

**Florida Scrub-Jay
(*Aphelocoma coerulescens*)**

**5-Year Review:
Summary and Evaluation**



Photo: Todd Mecklenborg

**U.S. Fish and Wildlife Service
South Atlantic - Gulf & Mississippi Basin
North Florida Ecological Services Office
Jacksonville, Florida**

5-YEAR REVIEW
Florida Scrub-Jay (*Aphelocoma coerulescens*)

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5-YEAR REVIEW

Florida Scrub-Jay (*Aphelocoma coerulescens*)

I. GENERAL INFORMATION

A. Methodology used to complete the review

On June 20, 2019, the U.S. Fish and Wildlife Service (hereafter the Service) published a notice in the *Federal Register* (84 FR 28850) announcing the 5-year review of this species and requesting new information concerning the biology and status. A 60-day comment period terminated on August 19, 2019. Comments were received and the information was incorporated in the review analysis.

This review incorporates information found in the final rule listing this species under the Endangered Species Act of 1973, as amended (Act), Recovery Plans (1990, 1999, and 2019), previous 5-year reviews, published research, project reports, unpublished field observations, and personal communications. The Service relied on the best available information pertaining to historical and current distributions, life history, threats, and habitat of the species. No part of this review was contracted to an outside party. The Service's species lead recovery biologist completed this review. The documents utilized to complete this review are on file at the North Florida Ecological Services Office, Jacksonville, Florida.

B. Reviewers

Lead Region: Aaron Valenta, South Atlantic - Gulf Region & Mississippi Basin
Regional Office, 404-679-4144

Lead Field Office: Todd Mecklenborg, North Florida Ecological Services Field
Office, 904-731-3029

Cooperating Field Office: Elizabeth Landrum, South Florida Ecological Services
Field Office, 772-469-4304

C. Background

- 1. Federal Register Notice citation announcing initiation of this review:** 84 FR 28850, June 20, 2019
- 2. Species status:** Declining. Based on the most recent range-wide survey (Boughton and Bowman 2011). The comparative data between 1992-93 and 2009-10 of 178 managed land parcels revealed the populations have declined by as much as 25% or more on these managed conservation lands. Outside of managed conservation areas (suburban and private areas), the decline is estimated to be much greater.

3. **Recovery achieved:** 2 (26-50% recovery objectives achieved)
4. **Listing history:** Original Listing
FR notice: 52 FR 20715
Date listed: June 3, 1987
Entity listed: Subspecies
Classification: Threatened
5. **Associated rulemakings:** None
6. **Review History:** The Service announced a review of all endangered and threatened species listed before January 1, 1991, under the Endangered Species Act of 1973, as amended (56 FR 56882). The Service requested comments and any new scientific or commercial information on these species. No in-depth assessment of the five-factors or threats on individual species recovery were completed during this review.

A 5-Year Review was signed on September 28, 2007 that included updated biology and habitat information, current species status, and a Five-Factor Analysis. The species status was noted as Decreasing. “Although scrub-jays in 75% of populations recently surveyed have declined in numbers since the 1992-1993, the species is still relatively widely distributed throughout its historical range. Furthermore, three metapopulations (Ocala National Forest, Merritt Island/Cape Canaveral, and Lake Wales Ridge) are believed to contain sufficient numbers of scrub-jay groups to persist long-term.” No change in Classification was recommended. A new Recovery Priority Number was assigned during this review based on additional information obtained after species listing.
7. **Species’ Recovery Priority Number at start of review (48 FR 43098):** 8C.
The “8” indicates a moderate degree of threat and high recovery potential; the “C” reflects a degree of conflict with economic activities (development and agriculture).
8. **Recovery Plan:**

Name of plan:	Florida Scrub Jay Recovery Plan
Date issued:	May 9, 1990
Name of plan:	South Florida Multi-Species Recovery Plan (Identifies recovery contributions for the South Florida Ecological Service’s office area of responsibility).
Date issued:	May 18, 1999
Name of plan:	Recovery Plan for the Florida Scrub-Jay (<i>Aphelocoma coerulescens</i>)
Date issued:	September 26, 2019

II. REVIEW ANALYSIS

A. Application of the 1996 Distinct Population Segment (DPS) policy:

- 1. Is the species under review listed as a DPS? No**
- 2. Is there relevant new information regarding application of the DPS policy that would lead you to consider listing this species as a DPS in accordance with the 1996 policy? No**

B. Recovery Criteria

- 1. Does the species have a final, approved recovery plan containing objective, measurable criteria? Yes**
- 2. Adequacy of recovery criteria.**
 - a. Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat? Yes**
 - b. Are the 5 listing factors that are relevant to this species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)? Yes**
- 3. List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information. For threats-related recovery criteria, please note which of the 5 listing factors are addressed by that criterion. If any of the 5-listing factors are not relevant to this species, please note that here.**

The 2019 recovery plan for delisting the species included the following three criteria:

- Each of the seven focal landscapes (East Coastal, North Central, Northeast Coastal, Lake Wales Ridge North, Lake Wales Ridge South, Southwest Inland, and Southeast Coastal) within six of the genetic unit's exhibit a stable or increasing trend including natural recruitment and multiple age classes.
- Subpopulations are connected to the extent that genetic diversity can be naturally maintained without translocations.
- When in addition to the above criteria, it can be demonstrated that the threats particularly habitat loss and degradation associated with sea level rise, development, and inadequate habitat management are diminished such that

sufficient habitat remains for the species to remain viable for the foreseeable future.

Achievements accomplished based on the original 1990 recovery plan criteria are detailed in the previous 5-Year Review (2007) that stated 26-50% of recovery objectives had been achieved. Past and ongoing achievements include development of management plans for the three existing, large population sites (Ocala National Forest, Merritt Island/Cape Canaveral, and Archbold Biological Station); evidence of Florida Scrub-Jays recolonizing restored or uninhabited areas; establishment of scrub preserves; and development of management guidelines for activities that negatively affect habitat.

