Pine Savannah HSIs For Mitigation Sites

Mitigation Site – BBMNWR PS-1 RCW

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

FWP

TY0: Baseline Conditions

Floodplain Valley
Mixed
Saw Timber

0.4 SI

TY1-TY50: Mitigation construction will be completed by TY1, therefore, we assume that hardwood midstory and overstory removal has occurred by this time resulting in an evergreen stand.

Floodplain Valley
Evergreen
Saw Timber

0.8 SI

FWOP

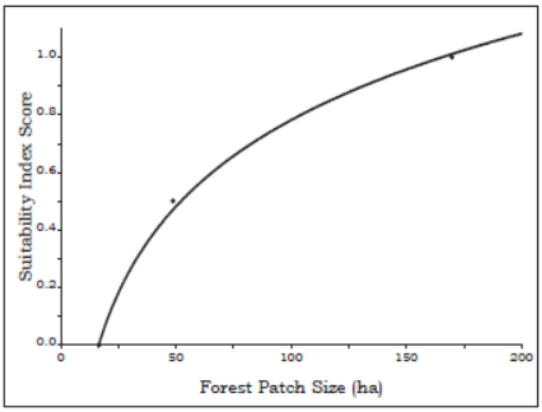
TY0-TY50: Without the proposed mitigation activities we assume that the subject site will remain a degraded pine savannah with dense hardwoods in the midstory and overstory.

Floodplain Valley
Mixed
Saw Timber

0.4 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.



Due to time restrictions, we were not able to re-run the relative sea level rise calculations for the mitigation HSI acreage calculations. Instead, the forest patch size calculations that were developed in this area for the HSI impact analysis were used. While the TY0, TY1 and TY50 acreages would be the same between the impact and mitigation analyses, the mitigation HSI uses TY20 as a target year unlike the impact assessment which uses TY18. Assumed that insignificant acreage would be lost between TY18 and TY20 and used the TY18 acreages calculated for the impact analysis for TY20 acreages in the mitigation analysis.

FWP

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

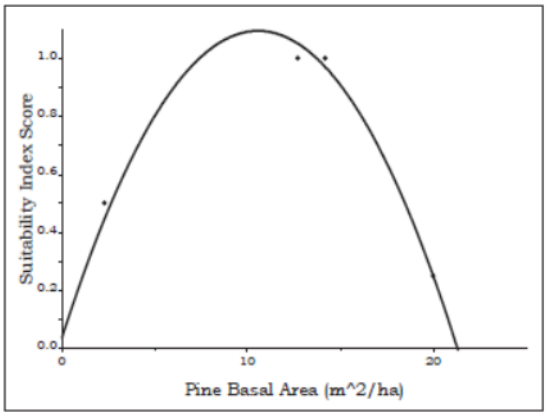
TY0: 248.2 ha
TY1: 239.9 ha
TY20: 210.9 ha
TY50: 65.3 ha

FWOP

TY0: 248.2 ha
TY1: 248.2 ha
TY20: 216.8 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.

Because of the limited amount of time given to the Service to complete the mitigation WVAs, field data collection site visits to obtain site specific habitat conditions were not possible. This mitigation site is, however, in proximity to sites where data was collected on the refuge for the impact assessments. In addition, based on aerial imagery, habitat conditions appear to be similar across these locations. We, therefore, assumed that habitat conditions at this mitigation site on BBMNWR are similar to those sites where data was collected on the refuge for the impact assessments.

FWP

We are assuming that mitigation construction will be completed by TY1. Pine stands within the refuge are typically thinned 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

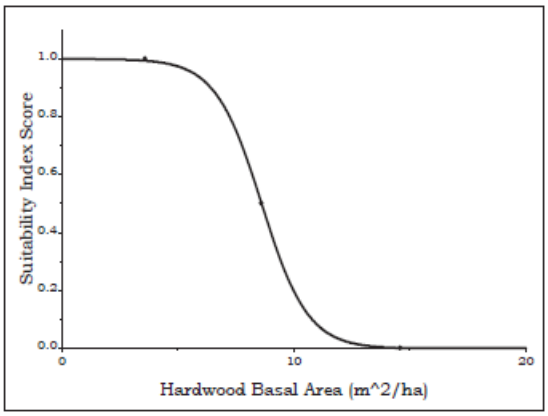
FWOP

We are assuming that without the proposed mitigation activities, the site would not be managed in the future as pine savannah habitat.

TY0: 34 m^2/ha
TY1: 35 m^2/ha
TY20: 56 m^2/ha
TY50: 36 m^2/ha

<u>Variable V4:</u> 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

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: 1.2 m^2/ha
TY20: 1.2 m^2/ha
TY50: 1.2 m^2/ha

FWOP

We are assuming that without the proposed mitigation activities, the site would not be managed in the future as pine savannah habitat.

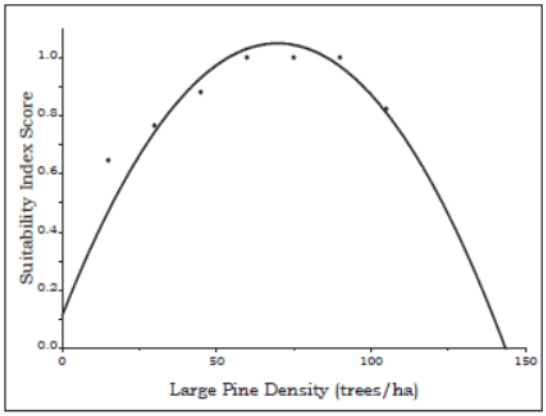
TY0: 19.8 m^2/ha
TY1: 20.8 m^2/ha
TY20: 56.2 m^2/ha
TY50: 57.0 m^2/ha

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.

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

TY0: 21.4 (trees/ha)
TY1: 22.2 (trees/ha)
TY20: 27.2 (trees/ha)

TY50: 49.4 (trees/ha)

FWOP

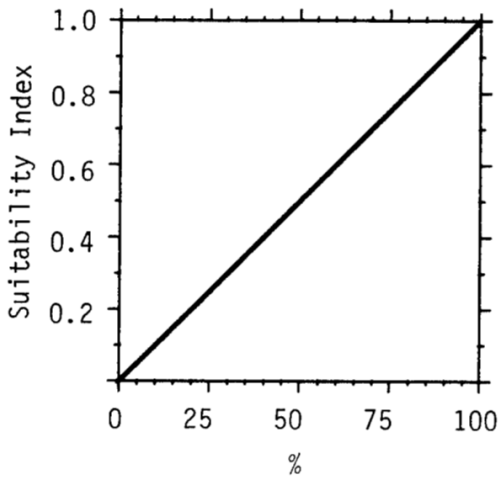
Assumed habitat would not be managed in the future for RCWs.

TY0: 21.4 (trees/ha)
TY1: 22.2 (trees/ha)
TY20: 27.2 (trees/ha)
TY50: 25.5 (trees/ha)

Mitigation Site – BBMNWR PS-1 Pine Warbler

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

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: 42 %
TY1: 25%
TY20: 25%
TY50: 25%

FWOP

Assumed that without the proposed mitigation activities, the site would not be managed as pine savannah habitat into the future and would consist of mixed pine/hardwood. Without thinnings and prescribed burns, assumed a dense canopy would exist over the life of the project. While hardwoods comprise a portion of the canopy only pines are considered under this variable.

It is assumed that a slight increase of pine canopy closure would occur over time as pines in midstory reach canopy height.

TY0: 42 %
TY1: 42%
TY20: 50%
TY50 50%

<u>Variable V2:</u> Successional stage of stand

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

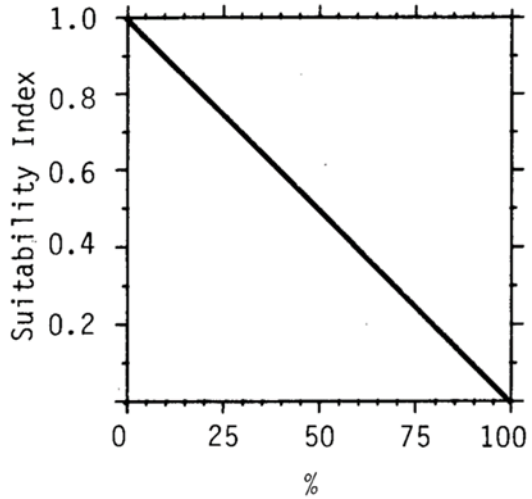
FWP and FWOP

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

TY0-TY50: 1 SI

<u>Variable V3:</u> 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

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%
TY1: 5%
TY20: 5%
TY50: 5%

FWOP

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

TY0: 53%
TY1: 53%
TY20: 75%
TY50: 90%

Mitigation Site – Camp Whispering Pines PS-25 (Forested) RCW

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

Until recently, Camp Whispering Pines was owned and managed by the Girl Scouts of America as longleaf pine savannah habitat. The property was recently sold to a private entity who has expressed an interest in logging the pines on the site.

FWP

Assumed that logging would not take place and the Camp Whispering Pines mitigation area would continue to be maintained as pine savannah habitat.

TY0-TY50:

Floodplain Valley
Evergreen
Saw Timber

0.8 SI

FWOP

TY0: Baseline Conditions

Floodplain Valley
Evergreen
Saw Timber

0.8 SI

TY1: Assumed that without the proposed mitigation activities the subject site will be logged and all pine removed by TY1. Since prescribed burns are often suppressed on private lands, assumed that burns would not take place under the FWOP scenario resulting in a regenerated mixed pine/hardwood stand.

Floodplain Valley
Mixed
Seedlings

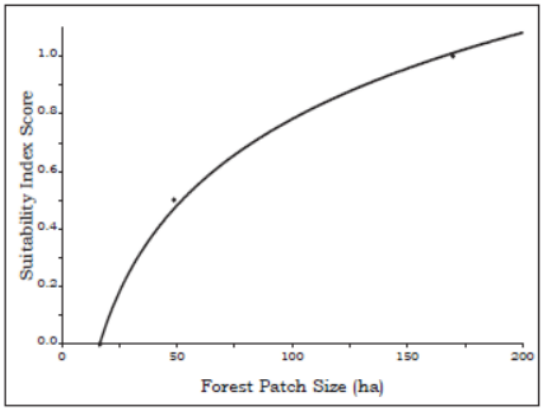
0.0 SI

TY20: Assumed that regenerated trees post harvest have reached pole size timber size by TY20 and saw size by TY50.

TY20: 0.4 SI
TY50: 0.4 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.



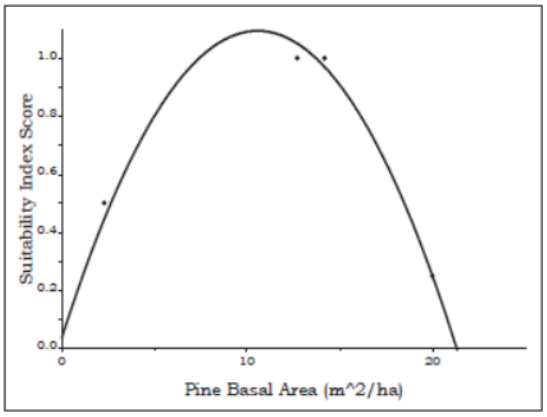
FWP and FWOP

Given the interior location of this mitigation site (north of I-12), RSLR impacts are not expected to extend to this area; therefore, assumed no change to size of contiguous forest under both FWP and FWOP scenarios.

TY0-TY50: 1458.08 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.

FWP

Assumed that initial mitigation construction will be completed by TY1. The site is currently managed as pine savannah; accordingly, we assumed that high quality habitat currently exists starting at TY0 and continuing over the life of the project.

TY0-TY50: 11.48 m^2/ha

FWOP

Assumed that without the proposed mitigation activities, the site would be logged and would not be managed as pine savannah habitat into the future.

TY0: Baseline Condition

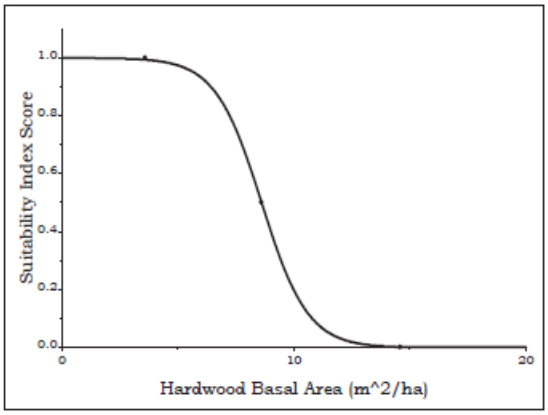
11.48 m^2/ha

TY1-TY50: Assumed as the site regenerates post logging the basal area of pines will increase over time. Used the pine in-growth spreadsheet to determine BAs at given TYs.

