: Percent of dominant canopy pines with deciduous understory in the upper 1/3 Layer

Due to fire suppression on private lands, it is assumed that the density of hardwoods in the canopy would increase over time.

FWP

It is assumed that there would be an accelerated rate of increase under the FWP scenario as compared to the FWOP scenario due to lack of pine savannah management (e.g., thinnings, burnings, herbicide treatments, etc.).

TY0: 30.0%
TY1: 30.0%
TY18: 40.0%
TY35: 48.8%
TY50: 57.5%

FWOP

TY0: 30.0%
TY1: 30.0%
TY18: 35.0%
TY35: 40.0%
TY50: 45.0%

Pine Savannah
HSI Results

See below for a summary of resulting Annual Average Habitat Unit (AAHUs) at the end of the period of analysis (year 50) for the pine savannah intermediate RSLR scenarios.

Pine Savannah - BBMNWR		Intermediate SLR	
Impact Type	**Species**	**Net Acres**	**AAHUS**
BBMNWR Direct		-1.19	
	RCW		-9.74
		-1.19	
	Pine Warbler		-2.53
BBMNWR Indirect - Protected Side		N/A	
	RCW		N/A
		N/A	
	Pine Warbler		N/A
BBMNWR Indirect - Unprotected Side		-0.25	
	RCW		-6.62
		-0.25	
	Pine Warbler		-1.71
Cumulative		**-1.44**	**-20.60**

Pine Savannah - Private Lands		Intermediate SLR	
Impact Type	**Species**	**Net Acres**	**AAHUS**
Private Land Direct		-145.31	
	RCW		0.00
		-145.31	
	Pine Warbler		-42.45
Private Land Indirect - Protected Side		-3.09	
	RCW		0.00
		-3.09	
	Pine Warbler		-10.52
Private Land Indirect - Unprotected Side		0.00	
	RCW		0.00
		0.00	
	Pine Warbler		-1.55
Cumulative		**-148.40**	**-54.52**

TOTAL		**-149.84**	**-75.12**