This new 5-Year Review will establish a baseline of new recovery criteria for future evaluations. The revised recovery plan, completed in late 2019, incorporates the knowledge gained since species listing in 1987 and derives its criteria from decades of research and conservation efforts focusing on range-wide resiliency, redundancy, and representation of the species. Dating back to 1969 when Dr. Glen Woolfenden began his novel research on species biology and the sociobiology of Florida Scrub-Jays, there are now nearly 300 scientific journal articles covering a broad variety of topics ranging from physiology to ecology (D. Breininger, pers. comm. 2020). Approximately 30 of the publications emphasize conservation and habitat management needs.

The focal landscape approach in the recovery criteria identifies areas where current populations may have long-term viability or have the potential for long-term viability (figures in Species Status Assessment Florida Scrub-Jay 2019). Some populations may have long-term viability if their current habitat is managed effectively, while others may require additional habitat to be acquired and managed. Numerous factors influence and are essential to maintaining population viability or improving a population's potential viability. Currently, Population Viability Analyses (PVA) are under development that will be utilized to improve this approach toward species recovery in the focal landscapes. The PVA (Vortex Model) incorporates and assesses multiple variables including base demographic rates, demographic stochasticity, environmental variation, genetic heterogeneity, inbreeding coefficients, habitat quality, catastrophes, and trends in demography and environment to assist in predicting future population levels over time.

C. Updated Information and Current Species Status

1. Biology and Habitat

- a. Abundance, population trends, demographic features, or demographic trends:** The majority of Florida Scrub-Jay populations range-wide have continued to decline since species listing. This trend has continued since the 1992-93 statewide survey as documented in the prior 5-Year Review (2007) and also in a more recent comparison study of

populations on managed areas (*State Wide Assessment of Florida Scrub-Jays on Managed Areas: A comparison of Current Populations to the Results of the 1992-93 Survey*, Boughton and Bowman 2011). The report examined how populations have fared on public lands acquired for conservation of Florida's natural resources and managed to sustain those resources. The comparative data between 1992-93 and 2009-10 from 178 managed land parcels revealed the populations have declined by as much as 25% or more just on these managed conservation lands. The extant population of 1,253 Florida Scrub-Jay family groups on these lands represent well less than 50% of the potential or estimated carrying capacity. The decline is estimated to be much greater in suburban and private areas where the habitat is not managed. Changes in the size of groups in the declining populations was not investigated but is certainly warranted in future assessments.

Boughton and Bowman (2011) estimated 2,400-2,600 Florida Scrub-Jay groups remaining range-wide, excluding Ocala National Forest. Based on known Florida Scrub-Jay group densities in a subset of timber management stands in Ocala National Forest and extrapolating to all stands of suitable habitat (~ 6 feet vegetative structure height), the Ocala National Forest population has been estimated between 900-1,000 Florida Scrub-Jay family groups (K. Miller and C. Faulhaber FWC, and J. Garcia USFS - pers. comm. 2017). Range-wide, the number of Florida Scrub-Jay family groups could be 3,400-3,600 providing the assumptions for the estimates are valid.

Summary of Population Trends in Focal Landscapes

The narratives for populations within a focal landscape are arranged in descending order from the largest population, typically with the most abundant landscape of potential habitat.

U.S Forest Service's Ocala National Forest and Seminole State Forest (North Central Genetic Unit D)

Ocala National Forest's roughly 226,000 acres of scrub habitat is the largest contiguous landscape remaining in peninsular Florida and supports the largest population of Florida Scrub-Jays throughout this species' range. Beginning in 1999, the U.S. Forest Service established the initial Scrub-Jay Management Area 8.4 (MA 8.4) focusing management actions to provide high-quality Florida Scrub-Jay habitat in perpetuity. Prior to the creation of the MA 8.4 category, Florida Scrub-Jays occupied areas of sand pine harvest (Timber Management Area MA 8.2) when the vegetative structure is suitable for occupancy after seedling planting or direct seeding and prior to harvest (3 to 12-year succession). Management Areas 8.4 are created from MA 8.2 after the timber has been harvested and

are maintained through mechanical reduction or prescribed fire or a combination of treatments. The initial MA 8.4 in 1999 was 1,874 acres in size. A second MA 8.4 added 988 acres in 2007. The Forest Plan was further amended in 2016, establishing 11 new MA 8.4 and significantly expanding the MA 8.4 category to approximately 51,850 acres of scrub habitat. There are currently 7,102 acres of suitable Florida Scrub-Jay habitat within MA 8.4 and at least 850 acres of new sand pine harvests are planned for 2020. Additionally, suitable scrub habitat and Florida Scrub-Jay occupancy occurs in MA 8.2 (timber harvest areas), Juniper Wilderness Area, and the Navy's Pinecastle Bombing Range. Monitoring data in study plots in MA 8.2 stands during 2011-2016 suggest a stable or increasing population will result as acreage of early successional habitat increases through the expansion on MA 8.4 during the next decade.

Conservation land adjacent to the southern boundary of Ocala National Forest and within typical Florida Scrub-Jay dispersal distance to the national forest property is Seminole State Forest. The Florida Forest Service (FFS) has been actively managing Seminole State Forest to improve optimum Florida Scrub-Jay habitat suitability. Nearly all of the scrub (~5,000 acres) and scrubby flatwoods (~1,200 acres) had been fire-suppressed for decades. Over the last decade, restoration activities have improved conditions on the large scrub ridge in the main forest block. The FFS has a dedicated scrub-jay biologist position, forest restoration plan benefitting Florida Scrub-Jays, and an active banding and monitoring program.