TY1: 0.2 m^2/ha
TY20: 20.6 m^2/ha
TY50: 48.5 m^2/ha

<u>Variable V4:</u> 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.

FWP

Assumed that initial mitigation construction will be completed by TY1. Given that the site is currently managed as pine savannah habitat, we assumed that hardwood midstory and understory

control would continue over the life of the project.

TY0-TY50: 1.15 m^2/ha

FWOP

The proposed project was sold to a private entity who has expressed intention to log the site. Assumed that without the proposed mitigation activities the site would be logged and would not be managed as pine savannah habitat into the future.

TY0: Baseline Condition
1.15 m^2/ha

TY1-TY50: Assumed that the proposed site would not be managed as pine savannah habitat into the future. Also assumed that as the sites regenerates the basal area of hardwoods would increase over time.

TY1: 0.16 m^2/ha
TY20: 7.58 m^2/ha
TY50: 28.21 m^2/ha

<u>Variable V5:</u> Relationship between distance to nearest habitat patch and SI

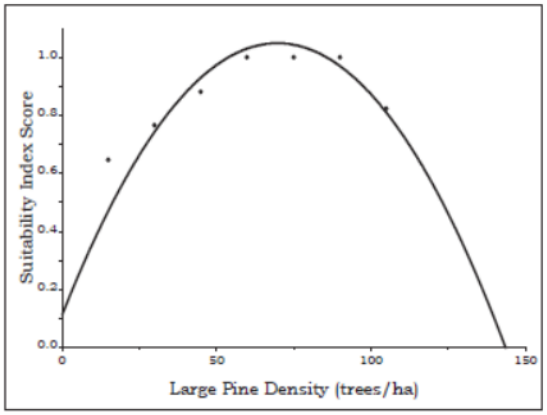
The proposed mitigation area is adjacent to pine savannah habitat under both the FWP and FWOP scenarios.

FWP and FWOP

TY0-50: 0 m

<u>Variable V6:</u> 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

Assumed that initial mitigation construction will be completed by TY1. The site is currently managed as pine savannah habitat with mature trees present. Assumed that any thinnings necessary would be conducted by TY1 and high quality pine savannah habitat would be maintained over the life of the project.

TY0-TY50: 74 (trees/ha)

FWOP

The proposed project was sold to a private entity who has expressed intention to log the site. Assumed that without the proposed mitigation activities the site would be logged and would not be managed as pine savannah habitat into the future.

TY0: Baseline Conditions
74 (trees/ha)

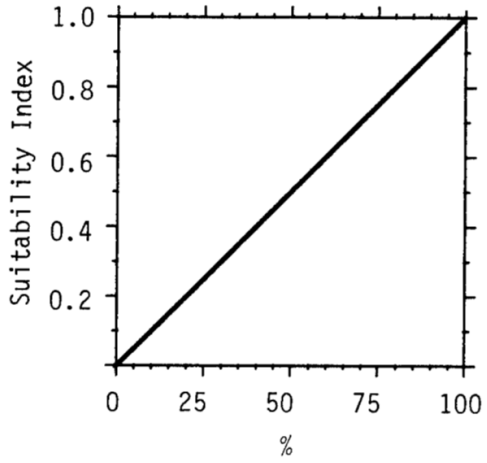
TY1-TY50: Assumed that pine trees that have regenerated after harvest will not have reached 35 cm or greater until TY50.

TY0: 0 (trees/ha)
TY1: 0 (trees/ha)
TY20: 0 (trees/ha)
TY50: 32 (trees/ha)

Mitigation Site – Camp Whispering Pines PS-25 (Forested) Pine Warbler

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

Assumed that logging would not take place and the Camp Whispering Pines mitigation area would continue to be maintained as high quality pine savannah habitat.

TY0: 25%
TY1: 25%
TY20: 25%
TY50: 25%

FWOP

Assumed that without the proposed mitigation activities, the site would be logged and would not be managed as pine savannah habitat into the future.

TY0: Baseline Conditions
25%

TY1: Assumed that without the proposed mitigation activities the subject site will be logged and all pine removed. Assumed at TY1 regenerated trees would be 1 year old and would not have reached canopy height.

TY1: 0%

TY20-TY50: Assumed that without pine savannah management practices a dense pine/hardwood stand would regenerate post harvest; therefore, estimated an increasing pine canopy closure over time.

TY20: 40%
TY50: 50%

<u>Variable V2:</u> 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 the FWP scenario.

TY0-TY50: 1 SI

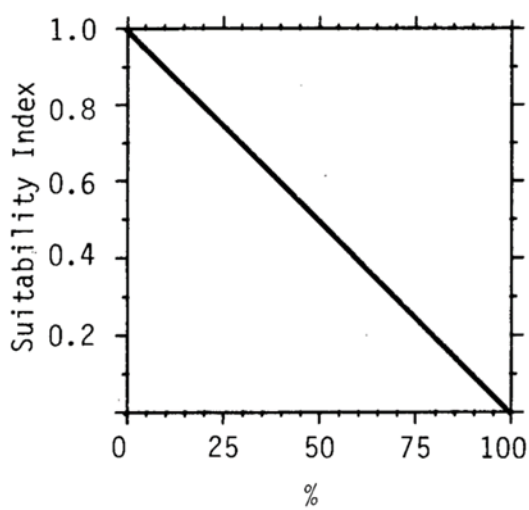
FWOP

Assumed that logging would take place by TY1 and site would regenerate naturally.

TY0: Baseline Conditions
1 SI
TY1: 0 SI
TY20: 0.5 SI
TY50: 1.0 SI

<u>Variable V3:</u> 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

Assumed that logging would not take place and the Camp Whispering Pines mitigation area would continue to be maintained as pine savannah habitat with low percentage of hardwoods in the upper $^{1}/_{3}$ layer.

TY0-TY50: 5%

FWOP

Assumed that site would be logged by TY1. In the absence of pine savannah management, the percent of hardwood midstory and understory would be a significant portion of the canopy, resulting in a large percentage of overstory pines with deciduous understory in the upper $^{1}/_{3}$ layer.

TY0: Baseline Conditions
5%

TY1: Sapling trees present post harvest
0%

TY20: 75%
TY50: 90%

Mitigation Site – Camp Whispering Pines PS-25 (Cleared) RCW

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

Until recently, Camp Whispering Pines was owned by the Girl Scouts of America with a majority of the property managed as longleaf pine savannah habitat. There are cleared areas, however, within the Camp Whispering Pine tract that could be restored and managed as pine savannah habitat into the future.

FWP

Assumed that the currently cleared areas are dominated by grasses/forbes.

TY0: Baseline Conditions

Floodplain Valley
Low Density Residential
Grass/Forb

0.0 SI

Assumed that longleaf pine plantings would take place and the site managed as pine savannah over the project life.

TY1: Assumed recent plantings, therefore, seedlings at TY1

Floodplain Valley
Evergreen
Seedling

0.0 SI

Assumed that planted longleaf have reached pole size timber by TY20 and saw size by TY50.

TY20:

Floodplain Valley
Evergreen
Pole

0.6 SI

TY50:

Floodplain Valley
Evergreen
Saw

0.8 SI

FWOP

TY0: Baseline Conditions

Floodplain Valley
Low Density Residential
Grass/Forb

0.0 SI

TY1: Assumed that without the proposed mitigation activities the currently cleared sites would naturally regenerate as a mixed pine/hardwood stand.

Floodplain Valley
Mixed
Seedling

0.0 SI

TY20-50: Assumed that the stand is comprised of timber size by TY20 and saw size by TY50. Since prescribed burns are often suppressed on private lands, assumed that burns would not take place under the FWOP scenario resulting in a regenerated mixed pine/hardwood stand.

TY20:

Floodplain Valley
Mixed
Pole

0.4 SI

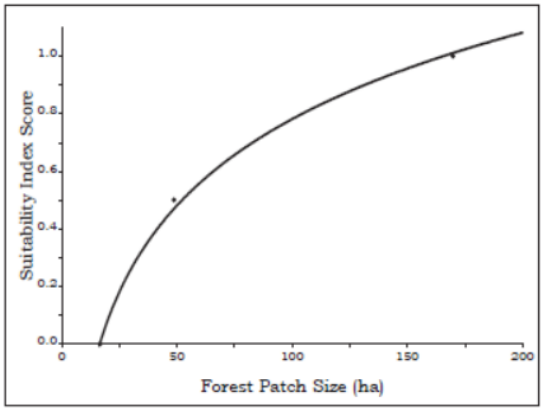
TY50:

Floodplain Valley
Mixed
Saw

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.



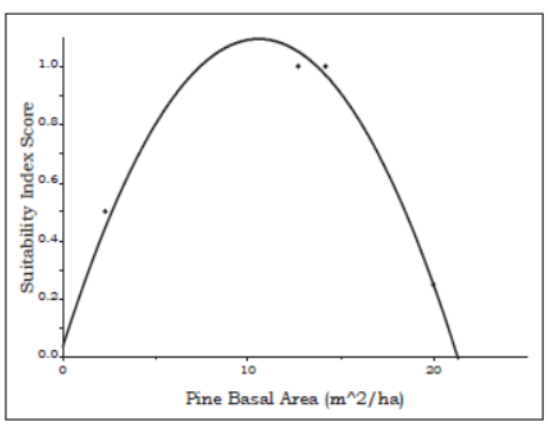
FWP and FWOP

Given the interior location of this mitigation site (north of I-12), RSLR impacts are not expected to extend to this area; therefore, assumed no change to size of contiguous forest under both FWP and FWOP scenarios.

TY0-TY50: 1458.08 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.

FWP

Assumed that longleaf pine plantings will be completed by TY1 and pine basal area would increase over time.

TY0: Baseline Condition
0 m^2/ha

TY1-TY50: Assumed as the pines mature on-site the basal area will increase.

TY1: 0.2 m^2/ha
TY20: 20.6 m^2/ha

TY50: Assumed that at TY50 the sight would have been thinned to maintain high quality pine savannah habitat.
11.5 m^2/ha

FWOP

Assumed that without the proposed mitigation activities, the cleared areas of the site would regenerate naturally as a pine/hardwood stand.

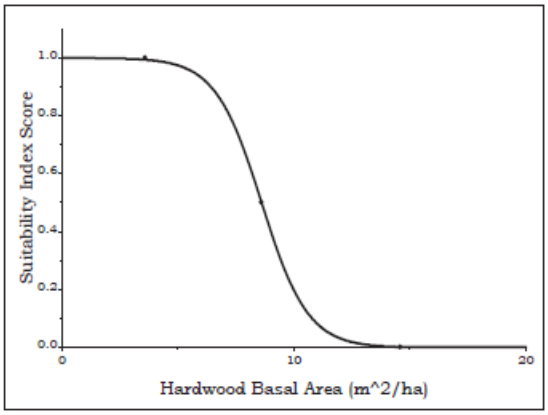
TY0: Baseline Conditions
0 m^2/ha

TY1-TY50: Assumed that cleared areas are no longer maintained and regeneration begins. Assumed as the site regenerates the basal area of pines will increase over time.

TY1: 0.2 m^2/ha
TY20: 20.6 m^2/ha
TY50: 48.5 m^2/ha

<u>Variable V4:</u> 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.

FWP

Assumed that initial mitigation construction will be completed by TY1. Given that the site would be managed as pine savannah habitat, we assumed that management (i.e., prescribed burns, herbicide treatments, etc.) would result in low hardwood basal areas over the project life.

TY0: Baseline Conditions:
0 m^2/ha

TY1: Assumed that cleared areas are planted with longleaf pine at TY1.
0.2 m^2/ha

TY20-TY50: Assumed hardwood midstory control.
1.15 m^2/ha

FWOP

Assumed that without the proposed mitigation activities, the cleared areas of the site would regenerate naturally as a pine/hardwood stand.