*Merritt Island NWR and Cape Canaveral Air Force Station
(Northeast Coastal Genetic Unit C)*

Merritt Island National Wildlife Refuge (Kennedy Space Center), Cape Canaveral Air Force Station, and Canaveral National Seashore currently supports the second largest contiguous population of Florida Scrub-Jays in the species range. Combined, these federal lands are estimated to have over 20,000 acres of potentially suitable Florida Scrub-Jays habitat. The large contiguous-landscape, along with the current habitat management efforts provides favorable conditions for long-term persistence of these populations. Opportunities for increasing habitat management and addressing future climate change impacts with our conservation partners are the main priorities on these federal lands. Currently, PVA models are under development for predicting outcomes of management options for this large population. The coastal populations appear to be slightly declining since the previous 5-Year Review.

Archbold Biological Station, Lake Placid Scrub, McJunkin Tract, and Gould Road (Lake Wales Ridge Genetic Unit B)

The largest population on Lake Wales Ridge (south-central Florida) occurs in the southern metapopulation and includes the private and public conservation lands of Archbold Biological Station and three tracts of the Lake Wales Ridge Wildlife and Environmental Areas (Lake Placid Scrub, McJunkin Tract, and Gould Road). Collectively, these protected conservation lands encompass roughly 7,000 acres. The stronghold for the area and supporting the majority of the Florida Scrub-Jay family groups is Archbold Biological Station with approximately 5,000 acres. This research station was founded in 1941. Beginning in 1969 a demographic study on Florida Scrub-Jays was initiated by Dr. Glen Woolfenden that continues today. It is among the longest and most complete studies of a bird species spanning over 10 generations. The most recent survey indicates a decline in the numbers of family groups at Archbold Biological Station, but is within historical variation for this population. This pattern is not unusual with the normal perturbations of population size recorded over the past 50-years at the station. Most likely, this decline is attributed to stochastic cyclic fluctuations. The 2017 family group numbers are close to the long-term average so most of the decline has occurred during the past 2-3 years, which is a very short period to draw conclusions. Continued monitoring of the population is essential to understand if this decline is beyond normal historical observations. Overall, the population level on the surrounding conservation lands appear to be stable or increasing since the previous 5-Year Review.

Avon Park Air Force Bombing Range (Lake Wales Ridge Genetic Unit B)

Avon Park Air Force Range contains the largest, most contiguous areas of potential habitat in the Lake Wales Ridge Genetic Unit's northern metapopulation with approximately 6,300 acres of oak scrub. These birds occupy a different relict dune in central Florida, the Bombing Range Ridge, which is critical for Florida Scrub-Jay recovery. This redundancy across different ridges of oak scrub habitat is important for the northern metapopulation's long-term persistence. A critical link between the two ridges – within Avon Park boundaries – in maintaining connectivity among Avon Park Bombing Range and the Lake Wales Ridge State Forest's Arbuckle Tract on the Lake Wales Ridge is a scrub patch roughly 800 acres between the these two large areas.

The Air Force recognized that encroachment of sand pine has caused many of the available acres of scrub habitat to be suboptimal. In response, the Air Force is funding and working with the Service to restore large areas of suboptimal habitat using mechanical operations and prescribed fire and continues to work aggressively to promote the recovery of this

species. In addition, Archbold Biological Station is working with the Air Force and Service to assess the quality of occupied and unoccupied scrub habitat, which should aid in targeted restoration to promote the recovery of the Florida Scrub-Jay population on the Avon Park Air Force Bombing Range.

Avon Park Bombing Range's Florida Scrub-Jay population has decline since the initial 1992-93 statewide survey. Once a population of 98 family groups, it currently has less than half this number. The population experienced an increase in the number of family groups from 2011 through 2014 (64, 63, 66, 65 respectively), but is currently only 47 family groups.

Lake Wales Ridge State Forest - Arbuckle Tract and surrounding Conservation Lands (Lake Wales Ridge Genetic Unit B)

The Florida Forest Service's Lake Wales Ridge State Forest Arbuckle Tract contains roughly 3,700 acres of scrub habitat. In combination with Lake Wales Ridge Wildlife and Environmental Area Hickory Scrub, the total area is greater than 4,000 acres. Located west of the Bombing Range Ridge but within Florida Scrub-Jay dispersal distance, these public conservation lands are essential to the Lake Wales Ridge northern metapopulation's persistence. Restoration activities over the last several decades have increased the amount of suitable scrub habitat resulting in an increase in Florida Scrub-Jay occupancy. The number of family groups has more than doubled from 9 family groups in 2009 to 19 groups in 2019.

St. Sebastian River Preserve State Park and Conservation Lands in Brevard County (East Coastal Genetic Unit A)

The mainland of Brevard County was once the fourth largest metapopulation within the species range. The population has declined by more than half resulting from continual habitat loss and degradation despite active habitat management programs within the county on many of its conservation lands. Data from ongoing Adaptive Resource Management (ARM) programs and preliminary data from the PVA under development identified that more aggressive habitat and population management is necessary to recover the population. St. Sebastian Preserve State Park and North Sebastian Conservation Area have the highest potentially viable population with approximately 2,150 acres of scrub and scrubby flatwood habitat. The population has remained relatively stable over the last decade. Other important managed conservation lands within Brevard County include Valkaria, Malabar, and Jordan Scrub Sanctuaries with greater than 1,000 acres collectively; however, these scrub sanctuaries' populations have declined from historical numbers but several conservation lands have shown improvement in recent years.

*Duette Preserve/Mosaic Wellfield and surrounding Conservation Lands
(Southwest Inland Genetic Unit F)*

The only potentially viable Florida Scrub-Jay population on Florida's west coast occurs at Manatee County's Duette Preserve, the adjacent private Mosaic Wellfield, and several surrounding public conservation lands. A 1999 PVA (Stith) revealed this metapopulation had a very high risk of extinction ($p=0.97$) and quasi-extinction ($p=1.0$). Additionally, Habitat Suitability Index (HSI) modeling by Breininger (1992) and a demographic analysis in 2001 suggested that the majority of the Florida Scrub-Jays territories on the mining property were reproductive sinks with habitat not easily restorable. Based on these data, Mosaic Fertilizer Company collaborated with species experts and government agencies to develop a Florida Scrub-Jay Habitat Management Plan in 2002 for the extant 14 family groups on their lands. Along with habitat management, a component of the plan included translocating Florida Scrub-Jays onto restored managed lands thereby improving the population demographics. Commencing in 2003 and terminating in 2011, there were 51 Florida Scrub-Jays translocated to the roughly 1,000 acres Mosaic Wellfield parcel adjacent to Duette Preserve. The majority of the family groups reside in the approximately 3,550 acres of scrub habitat within Duette Preserve. Prior to translocations on the adjacent Mosaic Wellfield property, Duette Preserve had only 5 Florida Scrub-Jay family groups (1992-93). Currently, there are 36 family groups on Duette Preserve and Mosaic Wellfield. While the number of family groups solely on the Mosaic Wellfield has remained between 5-8 family groups over the last several years, descendants of the translocated birds have dispersed throughout the surrounding landscape. Managed conservation lands within dispersal distance of Duette Preserve/Mosaic Wellfield include Coker Prairie, Gilley Creek, Moody Branch, and Little Manatee River Southfork Tract. There are over 50 Florida Scrub-Jay family groups collectively on these conservation lands.

Jonathan Dickinson State Park (Southeast Coastal Genetic Unit I)

Jonathan Dickinson State Park has approximately 2,800 acres of scrub habitat. The population is currently at 30% of its predicted 70% carrying capacity based on the amount of potential suitable habitat in the park. Ongoing habitat management targeting early successional scrub conditions has occurred for many years; however, the population has not responded as anticipated with the increased amount of unoccupied suitable habitat available.

A research project was initiated in 2019 to analyze genomic patterns and conduct demographic monitoring to determine the extent and

consequences of inbreeding in small, isolated populations and to evaluate translocation success in the southern Atlantic coastal metapopulation. Intensive monitoring is ongoing at Jonathan Dickinson State Park and Savannas Preserve State Park to characterize the demography of these populations (census, banding, blood sampling) to establish the baseline of the resident birds. In a cooperative effort the Florida Fish and Wildlife Conservation Commission, U.S. Forest Service and Jonathan Dickinson State Park, began Florida Scrub-Jay translocations from Ocala National Forest to Jonathan Dickinson State Park in 2019 and 2020 prior to the onset of breeding. A breeding pair with a female helper were translocated to park property in February 2019. In January 2020, another translocation occurred consisting of a breeding pair with a male helper and second breeding pair. The outcome of the translocations will inform population management decisions, determine if future translocations may be a management tool for population augmentation and genetic rescue, and to increase knowledge of translocation protocols for use in other populations.

Allen David Broussard Catfish Creek Preserve State Park and surrounding Conservation Lands (Lake Wales Ridge Genetic Unit B)

This conservation area has been aggressively managed over the last decade and the population has been steadily increasing. Although the number of Florida Scrub-Jay family groups has doubled during this timeframe, the number of family groups remains smaller than numbers documented during the statewide survey in 1992-93. Catfish Creek has greater than 1,600 acres of potential habitat on park property and is within typical Florida Scrub-Jay dispersal distance of Hatchineha Ranch and Lake Wales Ridge State Forest Hesperides Tract conservation lands. Collectively, these conservation lands have the potential to support a much larger Florida Scrub-Jay population totaling almost 2,400 acres of habitat.

Lake Wales Ridge Wildlife and Environmental Area - Carter Creek and surrounding Conservation lands (Lake Wales Ridge Genetic Unit B)

The population on this conservation land declined from 35 Florida Scrub-Jay family groups in 1992-93 to 2 family groups in 2011-13 resulting from habitat degradation. A concerted effort entailing habitat management, land acquisitions, monitoring, and property access restrictions by the Florida Fish and Wildlife Conservation Commission, The Nature Conservancy, Highlands County, and the Service has increased the number of family groups to almost half of the historical number.

Florida's current conservation and recreation lands acquisition program – Florida Forever – and the predecessor programs identified the importance of resource protection for Lake Istokpoga and the Greater Everglades Ecosystem through preservation of the Arbuckle Creek Watershed.

Arbuckle Creek Forever project consists of multiple large tracts of land to act as a wildlife and eco-corridor. Sebring Highlands Ridge Subdivision mega parcel is among the large parcels of which Carter Creek is a component. Over the last two plus decades of acquisitions, Carter Creek now has approximately 1,500 acres under conservation management with greater than 90% of the mega-parcel subdivision in public ownership.

Carter Creek's proximity to Avon Park Bombing Range to the east and Lake Wales Ridge State Forest's Arbuckle Tract to its north contribute to the northern metapopulation's resiliency and long-term persistence.

Number of Family Groups in Focal Landscapes

The following tables summarize the population trends from 2009-10 through 2019 for the focal landscape populations in terms of the number of family groups. Data sources include Boughton and Bowman 2011, Jay Watch, and private and conservation land ongoing monitoring programs. Blank cells indicate missing or unavailable data. For historical reference, the prior 5-Year Review completed in 2007 captures the number of family groups in many of the same populations from 1992/1993 through 2006.