TY0: Baseline Conditions
0 m^2/ha

TY1-TY50: Assumed that the proposed site would not be managed as pine savannah habitat into the future. Also assumed that as the sites regenerates the basal area of hardwoods would increase

TY1: 0.16 m^2/ha
TY20: 7.58 m^2/ha
TY50: 28.21 m^2/ha

<u>Variable V5:</u> Relationship between distance to nearest habitat patch and SI

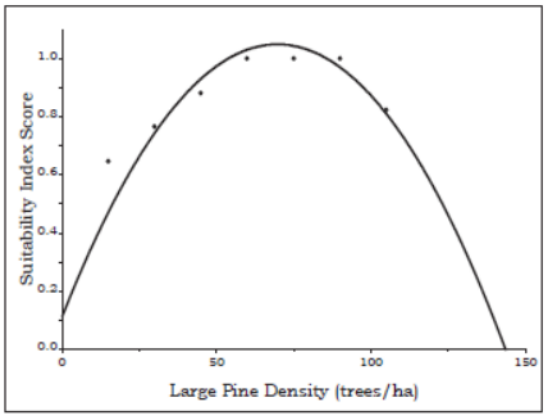
The proposed mitigation area is adjacent to pine savannah habitat under both the FWP and FWOP scenarios.

FWP and FWOP

TY0-50: 0 m

<u>Variable V6:</u> 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

Assumed that longleaf pine trees will be planted and would reach >35 cm dbh by TY50.

TY0-TY20: 0 (trees/ha)
TY50: 74 (trees/ha)

FWOP

Assumed that without the proposed mitigation activities, the cleared areas of the site would regenerate naturally as a pine/hardwood stand. Assume natural regeneration begins at TY1.

TY0: Baseline Conditions
0 (trees/ha)

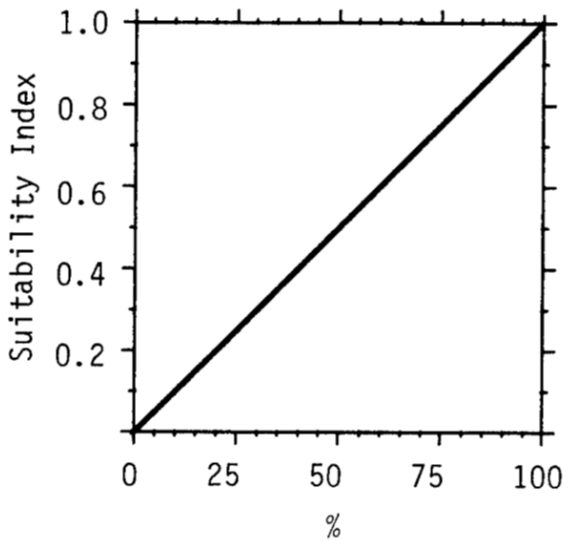
TY1-TY50: Assumed that pine trees that have regenerated after harvest will not have reached 35 cm or greater until TY50. Under this scenario have hardwoods in the midstory and overstory limiting the number of large pines as compared to the FWP scenario.

TY0-TY20: 0 (trees/ha)
TY50: 32 (trees/ha)

Mitigation Site – Camp Whispering Pines PS-25 (Cleared) Pine Warbler

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

Assumed longleaf pine plantings will be completed by TY1.

TY0: Baseline Conditions
0%

TY1: Planted longleaf have not reached canopy height
0%

TY20: Assumed first thinnings have been conducted and as pines mature the percent canopy closure would increase.
30%

TY50: Assumed that thinning and burning to reduce vegetative density (to increase habitat quality for RCWs) of the pine savannah habitat present would result in a decrease of pine canopy closure.
25%

FWOP

Assumed that without the proposed mitigation activities, the site would not be managed as pine savannah habitat into the future and would regenerate as a pine/hardwood stand.

TY0-TY1: Assumed at TY1 regenerated trees would be 1 year old and would not have reached canopy height.
0%

TY20-TY50: Assumed that without pine savannah management practices a dense pine/hardwood stand would regenerate post harvest; therefore, estimated an increasing pine canopy closure over time.

TY20: 40%
TY50: 50%

<u>Variable V2:</u> Successional stage of stand

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

FWP and FWOP

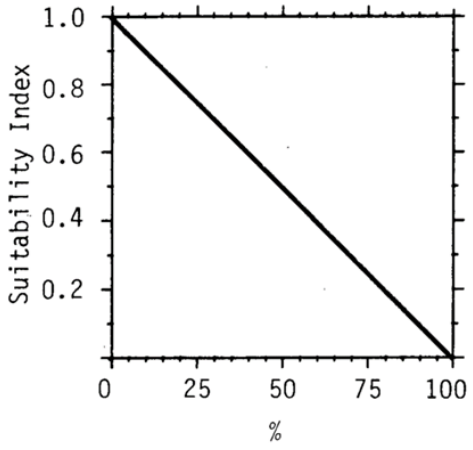
TY0-TY1: Assumed saplings dominate area
0 SI

TY20: Assumed young stand
.5 SI

TY50: Assumed mature stand
1.0 SI

<u>Variable V3:</u> 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

Assumed that pine savannah management techniques would limit the percentage of hardwoods in the upper $^{1}/_{3}$ layer.

TY0-TY1: Assumed saplings present, no trees in the canopy
0%

TY20-TY50: Assumed low density of hardwoods due to pine savannah management.
5%

FWOP

Assumed that in the absence of pine savannah management, the percent of hardwood midstory and understory would be a significant portion of the canopy, resulting in a large percentage of overstory pines with deciduous understory in the upper $^{1}/_{3}$ layer.

TY0-TY1: No canopy trees present
0%
TY20: 75%
TY50: 90%

Mitigation Site –PS-7 (Forested) RCW

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

FWP

TY0: Baseline Conditions

Floodplain Valley
Mixed
Saw Timber

0.4

TY1-TY50: Assumed thinnings and hardwood control in existing forested area would be complete by TY1, resulting in an evergreen stand.

Floodplain Valley
Evergreen
Saw Timber

0.8 SI

FWOP

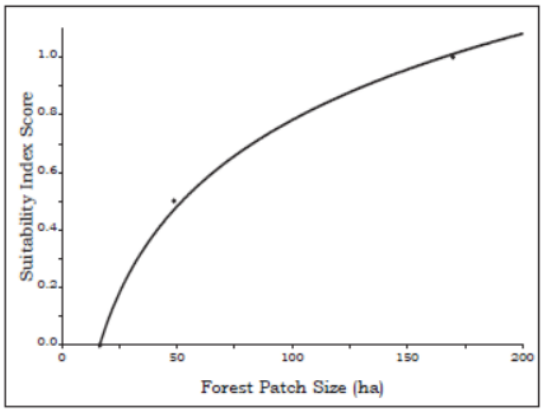
TY0-TY50: Since prescribed burns are often suppressed on private lands, assumed that without the proposed mitigation activities the subject site would consist of a mixed pine/hardwood stand into the future.

Floodplain Valley
Mixed
Saw Timber

0.4 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.



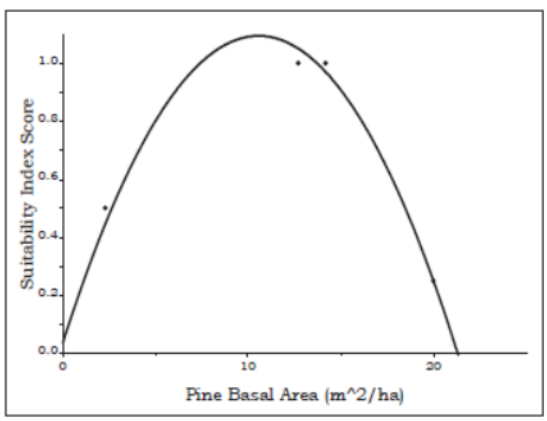
FWP and FWOP

Given the interior location of this mitigation site (north of I-12), RSLR impacts are not expected to extend to this area; therefore, assumed no change to size of contiguous forest under both FWP and FWOP scenarios.

TY0-TY50: 1078.45 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.

FWP

TY0: Baseline Conditions - Assumed that forested portions of mitigation site were comprised of a mixed pine/hardwood with an average age of 30 years. Used the pine in-growth spreadsheet to estimate BAs.

32.2 m^2/ha

TY1-TY50: Assuming that the site is currently dominated by mature pine trees in the overstory, any necessary thinning and burning would result in pine savannah habitat starting at TY1 and continuing over the life of the project.

11.48 m^2/ha

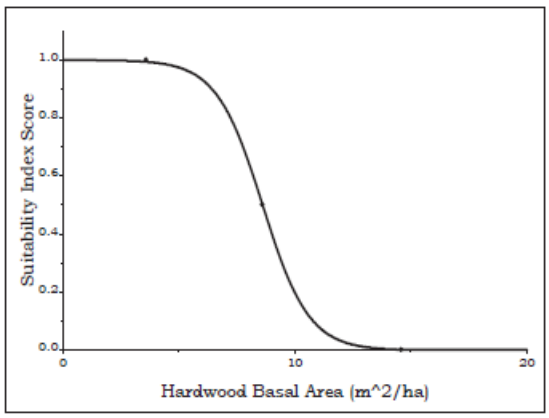
FWOP

Without the proposed mitigation activities, assumed site would be dominated by a mixed pine/hardwood stand over the life of the project. Assumed site consists of 30 year old pines at TY0 and used the pine in-growth spreadsheet to estimate BA over time.

TY0: 32.2 m^2/ha
TY1: 33.5 m^2/ha
TY20: 48.5 m^2/ha
TY50: 42.7 m^2/ha

<u>Variable V4:</u> 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.

FWP

TY0: Baseline Conditions - Assumed that forested portions of mitigation site were comprised of a mixed pine/hardwood with an average age of 30 years. Used the hardwood in-growth spreadsheet to estimate BAs.
14.2 m^2/ha

Assumed that mitigation construction will be completed by TY1. Given that the site would be managed as pine savannah habitat, we assumed that hardwood midstory and understory control would be conducted over the life of the project.

TY1-TY50: 1.15 m^2/ha

FWOP

Without the proposed mitigation activities, assumed site would be dominated by a mixed pine/hardwood stand over the life of the project. Used hardwood in-growth spreadsheet to estimate BA starting with a 30-year-old stand.

TY0: 14.2 m^2/ha
TY1: 14.9 m^2/ha
TY20: 28.2 m^2/ha
TY50: 43.7 m^2/ha

<u>Variable V5:</u> Relationship between distance to nearest habitat patch and SI

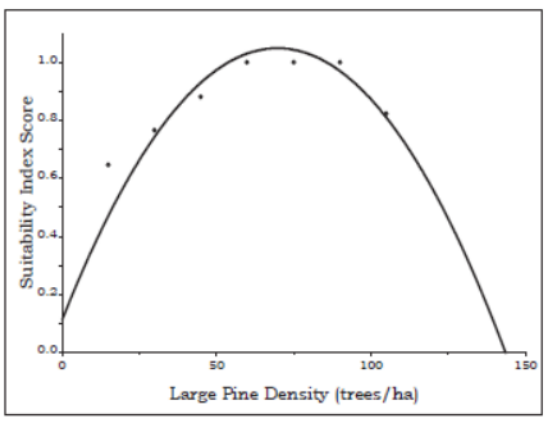
The proposed mitigation area is adjacent to pine savannah habitat under both the FWP and FWOP scenarios.

FWP and FWOP

TY0-50: 0 m

<u>Variable V6:</u> 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

Used pine in-growth spreadsheet to estimate the number of large pines starting with a 30-year-old stand. Assumed that any thinnings necessary would be conducted by TY1 and high quality pine savannah habitat would be maintained over the life of the project. With more open canopy, assumed pine regeneration and trees reaching >35cm by TY20.

TY0: 0 (trees/ha)
TY1: 0 (trees/ha)
TY20: 74 (trees/ha)

TY50: 74 (trees/ha)

FWOP

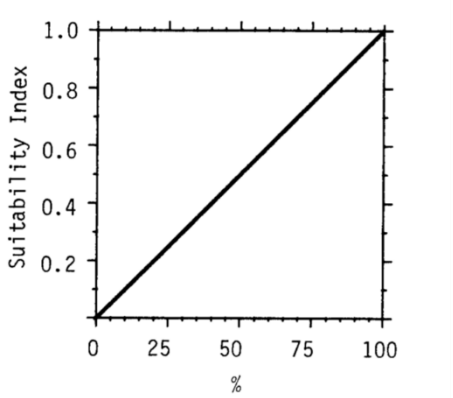
Without the proposed mitigation activities, assumed site would be dominated by a mixed pine/hardwood stand over the life of the project. Used pine in-growth spreadsheet to estimate the number of large pines starting with a 30-year-old stand. A more closed canopy is anticipated under the FWOP; however, assumed pine trees/ha would be lower under FWOP due to increased hardwood competition.