East Coastal Genetic Unit A

Focal Landscape	2010	2017	2018	2019
St. Sebastian River State Preserve	35	28	34	45
Valkaria Scrub Sanctuaries	16		10	10
Malabar Scrub Sanctuaries	0		5	10
Jordan Scrub Sanctuaries	6		11	10
North Sebastian Conservation Area	7	12	10	13

Lake Wales Ridge Genetic Unit B

Focal Landscape	2009	2010	2017	2018	2019
Archbold Biological Station		116	133		98
Avon Park Bombing Range	50	57	54	50	47
A.D.B. Catfish Creek State Park	13	9	17	15	22
LWRSF - Arbuckle Tract	9	10	19	19	21
LWRNWR - Flamingo Villas	9	9	9	11	11
Highlands Hammock State Park	4	2	8	8	11
Lake June-in-Winter Scrub S.P.	7	8	11	9	9
LWRSF - Walk in the Water	6	8	6	7	6
Saddle Blanket Scrub Preserve	2	1	1	1	2

Focal Landscapes on LWRWEA	2009	2010	2017	2018	2019
Lake Placid Scrub	34		33	30	35
McJunkin Tract	16	22	20	13	15
Carter Creek	3		5	13	16
Gould Road	4	5	7	8	10
Holmes Avenue	7	12		10	
Silver Lake	9		8		10
Henscratch Preserve	2		6		9
Highlands Ridge		18		9	
Royce Ranch		5	8	14	9
Sun N Lake North	7		5		7
Highlands Park Estates		12		4	
Jack Creek	1				0

Northeast Coastal Genetic Unit C

Focal Landscape	2009	2010	2017	2018	2019
Merritt Island NWR		275			270
Cape Canaveral Air Force Station	155		144	136	134
Canaveral National Seashore	* included in MINWR				

North Central Genetic Unit D

Focal Landscape	2010	2017	2018	2019
Seminole State Forest	44	38	44	37
Rock Springs Run	0	2	4	6
Ocala National Forest	* ~ 1,000 estimate			

* Based on known Florida Scrub-Jay group densities in a subset of timber management stands in Ocala National Forest and extrapolating to all stands of suitable habitat (~ 6 feet vegetative structure height), the Ocala National Forest population has been estimated at 900-1,000 Florida Scrub-Jay groups (K. Miller and C. Faulhaber FWC, and J. Garcia USFS - pers. comm. 2017).

Southwest Inland Genetic Unit F

Focal Landscape	2009	2010	2017	2018	2019
Duette Preserve/Mosaic Wellfield	12	21	24	26	36
E. Chance Reserve - Gilley Creek	3	4	5	6	7
Moody Branch Mitigation Park	3	5	3	5	5
E. Chance Reserve - Coker Tract				2	2
Little Manatee River Southfork	3	4	2	2	2

Southeast Coastal Genetic Unit I

Focal Landscape	2009	2010	2017	2018	2019
Jonathan Dickinson State Park	20	17	15	21	24
Hobe Sound NWR		0			
Seabranh Preserve State Park	0	0	0	1	
Atlantic Ridge Ecosystem		4			

Summary of Population Trends Not Included in Focal Landscapes

Although the following Florida Scrub-Jay populations are not a component of species recovery, all populations are important for the species. Because of their isolated locations or small potential carrying capacities or both, their long-term persistence is doubtful. The individual birds within these populations could serve a utility having the potential to contribute resiliency – through augmentation or possible genetic rescue via translocations – to other populations.

Marjorie Harris Carr Cross Florida Greenways State Recreation and Conservation Area – Triangle Property (North Central Genetic Unit D)

The Cross Florida Greenways' Triangle Property is an isolated population in Marion County bordered by Interstate-75 to its east and north. Marion Oaks housing development is adjacent to the west and south. The scrub habitat on the conservation land is roughly 1,100 acres; however, Florida Scrub-Jays utilize adjacent undeveloped land parcels within the housing development. The majority of the housing development occurs on xeric soils supporting scrub or sandhill communities. This population has been steadily increasing since 1992 and exceeds its predicted carrying capacity based on conservation land acreage. This is a result of active management on the conservation land and also from immigration due to habitat loss caused by ongoing road and house construction in the surrounding landscape. Smoke management issues associated with the adjacent major interstate from prescribed fire limits the opportunity to manage the property effectively by burning increased fuel loads.

Viera East Scrub Jay Preserve (East Coastal Genetic Unit A)

In 1994, Viera East Community Development District created a conservation area as part of a Habitat Conservation Plan. The 420-acre Florida Scrub-Jay preserve is located south of Helen and Allen Cruickshank Sanctuary and north of Capron Ridge Sanctuary in Brevard County. Prior to habitat restoration, the area supported three family groups in the early 90's. Responding to vegetative structure reduction accompanied with the reintroduction of fire, the population within the conservation area has increased to a habitat saturation condition as the

surrounding habitat continues to be developed. The Florida Scrub-Jay population has been well over the predicted carrying capacity within the conservation area for more than a decade. Collectively, Viera East Scrub Jay Preserve, Cruickshank Sanctuary, and Capron Ridge Sanctuary support roughly 30 Florida Scrub-Jay family groups.

Lyonia Preserve and Oscar Scherer State Park (Southwest Volusia County Genetic Unit G) and (Southwest Coastal Genetic Unit E)

The Florida Scrub-Jay populations on these managed conservation lands are typical of small isolated areas imbedded in an urban matrix. As the adjacent landscape becomes less suitable for occupancy from continual habitat loss and/or habitat degradation, the birds immigrate to the recently restored or existing suitable habitat on the conservation lands. The influx of individuals exceeds the carrying capacity on the conservation lands and density dependence issues begin to manifest. Demographic performance declines dramatically for the resident breeders. Eventually immigration ceases to occur when the surrounding landscape is no longer occupied and the population declines to a limited number of breeders. With little to no recruitment into the population, inbreeding becomes a major obstacle to overcome.

Lyonia Preserve in Volusia County has roughly 360 acres of scrub habitat. When restoration began in 1994, the site was unoccupied. By 2005, the Preserve had 45 Florida Scrub-Jay family groups. The predicted carrying capacity based on available acreage within the preserve is roughly 10 family groups. The population is steadily declining having 18 family groups during its most recent census.

Oscar Scherer State Park is located in Sarasota County, having approximately 570 acres of scrub and scrubby flatwoods, is another example of a small population in an urban setting. Prior to restoration activities in 1988, the park was unoccupied. The population reached 34 family groups in 1999. Similar to Lyonia Preserve, the predicted carrying capacity is much lower around 16 family groups. Since 2015, the population has been 6 family groups or less.

Savannas Preserve State Park and Disney Wilderness Preserve (Southeast Coastal Genetic Unit I) (Lake Wales Ridge Genetic Unit B)

These sites are similar to the previously described small, isolated populations. These conservation lands no longer have the level of immigration from the surrounding landscape they once enjoyed; hence, their numbers never increased dramatically but intrinsic recruitment is low within their populations.

Number of Family Groups in Non-Focal Landscapes

The following populations on conservation lands are not included in the 2019 Recovery Plan's Focal Landscape strategy. The population trends are summarized in the table below.

Non-Focal Landscape	2009	2010	2017	2018	2019
Cross Florida Greenways	14	17	25	29	36
Viera East Scrub Jay Preserve	21	21	25	21	23
Lyonia Preserve	31	32	31	25	18
Oscar Scherer State Park	17	16	4	5	6
Savannas Preserve State Park	7	7	8	9	9
Disney Wilderness Preserve	7	9	6	5	4

- b. Genetics, genetic variation, or trends in genetic variation:** In a series of papers Coulon et al. (2008, 2010, 2012) analyzed genetic structure and patterns of gene flow of Florida Scrub-Jays relative to metapopulations, habitat fragmentation, and gap distance between populations, based on genotyping over 1000 individuals from all 21 metapopulations at 20 microsatellite loci. Coulon et al. (2008) documented distinct genetic structuring throughout the extant range of the Florida Scrub-Jay. They described 10 genetic units, in which most individuals are more similar to other individuals within the genetic unit than to individuals in a different genetic unit.

The genetic units were congruent with metapopulations boundaries previously described by Stith et al. (1996) based on dispersal behavior: no metapopulations were split among different genetic units although some genetic units consisted of more than one metapopulation, likely because these genetically similar metapopulations were only recently fragmented. Indeed, Coulon et al. (2008) remarked "Assuming that the differences between metapopulations and the genetic groups mainly reflect the past existence of now extinct Florida Scrub-Jay populations, then the metapopulations of Stith et al. (1996) may be a good estimate of what the Florida Scrub-Jay genetic structure will be in the future." This implies greater differentiation among populations and more loss of genetic diversity. This can be seen already in some genetic units of Florida Scrub-Jays that exhibit as much differentiation as between two closely related species, the California Scrub-Jay (*A. californica*) and the Island Scrub-Jay (*A. insularis*).

Coulon et al.'s subsequent papers (2010, 2012) demonstrated the mechanisms by which habitat fragmentation influences the genetic spatial structure. Habitat fragmentation forces Florida Scrub-Jays to disperse greater distances while actually traversing fewer Florida Scrub-Jay territories. However, effective dispersal distances (gene flow) actually

decreases as fragmentation increases (Coulon et al. 2010), likely because birds that disperse greater distance have lower lifetime reproductive success (Fitzpatrick et al. 1999, Mumme et al. 2015, Fitzpatrick and Bowman 2016). In particular, the greatest impediment to gene flow is the width of the non-scrub gaps that separate habitat patches, rather than the geographic distance between those habitat patches (Coulon et al. 2012). These results suggest that fragmentation will always bear a cost, forcing birds to disperse farther and suffer reduced lifetime fitness. In addition, inbreeding is higher in fragmented habitat (Chen et al. 2016) and reduced gene flow decreases effective population sizes, thus potentially increasing the costs of inbreeding and genetic drift.

- c. **Taxonomic classification:** Florida Scrub-Jays (*Aphelocoma coerulescens*) are in the order Passeriformes and the family Corvidae. Cabanis transferred the Florida Scrub-Jay, which was originally named *Corvus coerulescens* by Bosc in 1795, to the genus *Aphelocoma* in 1851. In 1858, Baird made *coerulescens* the type species for the genus and it was considered a subspecies (*A. c. coerulescens*). It regained recognition as a full species from the American Ornithologists' Union (AOU 1995) because of genetic, morphological, and behavioral differences from the other members of this group; the California Scrub-Jay (*A. californica*), the Island Scrub-Jay (*A. insularis*), and the Woodhouse's Scrub-Jay (*A. woodhouseii*) that occur in western United States and Central America. The group name is retained for species in this complex; however, it is now hyphenated to "Scrub-Jay." Other jays of the same genus include the Transvolcanic Jay (*A. ultramarina*), the Unicolored Jay (*A. unicolor*), and the Mexican Jay (*A. wollweberi*) of Central America and southwest North America (AOU 2016).
- d. **Spatial distribution, trends in spatial distribution, or historic range:** Florida Scrub-Jays once occupied 39 of the 40 counties in peninsular Florida south of, and including Levy, Gilchrist, Alachua, Clay, and Duval counties. By 1983, Florida Scrub-Jays had become extirpated from 7 of the original 39 counties: Broward (mid-1970s), Dade (1960), Duval (1940-50), Gilchrist (1900), Hendry (1970) Pinellas (1960), and St. Johns (1970). As of 1993, Florida Scrub-Jays were extirpated from 9 of the 39 counties previously occupied (Alachua, Broward, Clay, Dade, Duval, Gilchrist, Hendry, Pinellas, and St. Johns) and most likely extirpated or nearly so (functionally extirpated) from an additional 12 counties. Only 9 counties had more than 30 Florida Scrub-Jay groups on managed conservation lands as of 2010; not necessarily a local population consisting of 30 interacting groups but total number of breeding individuals within a county boundary. Post-breeding 2015 surveys indicate that Florida Scrub-Jays have been extirpated from an additional 4 counties (Collier, Flagler, Levy, and Palm Beach) resulting in 13 of the original 39

counties lacking occupancy on public conservation lands (Species Status Assessment Florida Scrub-Jay 2019).