TY0: 0 (trees/ha)
TY1: 0 (trees/ha)
TY20: 32 (trees/ha)
TY50: 20 (trees/ha)

Mitigation Site – PS-7 (Forested) Pine Warbler

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

TY0: Baseline Conditions – Since prescribed burns are often suppressed on private lands, assumed that a mixed pine/hardwood stand currently exists with a dense canopy cover. While hardwoods comprise a portion of the canopy only pines are considered under this variable.
50%

TY1-TY50: Assumed initial pine savannah construction will be completed by TY1. Pine savannah management practices will result in an open pine canopy over the life of the project.
25%

FWOP

Assumed that without the proposed mitigation activities, the site would not be managed as pine savannah habitat into the future and would consist of mixed pine/hardwood. Without thinnings and prescribed burns, assumed a dense canopy would exist over the life of the project. While hardwoods comprise a portion of the canopy only pines are considered under this variable.

TY0-TY50: 50%

Variable V2: Successional stage of stand

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

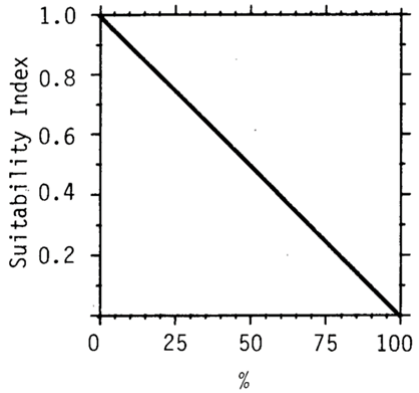
FWP and FWOP

Assumed a mature stand of trees would continue to exist on the site under both the FWP and FWOP scenarios.

TY0-TY50: 1.0 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

TY0: Baseline Conditions - Since prescribed burns are often suppressed on private lands, assumed that a mixed pine/hardwood stand currently exists a high percentage of hardwoods present in the upper $^{1}/_{3}$ layer.

90%

TY1-TY50: Pine savannah management techniques would limit the percentage of hardwoods in the upper $^{1}/_{3}$ layer.

5%

FWOP

Assumed that in the absence of pine savannah management, the percent of hardwoods would be a significant portion of the canopy, resulting in a large percentage of overstory pines with deciduous understory in the upper $^{1}/_{3}$ layer.

TY0-50: 90%

Mitigation Site – PS-7 (Cleared) RCW

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

FWP

Assumed that longleaf pine plantings would take place and the site managed as pine savannah over the project life.

TY0: Baseline Conditions

Floodplain Valley
Low Density Residential
Grass/Forb

0.0 SI

TY1: Assumed recent plantings, therefore, saplings at TY1

Floodplain Valley
Evergreen
Seedlings

0.0 SI

TY20: Assumed that planted longleaf have reached pole size timber.

Floodplain Valley
Evergreen
Pole

0.6 SI

TY50. Assumed that planted longleaf have reached saw size timber.

Floodplain Valley
Evergreen
Saw

0.8 SI

FWOP

TY0: Baseline Conditions

Floodplain Valley
Low Density Residential
Grass/Forb

0.0 SI

TY1: Since prescribed burns are often suppressed on private lands, assumed that burns would not take place under the FWOP scenario resulting in a regenerated mixed pine/hardwood stand. Thus, the currently cleared sites would naturally regenerate as a mixed pine/hardwood stand.

Floodplain Valley

Mixed
Seedlings

0.0 SI

TY20: Assumed the stand is comprised of pole size timber.

Floodplain Valley
Mixed
Pole

0.4 SI

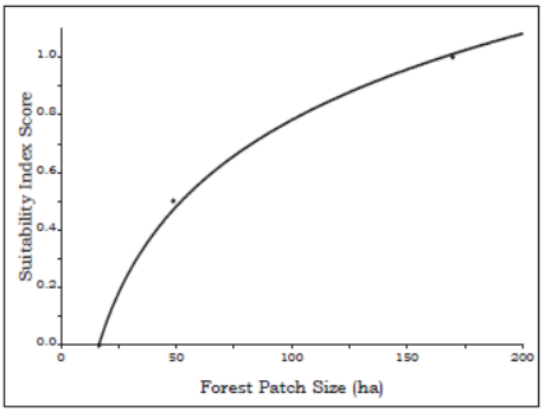
TY50: Assume the stand is comprised of saw size timber.

Floodplain Valley
Mixed
Saw

0.4 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.



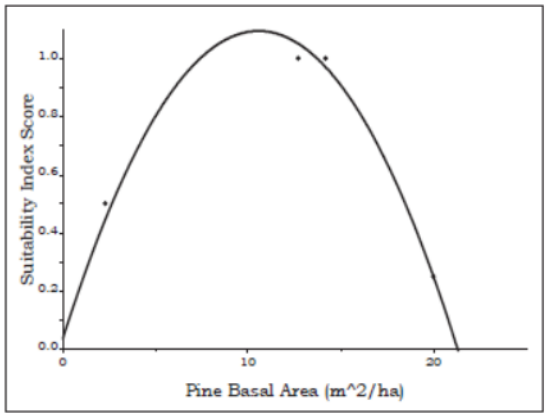
FWP and FWOP

Given the interior location of this mitigation site (north of I-12), RSLR impacts are not expected to extend to this area; therefore, assumed no change to size of contiguous forest under both FWP and FWOP scenarios.

TY0-TY50: 1078.45 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.

FWP

Assumed that longleaf pine plantings will be completed by TY1 and pine basal area would increase over time.

TY0: Baseline Conditions
0 m^2/ha

TY1-TY50: Assumed that cleared areas are planted with longleaf pine at TY1. As the pines mature on-site the basal area will increase.

TY1: 0.2 m^2/ha
TY20: 20.6 m^2/ha

TY50: Assumed that at TY50 the sight would have been thinned to maintain high quality pine savannah habitat.
11.5 m^2/ha

FWOP

Assumed that without the proposed mitigation activities, the cleared areas of the site would regenerate naturally as a pine/hardwood stand.

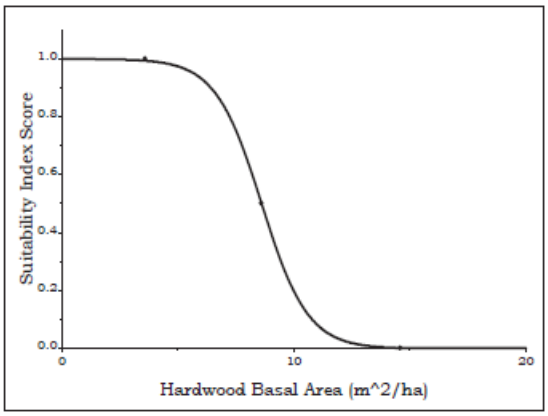
TY0: Baseline Conditions
0 m^2/ha

TY1-TY50: Assumed as the site regenerates the basal area of pines will increase over time.

TY1: 0.2 m^2/ha
TY20: 20.6 m^2/ha
TY50: 48.5 m^2/ha

<u>Variable V4:</u> 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.

FWP

TY0: Baseline Conditions
0 m^2/ha

TY1-TY50: Assumed that initial mitigation construction will be completed by TY1. Given that the site would be managed as pine savannah habitat, we assumed that management (i.e., prescribed burns, herbicide treatments, etc.) would result in low hardwood basal areas over the project life.

TY1: .0.2 m^2/ha

TY20-TY50: Assumed hardwood midstory control.
1.15 m^2/ha

FWOP

Assumed that without the proposed mitigation activities, the cleared areas of the site would regenerate naturally as a pine/hardwood stand.

TY0: 0 m^2/ha

TY1-TY50: Assumed that the proposed site would not be managed as pine savannah habitat into the future. Also assumed that as the sites regenerates the basal area of hardwoods would increase

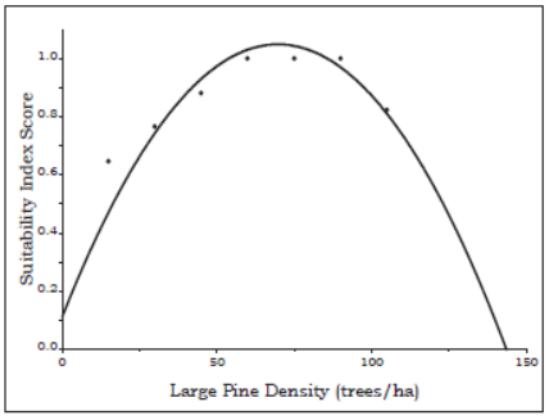
TY1: 0.16 m^2/ha
TY20: 7.58 m^2/ha
TY50: 28.21 m^2/ha

<u>Variable V5:</u> Relationship between distance to nearest habitat patch and SI

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

<u>Variable V6:</u> 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

Assumed that pine trees will be planted at TY1. Assume that trees planted at TY0 would reach >35 cm dbh by TY50.

TY0: Baseline Conditions
0 (trees/ha)
TY1-TY20: 0 (trees/ha)
TY50: 74 (trees/ha)

FWOP

Assumed that without the proposed mitigation activities, the cleared areas of the site would regenerate naturally as a pine/hardwood stand. Assume natural regeneration begins at TY1.

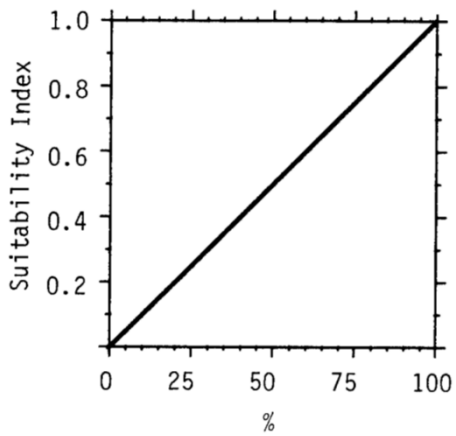
TY0: Baseline Conditions
0 (trees/ha)

TY1-TY50: Assumed that pine trees that have regenerated will not have reached 35 cm or greater until TY50. Under this scenario have hardwoods in the midstory and overstory limiting the number of large pines as compared to the FWP scenario.

TY1-TY20: 0 (trees/ha)
TY50: 32 (trees/ha)

Mitigation Site – PS-7 (Cleared) Pine Warbler

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

Assumed longleaf pine plantings will be completed by TY1.

TY0: Baseline Conditions
0%

TY1: Planted longleaf pine trees have not reached canopy height
0%

TY20: Assumed first thinnings have been conducted and as pines mature the percent canopy closure would increase.
30%

TY50: Assumed that thinning and burning to reduce vegetative density (to increase habitat quality for RCWs) of the pine savannah habitat present would result in a decrease of pine canopy closure.
25%

FWOP

Assumed that without the proposed mitigation activities, the site would not be managed as pine savannah habitat into the future and would consist of mixed pine/hardwood. Without thinnings and prescribed burns, assumed a dense canopy would exist over the life of the project. While hardwoods comprise a portion of the canopy only pines are considered under this variable.

TY0: Baseline Conditions
0%

TY1: Assumed at TY1 regenerated trees would be 1 year old and would not have reached canopy height.
0%

TY20-TY50: Assumed that without pine savannah management practices a dense pine/hardwood stand would regenerate; therefore, estimated an increasing pine canopy closure over time.

TY20: 40%
TY50: 50%

<u>Variable V2:</u> Successional stage of stand

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

FWP and FWOP

Assumed regeneration begins at TY0

TY0-TY1: Assumed saplings dominate area
0 SI

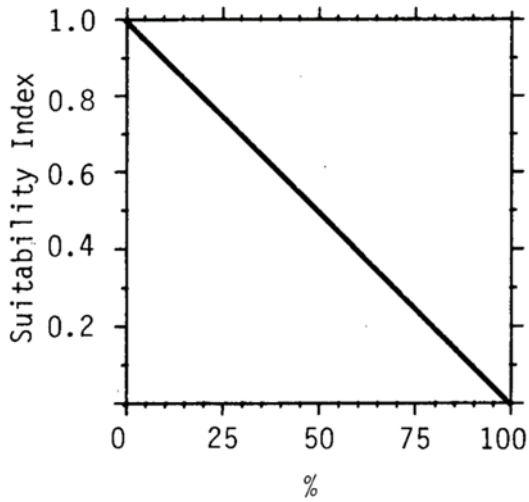
TY20: Assumed young stand
.5 SI

TY50: Assumed mature stand

1.0 SI

<u>Variable V3:</u> 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

Assumed that pine savannah management techniques would limit the percentage of hardwoods in the upper $^{1}/_{3}$ layer.

TY0-TY1: Assumed seedlings present, no trees in the canopy
0%

TY20-TY50: Assumed low density of hardwoods due to pine savannah management.
5%

FWOP

Assumed that in the absence of pine savannah management, the percent of hardwood midstory and understory would be a significant portion of the canopy, resulting in a large percentage of overstory pines with deciduous understory in the upper $^{1}/_{3}$ layer.

TY0-TY1: No canopy trees present
0%
TY20: 75%

TY50: 90%

Mitigation Site –PS-6 (Forested) RCW

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

FWP

TY0: Baseline Conditions

Floodplain Valley
Mixed
Saw Timber

0.4

TY1-TY50: Assumed thinnings and hardwood control in existing forested area would be complete by TY1, resulting in an evergreen stand.

Floodplain Valley
Evergreen
Saw Timber

0.8 SI

FWOP

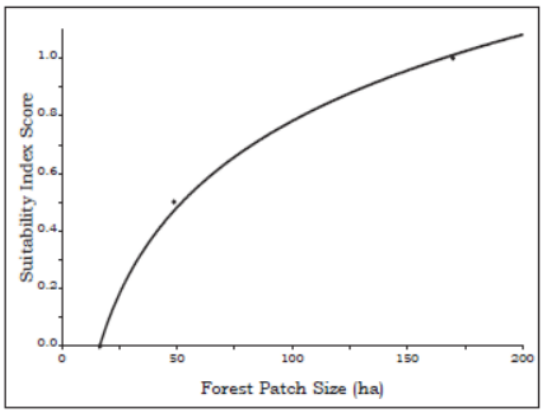
TY0-TY50: Since prescribed burns are often suppressed on private lands, assumed that without the proposed mitigation activities the subject site would consist of a mixed pine/hardwood stand into the future.

Floodplain Valley
Mixed
Saw Timber

0.4 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.



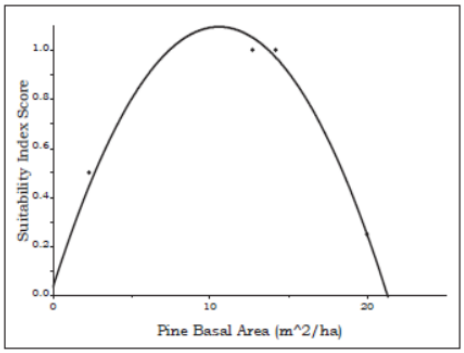
FWP and FWOP

Given the interior location of this mitigation site (north of I-12), RSLR impacts are not expected to extend to this area; therefore, assumed no change to size of contiguous forest under both FWP and FWOP scenarios.

TY0-TY50: 566.67 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.

FWP

TY0: Baseline Conditions - Assumed that forested portions of mitigation site were comprised of a mixed pine/hardwood with an average age of 30 years. Used the pine in-growth spreadsheet to estimate BAs.

32.2 m^2/ha

TY1-TY50: Assuming that the site is currently dominated by mature pine trees in the overstory, any necessary thinning and burning would result in pine savannah habitat starting at TY1 and continuing over the life of the project.

11.48 m^2/ha

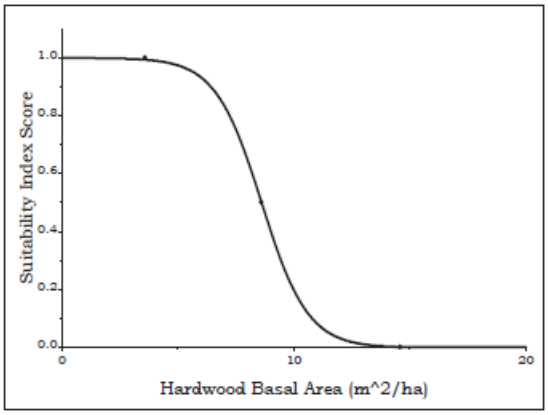
FWOP

Without the proposed mitigation activities, assumed site would be dominated by a mixed pine/hardwood stand over the life of the project. Assumed site consists of 30 year old pines at TY0 and used the pine in-growth spreadsheet to estimate BA.

TY0: 32.2 m^2/ha
TY1: 33.5 m^2/ha
TY20: 48.5 m^2/ha
TY50: 42.7 m^2/ha

<u>Variable V4:</u> 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.

FWP

TY0: Baseline Conditions - Assumed that forested portions of mitigation site were comprised of a mixed pine/hardwood with an average age of 30 years. Used the hardwood in-growth spreadsheet to estimate BAs.
14.2 m^2/ha

Assumed that mitigation construction will be completed by TY1. Given that the site would be managed as pine savannah habitat, we assumed that hardwood midstory and understory control would be conducted over the life of the project.

TY1-TY50: 1.15 m^2/ha

FWOP

Without the proposed mitigation activities, assumed site would be dominated by a mixed pine/hardwood stand over the life of the project. Used hardwood in-growth spreadsheet to estimate BA starting with a 30-year-old stand.

TY0: 14.2 m^2/ha
TY1: 14.9 m^2/ha
TY20: 28.2 m^2/ha
TY50: 43.7 m^2/ha

<u>Variable V5:</u> Relationship between distance to nearest habitat patch and SI

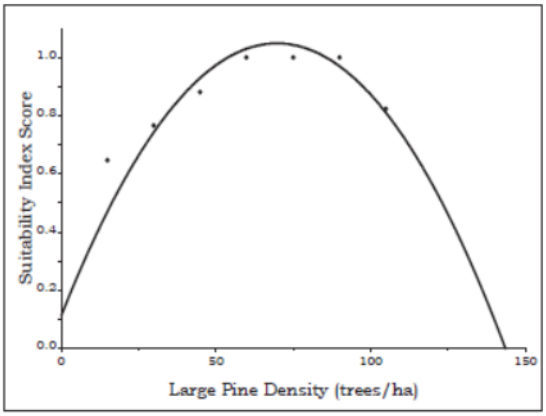
The proposed mitigation area is adjacent to pine savannah habitat under both the FWP and FWOP scenarios.

FWP and FWOP

TY0-50: 0 m

<u>Variable V6:</u> 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

Used pine in-growth spreadsheet to estimate the number of large pines starting with a 30-year-old stand. Assumed that any thinnings necessary would be conducted by TY1 and high quality pine savannah habitat would be maintained over the life of the project. With more open canopy, assumed pine regeneration and trees reaching >35cm by TY20.

TY0: 0 (trees/ha)
TY1: 0 (trees/ha)
TY20: 74 (trees/ha)
TY50: 74 (trees/ha)

FWOP

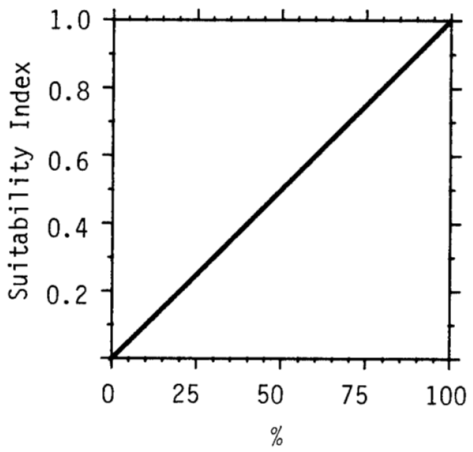
Without the proposed mitigation activities, assumed site would be dominated by a mixed pine/hardwood stand over the life of the project. Used pine in-growth spreadsheet to estimate the number of large pines starting with a 30-year-old stand. A more closed canopy is anticipated under the FWOP; however, assumed pine trees/ha would be lower under FWOP due to increased hardwood competition.

TY0: 0 (trees/ha)
TY1: 0 (trees/ha)
TY20: 32 (trees/ha)
TY50: 20 (trees/ha)

Mitigation Site – PS-6 (Forested) Pine Warbler

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

TY0: Baseline Conditions – Since prescribed burns are often suppressed on private lands, assumed that a mixed pine/hardwood stand currently exists with a dense canopy cover. While hardwoods comprise a portion of the canopy only pines are considered under this variable.
50%

TY1-TY50: Assumed initial pine savannah construction will be completed by TY1. Pine savannah management practices will result in an open pine canopy over the life of the project.
25%

FWOP

Assumed that without the proposed mitigation activities, the site would not be managed as pine savannah habitat into the future and would consist of mixed pine/hardwood. Without thinnings and prescribed burns, assumed a dense canopy would exist over the life of the project. While hardwoods comprise a portion of the canopy only pines are considered under this variable.

TY0-TY50: 50%

<u>Variable V2:</u> Successional stage of stand

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

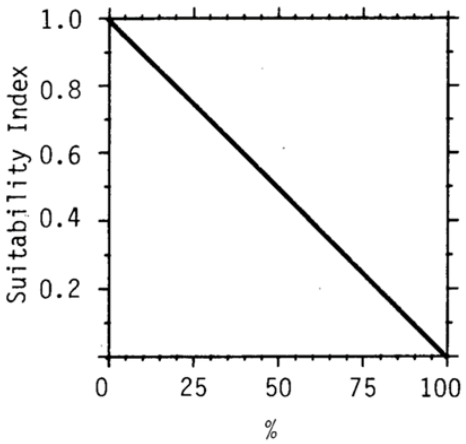
FWP and FWOP

Assumed a mature stand of trees would continue to exist on the site under both the FWP and FWOP scenarios.

TY0-TY50: 1.0 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

TY0: Baseline Conditions - Since prescribed burns are often suppressed on private lands, assumed that a mixed pine/hardwood stand currently exists a high percentage of hardwoods present in the upper $^1/_3$ layer.
90%

TY1-TY50: Pine savannah management techniques would limit the percentage of hardwoods in the upper $^1/_3$ layer.
5%

FWOP

Assumed that in the absence of pine savannah management, the percent of hardwoods would be a significant portion of the canopy, resulting in a large percentage of overstory pines with deciduous understory in the upper $^1/_3$ layer.

TY0-50: 90%

Mitigation Site – PS-6 (Cleared) RCW

<u>Variable V1:</u> 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

FWP

Assumed that longleaf pine plantings would take place and the site managed as pine savannah over the project life.
TY0: Baseline Conditions

Floodplain Valley
Low Density Residential
Grass/Forb

0.0 SI

TY1: Assumed recent plantings, therefore, seedlings at TY1

Floodplain Valley
Evergreen
Seedlings

0.0 SI

TY20: Assumed that planted longleaf have reached pole size timber.

Floodplain Valley
Evergreen
Pole

0.6 SI

TY50: Assumed that planted longleaf have reached saw size timber.

Floodplain Valley
Evergreen
Saw

0.8 SI

FWOP

TY0: Baseline Conditions

Floodplain Valley
Low Density Residential
Grass/Forb

0.0 SI

TY1: Since prescribed burns are often suppressed on private lands, assumed that burns would not take place under the FWOP scenario resulting in a regenerated mixed pine/hardwood stand. Thus, the currently cleared sites would naturally regenerate as a mixed pine/hardwood stand.

Floodplain Valley
Mixed
Seedlings

0.0 SI

TY20: Assumed the stand is comprised of pole size timber.

Floodplain Valley
Mixed
Pole

0.4 SI

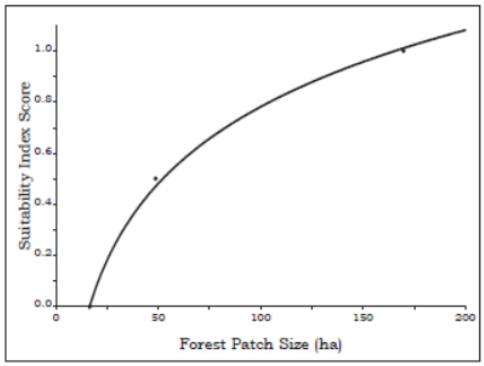
TY50: Assume the stand is comprised of saw size timber.

Floodplain Valley
Mixed
Saw

0.4 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.



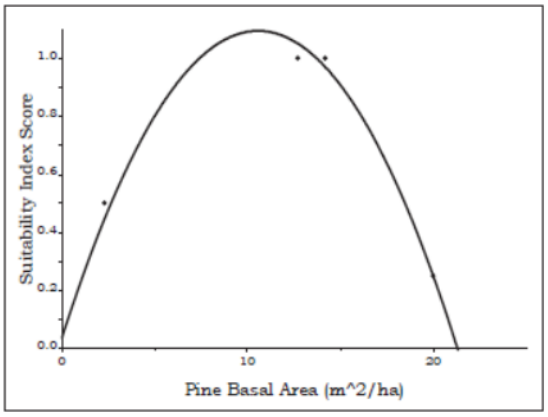
FWP and FWOP

Given the interior location of this mitigation site (north of I-12), RSLR impacts are not expected to extend to this area; therefore, assumed no change to size of contiguous forest under both FWP and FWOP scenarios.