- e. **Habitat or ecosystem conditions:** The natural communities (scrub and scrubby flatwoods) where Florida Scrub-Jays reside occur on relict dunes and sand ridges in peninsula Florida, primarily concentrated along both the Atlantic and Gulf coasts and on the central ridges (Laessle 1958, Davis 1967, Myers 1990). Florida Scrub-Jays need large, open landscapes of scrub habitat for long-term population persistence (Woolfenden and Fitzpatrick 1984, 1991). Modeling studies suggest that most habitat must be optimal for population recovery and that extinction risk declines rapidly between 10 and 100 breeding pairs if all habitat is optimal (Breininger et al. 1999). These studies were conducted in expansive populations and current threats to persistence are much higher even for large populations as genetic diversity declines. Optimal habitat is defined as a condition when reproductive success (recruitment) exceeds mortality. These landscapes need to include patches that have optimal characteristics within a “matrix” of habitat that does not lower the suitability of the focal patches.

Optimal habitat can be described as low and open with low densities of pine trees (Woolfenden and Fitzpatrick 1984, 1991). Florida Scrub-Jays do not use forests and avoid areas near forests (greater than 65% tree cover; Breininger et al. 1995). Nest predation and more importantly juvenile survivorship are factors influencing the Florida Scrub-Jay’s preference for landscapes dominated by frequently low, open recently burned scrub structure (Schaub et al. 1992, Breininger et al. 1998, Fitzpatrick and Bowman 2016). Vegetation that characterizes open scrub allows Florida Scrub-Jays to monitor a large area while providing refuge and the opportunity for Florida Scrub-Jays to be inconspicuous in their activities.

The fragmentation of scrub landscapes results in an increase of woodlands and forests (Duncan et al. 1999). Disturbances related to human development, fire suppression, and other disruptions of natural fire patterns have made many edges of habitat fragments unsuitable for Florida Scrub-Jays (Breininger 1999, Breininger et al. 1998, 1999). Landscapes, fragmented by woodlands, forests, and tall shrubs, no longer allow Florida Scrub-Jays to scan large areas for predators that may be important for the Florida Scrub-Jay’s visual sentinel system, which is adapted for predator detection (McGowan and Woolfenden 1989).

Florida Scrub-Jays have adapted to frequent fires by defending large territories, thereby increasing the probability of having enough patches in optimal condition within a territory at any given time (Woolfenden and Fitzpatrick 1984, 1991; Breininger et al. 1995, Fitzpatrick and Bowman

2016). Oak scrub represents the potential focal habitat, but not all of it is necessarily in optimal condition at the same time. Patches of oak scrub vary in quality depending on the time since fire. Florida Scrub-Jay mortality exceeds reproductive success where there are no patches of oaks at optimal height (4-5.5 ft) or where scrub is too tall (> 5.5 ft; Breininger and Carter 2003, Breininger and Oddy 2004). Tall oaks impede the ability to spot predators whereas short oaks can still provide numerous foraging opportunities.

Florida Scrub-Jays maintain and defend non-overlapping territories ranging from 10 acres to over 40 acres on the landscape. Territory size is not independent of density and territories are larger when density is low. Territory size is also dependent on group size; larger families defend larger territories. Florida Scrub-Jays are the ultimate despots, occupying and defending against other conspecifics to own absolutely as much habitat as they can (Fitzpatrick and Bowman 2016). Average territory size is 22-25 acres when the habitat is in optimal conditions (Woolfenden and Fitzpatrick 1984, 1991; Breininger et al. 1995). Within each territory there should be greater than 2.5 acres of oak scrub that is 4-5.5 feet tall (Breininger and Oddy 2004). Remaining oak scrub should be medium height or shorter than 4 feet and have many openings. The mosaic of optimal height oak scrub and short oak scrub will be dynamic because of the fire frequency. Saw palmetto and herbaceous marshes within Florida Scrub-Jay territories should be short (< 5.5 ft; Breininger et al. 1995, 1998). Recent studies confirm the area of oak scrub in the natal territory correlated positively with nestling and juvenile body mass and the two had long-term consequences: it was positively related to the probability of becoming a breeder and negatively related to age at first breeding, particularly for males (Mumme et al. 2015).

Optimal Florida Scrub-Jay habitat is maintained by relatively frequent fires (Woolfenden and Fitzpatrick 1984, 1991; Breininger et al. 1995, 2006; Duncan et al. 1995). Long-term data suggest that Florida Scrub-Jay populations persist under frequent fire regimes if the fires are not too extensive and if the habitat is not already in a degraded state (Breininger and Oddy 2004). On the Lake Wales Ridge, too frequent fire can be detrimental as it truncates the post-fire optimal habitat successional stage and increases the relative weight of poor reproductive performance in the 1-2 years post-fire (R. Bowman, pers. comm.). Disturbance intervals necessary to achieve and maintain suitable habitat conditions for Florida Scrub-Jays vary depending on local site conditions and previous histories (FWC 2019). In most scrub landscapes that support Florida Scrub-Jay habitat, humans have disrupted natural fire patterns, so that fire no longer spreads across landscape (Duncan et al. 1999, Duncan and Schmalzer 2004).

f. Population Management via Translocations:

Translocations are a useful tool in population management whether its intent is establishing new populations, augmenting small populations (improve demography), or genetic rescue of small isolated populations (overcome inbreeding).

Florida Scrub-Jay translocations have occurred periodically since the late 1980's and continue through the present in an attempt to reestablish populations, augment and grow at-risk populations, and decrease local extirpations. Techniques to undertake the most successful translocations are still needed. Development of techniques are underway with an increased research component to fully understand and optimize demographic response of recipient populations.