TY0-TY50: 1078.45 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.

FWP

Assumed that longleaf pine plantings will be completed by TY1 and pine basal area would increase over time.

TY0: Baseline Conditions
0 m^2/ha

TY1-TY50: Assumed that cleared areas are planted with longleaf pine at TY1. As the pines mature on-site the basal area will increase.

TY1: 0.2 m^2/ha
TY20: 20.6 m^2/ha

TY50: Assumed that at TY50 the sight would have been thinned to maintain high quality pine savannah habitat.
11.5 m^2/ha

FWOP

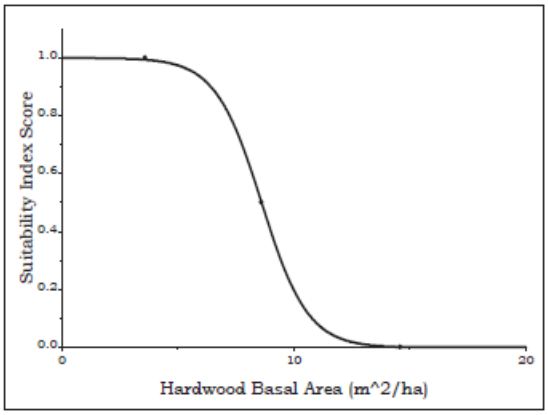
Assumed that without the proposed mitigation activities, the cleared areas of the site would regenerate naturally as a pine/hardwood stand.

TY0: Baseline Conditions
0 m^2/ha

TY1-TY50: Assumed as the site regenerates the basal area of pines will increase over time.
TY1: 0.2 m^2/ha
TY20: 20.6 m^2/ha
TY50: 48.5 m^2/ha

<u>Variable V4:</u> 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.

FWP

TY0: Baseline Conditions
0 m^2/ha

TY1-TY50: Assumed that initial mitigation construction will be completed by TY1. Given that the site would be managed as pine savannah habitat, we assumed that management (i.e., prescribed burns, herbicide treatments, etc.) would result in low hardwood basal areas over the project life.

TY1: 0.2 m^2/ha

TY20-TY50: Assumed hardwood midstory control.
1.15 m^2/ha

FWOP

Assumed that without the proposed mitigation activities, the cleared areas of the site would regenerate naturally as a pine/hardwood stand.

TY0: 0 m^2/ha

TY1-TY50: Assumed that the proposed site would not be managed as pine savannah habitat into the future. Also assumed that as the sites regenerates the basal area of hardwoods would increase

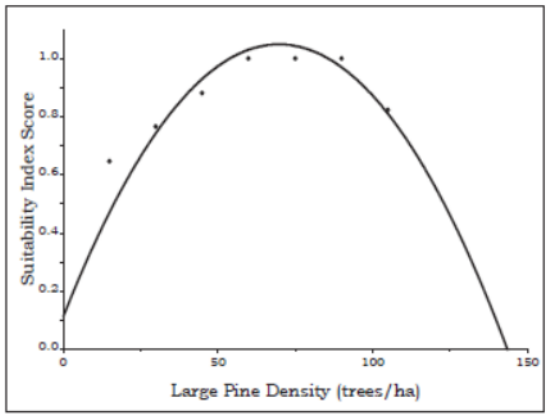
TY1: 0.16 m^2/ha
TY20: 7.58 m^2/ha
TY50: 28.21 m^2/ha

<u>Variable V5:</u> Relationship between distance to nearest habitat patch and SI

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

<u>Variable V6:</u> 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

Assumed that pine trees will be planted at TY1. Assume that trees planted at TY0 would reach >35 cm dbh by TY50.

TY0: Baseline Conditions
0 (trees/ha)
TY1-TY20: 0 (trees/ha)
TY50: 74 (trees/ha)

FWOP

Assumed that without the proposed mitigation activities, the cleared areas of the site would regenerate naturally as a pine/hardwood stand. Assume natural regeneration begins at TY1.

TY0: Baseline Conditions
0 (trees/ha)

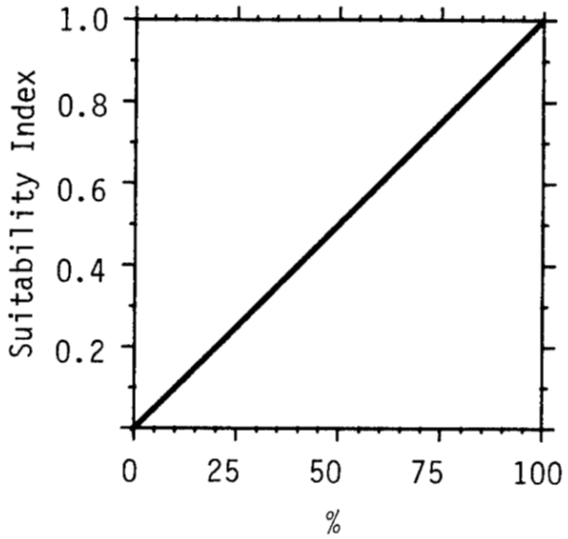
TY1-TY50: Assumed that pine trees that have regenerated will not have reached 35 cm or greater until TY50. Under this scenario have hardwoods in the midstory and overstory limiting the number of large pines as compared to the FWP scenario.

TY1-TY20: 0 (trees/ha)
TY50: 32 (trees/ha)

Mitigation Site – PS-6 (Cleared) Pine Warbler

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

Assumed longleaf pine plantings will be completed by TY1.

TY0: Baseline Conditions
0%

TY1: Planted longleaf pine trees have not reached canopy height
0%

TY20: Assumed first thinnings have been conducted and as pines mature the percent canopy closure would increase.
30%

TY50: Assumed that thinning and burning to reduce vegetative density (to increase habitat quality for RCWs) of the pine savannah habitat present would result in a decrease of pine canopy closure.
25%

FWOP

Assumed that without the proposed mitigation activities, the site would not be managed as pine savannah habitat into the future and would consist of mixed pine/hardwood. Without thinnings and prescribed burns, assumed a dense canopy would exist over the life of the project. While hardwoods comprise a portion of the canopy only pines are considered under this variable.

TY0: Baseline Conditions
0%

TY1: Assumed at TY1 regenerated trees would be 1 year old and would not have reached canopy height.
0%

TY20-TY50: Assumed that without pine savannah management practices a dense pine/hardwood stand would regenerate; therefore, estimated an increasing pine canopy closure over time.

TY20: 40%
TY50: 50%

Variable V2: Successional stage of stand

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

FWP and FWOP

Assumed regeneration begins at TY0

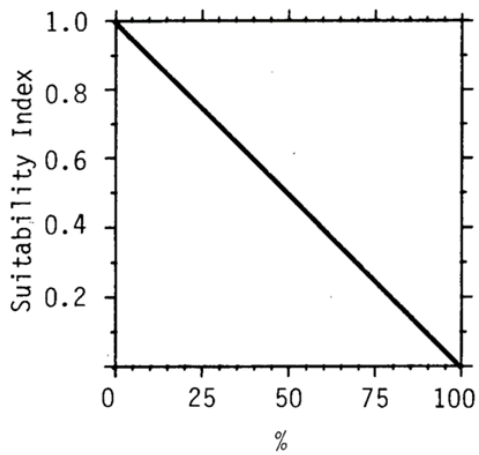
TY0-TY1: Assumed saplings dominate area
0 SI

TY20: Assumed young stand
.5 SI

TY50: Assumed mature stand
1.0 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

Assumed that pine savannah management techniques would limit the percentage of hardwoods in the upper $^{1}/_{3}$ layer.

TY0-TY1: Assumed seedlings present, no trees in the canopy
0%

TY20-TY50: Assumed low density of hardwoods due to pine savannah management.
5%

FWOP

Assumed that in the absence of pine savannah management, the percent of hardwood midstory and understory would be a significant portion of the canopy, resulting in a large percentage of overstory pines with deciduous understory in the upper $^{1}/_{3}$ layer.

TY0-TY1: No canopy trees present
0%
TY20: 75%
TY50: 90%

Mitigation Site –PS-19 (Forested) RCW

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

FWP

TY0: Baseline Conditions

Floodplain Valley
Mixed
Saw Timber

0.4

TY1-TY50: Assumed thinnings and hardwood control in existing forested area would be complete by TY1, resulting in an evergreen stand.

Floodplain Valley
Evergreen
Saw Timber

0.8 SI

FWOP

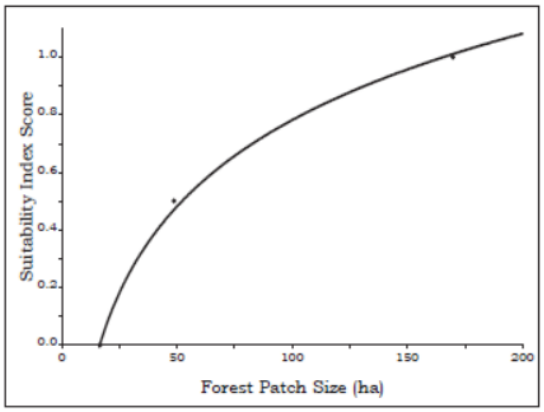
TY0-TY50: Since prescribed burns are often suppressed on private lands, assumed that without the proposed mitigation activities the subject site would consist of a mixed pine/hardwood stand into the future.

Floodplain Valley
Mixed
Saw Timber

0.4 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.



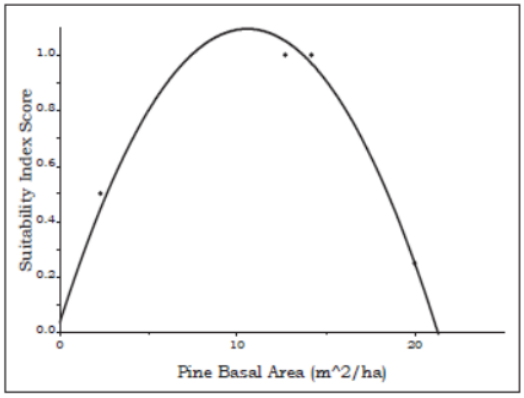
FWP and FWOP

Given the interior location of this mitigation site (north of I-12), RSLR impacts are not expected to extend to this area; therefore, assumed no change to size of contiguous forest under both FWP and FWOP scenarios.

TY0-TY50: 131.77 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.

FWP

TY0: Baseline Conditions - Assumed that forested portions of mitigation site were comprised of a mixed pine/hardwood with an average age of 30 years. Used the pine in-growth spreadsheet to estimate BAs.

32.2 m^2/ha

TY1-TY50: Assuming that the site is currently dominated by mature pine trees in the overstory, any necessary thinning and burning would result in pine savannah habitat starting at TY1 and continuing over the life of the project.

11.48 m^2/ha

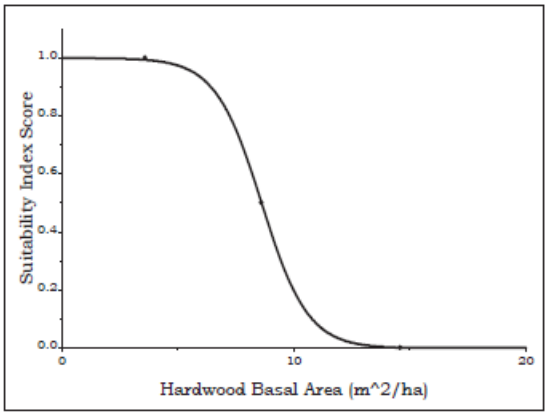
FWOP

Without the proposed mitigation activities, assumed site would be dominated by a mixed pine/hardwood stand over the life of the project. Assumed site consists of 30 year old pines at TY0 and used the pine in-growth spreadsheet to estimate BA over time.

TY0: 32.2 m^2/ha
TY1: 33.5 m^2/ha
TY20: 48.5 m^2/ha
TY50: 42.7 m^2/ha

<u>Variable V4:</u> 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.

FWP

TY0: Baseline Conditions - Assumed that forested portions of mitigation site were comprised of a mixed pine/hardwood with an average age of 30 years. Used the hardwood in-growth

spreadsheet to estimate BAs.

14.2 m^2/ha

Assumed that mitigation construction will be completed by TY1. Given that the site would be managed as pine savannah habitat, we assumed that hardwood midstory and understory control would be conducted over the life of the project.

TY1-TY50: 1.15 m^2/ha

FWOP

Without the proposed mitigation activities, assumed site would be dominated by a mixed pine/hardwood stand over the life of the project. Used hardwood in-growth spreadsheet to estimate BA starting with a 30-year-old stand.

TY0: 14.2 m^2/ha
TY1: 14.9 m^2/ha
TY20: 28.2 m^2/ha
TY50: 43.7 m^2/ha

<u>Variable V5:</u> Relationship between distance to nearest habitat patch and SI

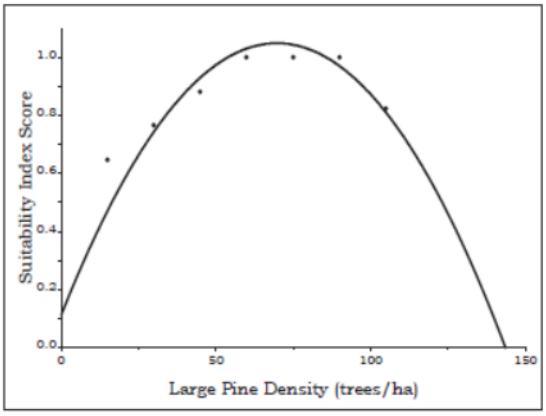
The proposed mitigation area is adjacent to pine savannah habitat under both the FWP and FWOP scenarios.

FWP and FWOP

TY0-50: 0 m

<u>Variable V6:</u> 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

Used pine in-growth spreadsheet to estimate the number of large pines starting with a 30-year-old stand. Assumed that any thinnings necessary would be conducted by TY1 and high quality pine savannah habitat would be maintained over the life of the project. With more open canopy, assumed pine regeneration and trees reaching >35cm by TY20.

TY0: 0 (trees/ha)
TY1: 0 (trees/ha)
TY20: 74 (trees/ha)
TY50: 74 (trees/ha)

FWOP

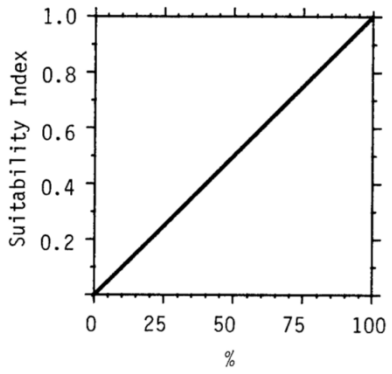
Without the proposed mitigation activities, assumed site would be dominated by a mixed pine/hardwood stand over the life of the project. Used pine in-growth spreadsheet to estimate the number of large pines starting with a 30-year-old stand. A more closed canopy is anticipated under the FWOP; however, assumed pine trees/ha would be lower under FWOP due to increased hardwood competition.

TY0: 0 (trees/ha)
TY1: 0 (trees/ha)
TY20: 32 (trees/ha)
TY50: 20 (trees/ha)

Mitigation Site – PS-19 (Forested) Pine Warbler

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

TY0: Baseline Conditions – Since prescribed burns are often suppressed on private lands, assumed that a mixed pine/hardwood stand currently exists with a dense canopy cover. While hardwoods comprise a portion of the canopy only pines are considered under this variable.
50%

TY1-TY50: Assumed initial pine savannah construction will be completed by TY1. Pine savannah management practices will result in an open pine canopy over the life of the project.
25%

FWOP

Assumed that without the proposed mitigation activities, the site would not be managed as pine savannah habitat into the future and would consist of mixed pine/hardwood. Without thinnings and prescribed burns, assumed a dense canopy would exist over the life of the project. While hardwoods comprise a portion of the canopy only pines are considered under this variable.

TY0-TY50: 50%

Variable V2: Successional stage of stand

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

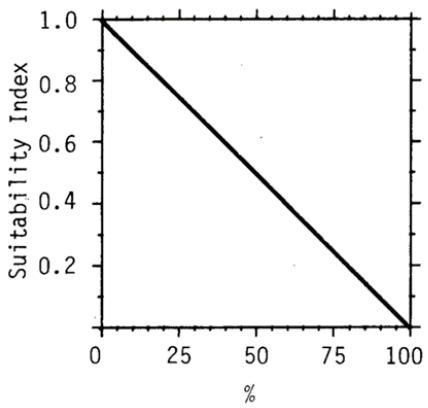
FWP and FWOP

Assumed a mature stand of trees would continue to exist on the site under both the FWP and FWOP scenarios.

TY0-TY50: 1.0 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

TY0: Baseline Conditions - Since prescribed burns are often suppressed on private lands, assumed that a mixed pine/hardwood stand currently exists a high percentage of hardwoods present in the upper $^{1}/_{3}$ layer.

90%

TY1-TY50: Pine savannah management techniques would limit the percentage of hardwoods in the upper $^{1}/_{3}$ layer.

5%

FWOP

Assumed that in the absence of pine savannah management, the percent of hardwoods would be a significant portion of the canopy, resulting in a large percentage of overstory pines with deciduous understory in the upper $^{1}/_{3}$ layer.

TY0-50: 90%

Mitigation Site – PS-19 (Cleared) RCW

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

FWP

Assumed that longleaf pine plantings would take place and the site managed as pine savannah over the project life.

TY0: Baseline Conditions

Floodplain Valley
Low Density Residential
Grass/Forb

0.0 SI

TY1: Assumed recent plantings, therefore, seedlings at TY1

Floodplain Valley
Evergreen
Seedlings

0.0 SI

TY20: Assumed that planted longleaf have reached pole size timber.

Floodplain Valley
Evergreen
Pole

0.6 SI

TY50: Assumed that planted longleaf have reached saw size timber.

Floodplain Valley
Evergreen
Saw

0.8 SI

FWOP

TY0: Baseline Conditions

Floodplain Valley
Low Density Residential
Grass/Forb

0.0 SI

TY1: Since prescribed burns are often suppressed on private lands, assumed that burns would not take place under the FWOP scenario resulting in a regenerated mixed pine/hardwood stand. Thus, the currently cleared sites would naturally regenerate as a mixed pine/hardwood stand.

Floodplain Valley
Mixed
Seedlings

0.0 SI

TY20: Assumed the stand is comprised of pole size timber.

Floodplain Valley
Mixed
Pole

0.4 SI

TY50: Assume the stand is comprised of saw size timber.

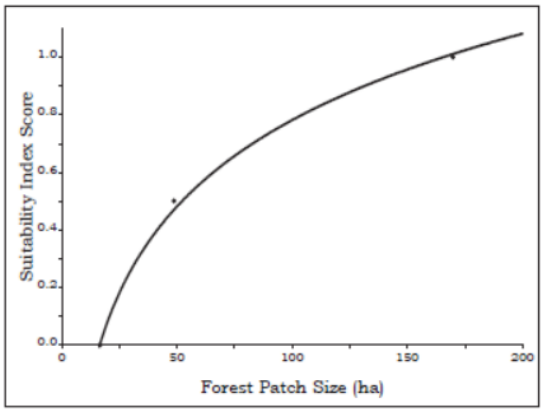
Floodplain Valley
Mixed
Saw

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.



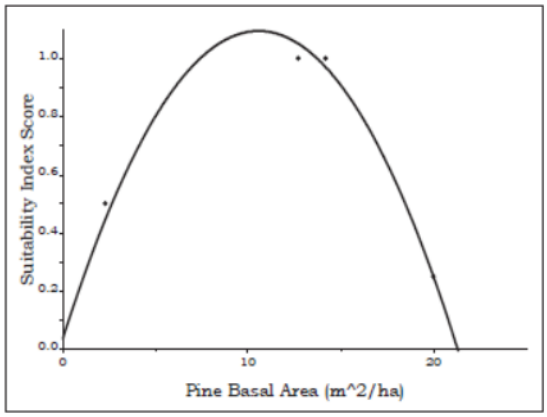
FWP and FWOP

Given the interior location of this mitigation site (north of I-12), RSLR impacts are not expected to extend to this area; therefore, assumed no change to size of contiguous forest under both FWP and FWOP scenarios.

TY0-TY50: 131.77 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.

FWP

Assumed that longleaf pine plantings will be completed by TY1 and pine basal area would increase over time.

TY0: Baseline Conditions
0 m^2/ha

TY1-TY50: Assumed that cleared areas are planted with longleaf pine at TY1. As the pines mature on-site the basal area will increase.

TY1: 0.2 m^2/ha
TY20: 20.6 m^2/ha

TY50: Assumed that at TY50 the sight would have been thinned to maintain high quality pine savannah habitat.
11.5 m^2/ha

FWOP

Assumed that without the proposed mitigation activities, the cleared areas of the site would regenerate naturally as a pine/hardwood stand.

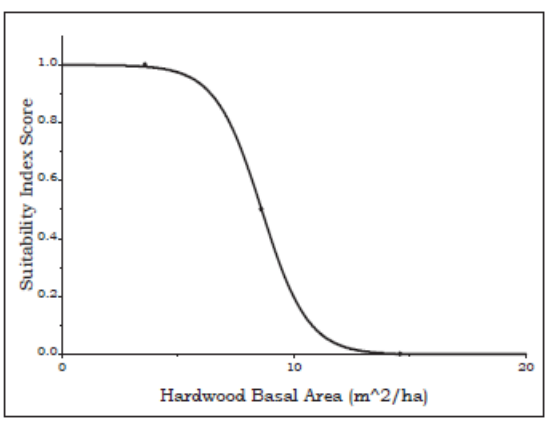
TY0: Baseline Conditions
0 m^2/ha

TY1-TY50: Assumed as the site regenerates the basal area of pines will increase over time.

TY1: 0.2 m^2/ha
TY20: 20.6 m^2/ha
TY50: 48.5 m^2/ha

<u>Variable V4:</u> 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.

FWP

TY0: Baseline Conditions
0 m^2/ha

TY1-TY50: Assumed that initial mitigation construction will be completed by TY1. Given that the site would be managed as pine savannah habitat, we assumed that management (i.e., prescribed burns, herbicide treatments, etc.) would result in low hardwood basal areas over the project life.

TY1: 0.2 m^2/ha

TY20-TY50: Assumed hardwood midstory control.
1.15 m^2/ha

FWOP

Assumed that without the proposed mitigation activities, the cleared areas of the site would regenerate naturally as a pine/hardwood stand.

TY0: 0 m^2/ha

TY1-TY50: Assumed that the proposed site would not be managed as pine savannah habitat into the future. Also assumed that as the sites regenerates the basal area of hardwoods would increase

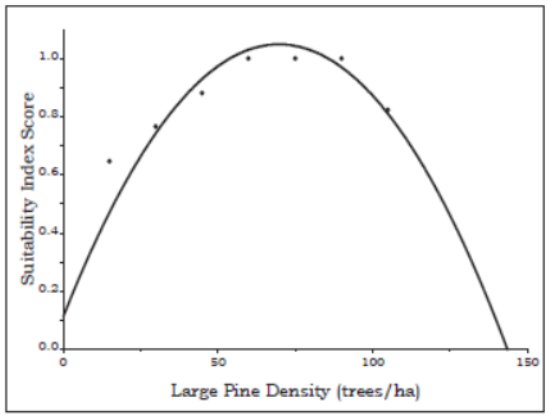
TY1: 0.16 m^2/ha
TY20: 7.58 m^2/ha
TY50: 28.21 m^2/ha

<u>Variable V5:</u> Relationship between distance to nearest habitat patch and SI

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

<u>Variable V6:</u> 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

Assumed that pine trees will be planted at TY1. Assume that trees planted at TY0 would reach >35 cm dbh by TY50.

TY0: Baseline Conditions
0 (trees/ha)
TY1-TY20: 0 (trees/ha)
TY50: 74 (trees/ha)

FWOP

Assumed that without the proposed mitigation activities, the cleared areas of the site would regenerate naturally as a pine/hardwood stand. Assume natural regeneration begins at TY1.

TY0: Baseline Conditions
0 (trees/ha)

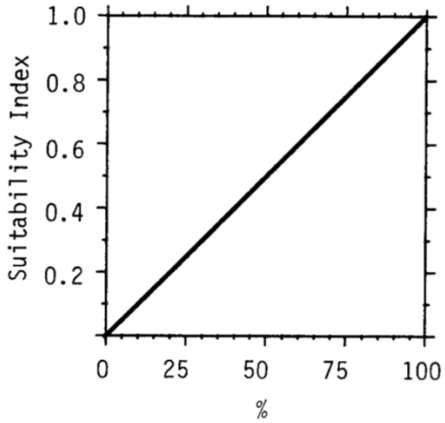
TY1-TY50: Assumed that pine trees that have regenerated will not have reached 35 cm or greater until TY50. Under this scenario have hardwoods in the midstory and overstory limiting the number of large pines as compared to the FWP scenario.

TY1-TY20: 0 (trees/ha)
TY50: 32 (trees/ha)

Mitigation Site – PS-19 (Cleared) Pine Warbler

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

Assumed longleaf pine plantings will be completed by TY1.

TY0: Baseline Conditions
0%

TY1: Planted longleaf pine trees have not reached canopy height
0%

TY20: Assumed first thinnings have been conducted and as pines mature the percent canopy closure would increase.
30%

TY50: Assumed that thinning and burning to reduce vegetative density (to increase habitat quality for RCWs) of the pine savannah habitat present would result in a decrease of pine canopy closure.
25%

FWOP

Assumed that without the proposed mitigation activities, the site would not be managed as pine savannah habitat into the future and would consist of mixed pine/hardwood. Without thinnings and prescribed burns, assumed a dense canopy would exist over the life of the project. While hardwoods comprise a portion of the canopy only pines are considered under this variable.

TY0: Baseline Conditions
0%

TY1: Assumed at TY1 regenerated trees would be 1 year old and would not have reached canopy height.

0%

TY20-TY50: Assumed that without pine savannah management practices a dense pine/hardwood stand would regenerate; therefore, estimated an increasing pine canopy closure over time.

TY20: 40%
TY50: 50%

<u>Variable V2:</u> Successional stage of stand

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

FWP and FWOP

Assumed regeneration begins at TY1

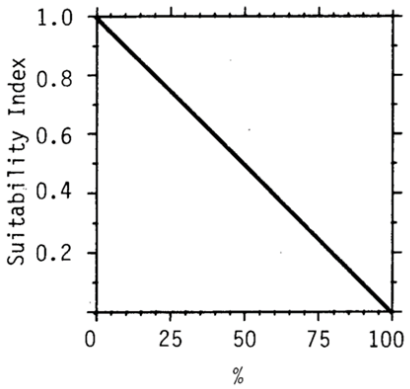
TY0-TY1: Assumed saplings dominate area
0 SI

TY20: Assumed young stand
.5 SI

TY50: Assumed mature stand
1.0 SI

<u>Variable V3:</u> 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

Assumed that pine savannah management techniques would limit the percentage of hardwoods in the upper $^1/_3$ layer.

TY0-TY1: Assumed seedlings present, no trees in the canopy
0%

TY20-TY50: Assumed low density of hardwoods due to pine savannah management.
5%

FWOP
Assumed that in the absence of pine savannah management, the percent of hardwood midstory and understory would be a significant portion of the canopy, resulting in a large percentage of overstory pines with deciduous understory in the upper $^1/_3$ layer.

TY0-TY1: No canopy trees present
0%
TY20: 75%
TY50: 90%

Mitigation Site – PS-26 RCW

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

FWP

TY0: Baseline Conditions

Floodplain Valley
Mixed
Saw Timber

0.4

TY1-TY50: Assumed thinnings and hardwood control in existing forested area would be complete by TY1, resulting in an evergreen stand.

Floodplain Valley
Evergreen
Saw Timber

0.8 SI

FWOP

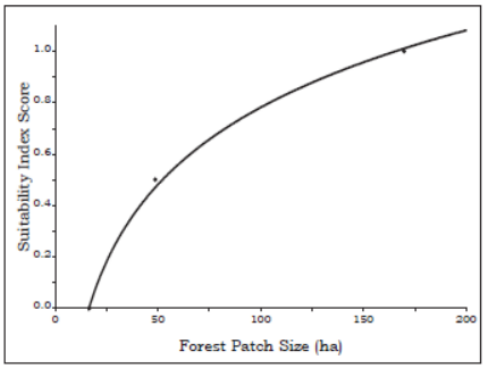
TY0-TY50: Since prescribed burns are often suppressed on private lands, assumed that without the proposed mitigation activities the subject site would consist of a mixed pine/hardwood stand into the future.

Floodplain Valley
Mixed
Saw Timber

0.4 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.



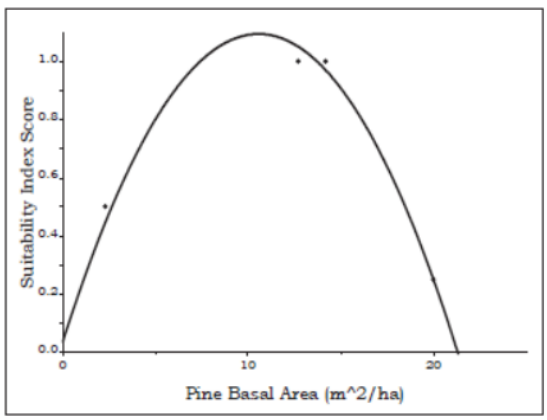
FWP and FWOP

The forest patch size is 1920.4 ha and consists of habitat on and off refuge property. A cursory review of elevations within this area on Google Earth shows a significant portion higher than 3.3 feet (the elevation at which no loss of pine is expected under the intermediate SLR scenario). Therefore, assumed that even with the loss of some lower elevation acreage (mainly occurring within drains) the forest patch size would remain over 170 ha (≥170 ha = 1 SI) over the 50 year project life.

TY0-TY50: 1920.4 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.

FWP

TY0: Baseline Conditions - Assumed that forested portions of mitigation site were comprised of a mixed pine/hardwood with an average age of 30 years. Used the pine in-growth spreadsheet to estimate BAs.

32.2 m^2/ha

TY1-TY50: Assuming that the site is currently dominated by mature pine trees in the overstory, any necessary thinning and burning would result in pine savannah habitat starting at TY1 and continuing over the life of the project.

11.48 m^2/ha

FWOP

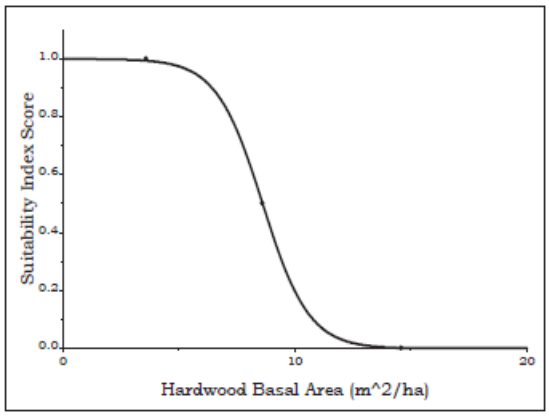
Without the proposed mitigation activities, assumed site would be dominated by a mixed

pine/hardwood stand over the life of the project. Assumed site consists of 30 year old pines at TY0 and used the pine in-growth spreadsheet to estimate BA over time.

TY0: 32.2 m^2/ha
TY1: 33.5 m^2/ha
TY20: 48.5 m^2/ha
TY50: 42.7 m^2/ha

<u>Variable V4:</u> 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.

FWP

TY0: Baseline Conditions - Assumed that forested portions of mitigation site were comprised of a mixed pine/hardwood with an average age of 30 years. Used the hardwood in-growth spreadsheet to estimate BAs.
14.2 m^2/ha

Assumed that mitigation construction will be completed by TY1. Given that the site would be managed as pine savannah habitat, we assumed that hardwood midstory and understory control would be conducted over the life of the project.

TY1-TY50: 1.15 m^2/ha

FWOP

Without the proposed mitigation activities, assumed site would be dominated by a mixed pine/hardwood stand over the life of the project. Used hardwood in-growth spreadsheet to estimate BA starting with a 30-year-old stand.

TY0: 14.2 m^2/ha
TY1: 14.9 m^2/ha
TY20: 28.2 m^2/ha
TY50: 43.7 m^2/ha

<u>Variable V5:</u> Relationship between distance to nearest habitat patch and SI

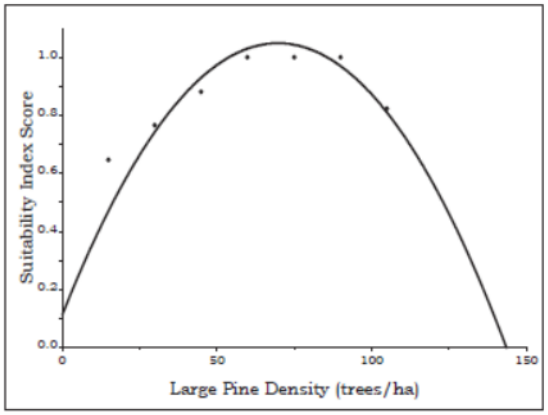
The proposed mitigation area is adjacent to pine savannah habitat under both the FWP and FWOP scenarios.

FWP and FWOP

TY0-50: 0 m

<u>Variable V6:</u> 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

Used pine in-growth spreadsheet to estimate the number of large pines starting with a 30-year-old stand. Assumed that any thinnings necessary would be conducted by TY1 and high quality pine savannah habitat would be maintained over the life of the project. With more open canopy, assumed pine regeneration and trees reaching >35cm by TY20.

TY0: 0 (trees/ha)
TY1: 0 (trees/ha)
TY20: 74 (trees/ha)
TY50: 74 (trees/ha)

FWOP

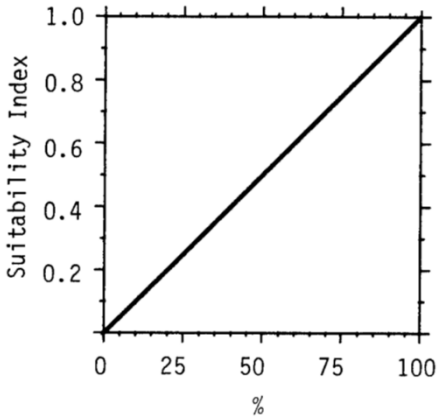
Without the proposed mitigation activities, assumed site would be dominated by a mixed pine/hardwood stand over the life of the project. Used pine in-growth spreadsheet to estimate the number of large pines starting with a 30-year-old stand. A more closed canopy is anticipated under the FWOP; however, assumed pine trees/ha would be lower under FWOP due to increased hardwood competition.

TY0: 0 (trees/ha)
TY1: 0 (trees/ha)
TY20: 32 (trees/ha)
TY50: 20 (trees/ha)

Mitigation Site – PS-26 Pine Warbler

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

TY0: Baseline Conditions – Since prescribed burns are often suppressed on private lands, assumed that a mixed pine/hardwood stand currently exists with a dense canopy cover. While hardwoods comprise a portion of the canopy only pines are considered under this variable.
50%

TY1-TY50: Assumed initial pine savannah construction will be completed by TY1. Pine savannah management practices will result in an open pine canopy over the life of the project.
25%

FWOP

Assumed that without the proposed mitigation activities, the site would not be managed as pine savannah habitat into the future and would consist of mixed pine/hardwood. Without thinnings and prescribed burns, assumed a dense canopy would exist over the life of the project. While hardwoods comprise a portion of the canopy only pines are considered under this variable.

TY0-TY50: 50%

Variable V2: Successional stage of stand

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

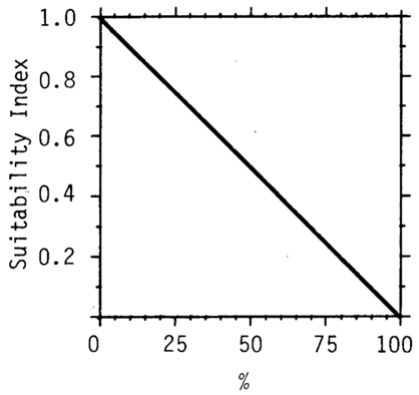
FWP and FWOP

Assumed a mature stand of trees would continue to exist on the site under both the FWP and FWOP scenarios.

TY0-TY50: 1.0 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

TY0: Baseline Conditions - Since prescribed burns are often suppressed on private lands, assumed that a mixed pine/hardwood stand currently exists a high percentage of hardwoods present in the upper $^{1}/_{3}$ layer.

90%

TY1-TY50: Pine savannah management techniques would limit the percentage of hardwoods in the upper $^{1}/_{3}$ layer.

5%

FWOP

Assumed that in the absence of pine savannah management, the percent of hardwoods would be a significant portion of the canopy, resulting in a large percentage of overstory pines with deciduous understory in the upper $^{1}/_{3}$ layer.

TY0-50: 90%