The following narrative supports the need for an increased understanding of why translocations succeed or fail, and is a brief summary of completed and ongoing translocations:

- The initial effort translocated 20 individuals (14 nonbreeders and 6 breeders) from central Florida to southwest Florida between 1989 and 1995 (Mumme and Below 1995, Mumme and Below 1999) in an endeavor to establish and study a new isolated population. Almost 50%, 9 of the 20 disappeared within the first 8 weeks. From 1991 to 1997 the established population maintained 6-10 individuals and 1-3 breeding pairs, suggesting that Florida Scrub-Jay translocation may be a useful management tool for reintroduction and augmentation of populations when habitat conditions are also successfully restored.
- A translocation effort conducted by a mining operation began translocating Florida Scrub-Jays as part of a regulatory requirement. Translocations were performed to improve the local population demography and reduce the metapopulation extinction risk. Fifty-one individuals were translocated from 2007 through 2011. The recipient site initially had 1-2 breeding pairs. In conjunction with habitat management and the translocation of 51 individuals, the population has grown to 36 breeding pairs and an unknown number of dispersals supporting the surrounding area. Thirty-four of these breeding pair have at least one bird related to a translocated individual. Immigration has occurred in the population. Continued management and monitoring of this case study is of high priority to understand the long-term responses of translocation to the metapopulation and continued growth of this population.
- Overlaying this timeframe, a cooperative effort initiated in 2008 between Brevard County's Environmentally Endangered Lands

(EELS) program, Brevard Zoo, the Florida Fish and Wildlife Conservation Commission, St. Johns River Water Management District, and the Service began “salvaging” individual Florida Scrub-Jays – covered under incidental take permits – to conservation lands to augment small populations throughout the county. Forty-five individuals have been translocated thus far with varying degrees of success.

Twelve family groups (42 individuals) were translocated between 2008 and 2015 to Buck Lake Conservation Area in Brevard County. The number of breeding pairs rose from 5 family groups in 2007 to 10 family groups for a number of years but began declining after translocation ceased. The number of family groups has decline to two breeding pairs for the last several years. These translocations have not achieved the intended long-term objective of increasing habitat occupancy. The reasons for the decline are unknown at this point.

- A similar translocation was conducted in an attempt to augment a small population in Volusia County by salvaging Florida Scrub-Jays from post-development activities. The Florida Fish and Wildlife Commission and the St. Johns River Water Management District translocated eight birds in 2011 from the Deltona Villages to Lake Monroe Conservation Area. This translocation effort did not increase the resident population breeding pair numbers as anticipated.
- Initiated in 2017, Dr. Karl Miller from the Florida Fish and Wildlife Commission began researching donor site and recipient site population effects by translocating Florida Scrub-Jays from Ocala National Forest to other conservation lands. Two concurrent research projects are testing the efficacy of translocating Florida Scrub-Jay family groups without an acclimation period and the success of translocating Florida Scrub-Jay helpers. Florida Fish and Wildlife Conservation Commission staff translocated sixty-two individuals during 2017-2020 to Seminole State Forest, Rock Springs Run State Park, and Jonathan Dickinson State Park.
- The most recent translocation effort is assessing the potential genetic rescue of a small, isolated population between Florida Scrub-Jay genetic units. A baseline of the resident population was documented in Jonathan Dickinson State Park (recipient) prior to translocating three individuals (breeding pair and female helper) from Ocala National Forest (donor) in 2019 and five individuals (two breeding pairs and a male helper) in 2020.

These translocation efforts have had various results having some failing to meet their objectives while others have succeeded in fulfilling their

intended outcomes. Specific recommendations for the success of translocating Florida Scrub-Jays will require long-term monitoring of the translocated birds and the recipient population. Additional translocations will be needed to fully understand how this management tool can be used in the future to assist in species recovery. In general, sites that have been the most successful have an abundance of vacant habitat with a small recipient population. Translocations should be prioritized to sites where long-term population persistence is achievable and planned.

2. Five-Factor Analysis

a. The present or threatened destruction, modification or curtailment of its habitat or range:

Direct Habitat Loss - Consistent with the original threats assessment, habitat loss resulting from economic activities (conversion to commercial, residential, and agricultural uses) remains a significant risk to the Florida Scrub-Jay. Continued growth of the human population throughout peninsular Florida will persist well into the future, and will be accompanied by substantially increased infrastructure needs. Given the rarity of oak scrub habitat, and its development value as well-drained high ground, progressive habitat loss inevitably will continue to reduce the distribution of Florida Scrub-Jays until no habitat patches remain outside of formally protected and managed private and public conservation lands. Coupled with direct habitat conversion, inadequate habitat management (habitat degradation) also remains a significant risk to populations.

Habitat Fragmentation - Widespread conversion and degradation of oak scrub vegetation has resulted in extreme fragmentation of Florida Scrub-Jay habitat, and the threats associated with this phenomenon certainly now exceed in importance those associated with outright habitat loss. Small, isolated populations suffer higher risks of extirpation owing to both demographic and genetic problems. Management of isolated habitat patches is difficult, especially those patches surrounded by human residential development. Edge effects render small patches of scrub less suitable for successful reproduction and offspring survival than larger patches. Consequently, many small scrub patches represent population sinks.

Habitat Degradation from Fire Suppression - The Florida peninsula has the highest lightning-strike frequency in North America. Therefore, for millions of years, Florida's native habitats and species have adapted to the periodic recurrence of lightning-induced wildfire, mainly during the rainy season months of May through September (Myers 1990). Human interference with natural fire regimes has become a major contributor to the ongoing decline of the Florida Scrub-Jay. Without any doubt, fire

suppression represents one of the two most important threats to persistence of the species across its range – the other is demographic instability resulting from human development. Importantly, disruption of natural fire regimes exceeds habitat loss and habitat fragmentation as limiting factors causing local population declines (Woolfenden and Fitzpatrick 1991, 1996a; Fitzpatrick et al. 1994, 1999).

Lightning strikes cause virtually all naturally-occurring fires in peninsular Florida scrub habitat (Abrahamson 1984, Hofstetter 1984, Woolfenden and Fitzpatrick 1990), and these fires are vital to maintenance of scrub habitat in its optimal structure and composition (Nash 1895, Harper 1927, Webber 1935, Davis 1943, Laessle 1968, Abrahamson et al. 1984). Prevention and containment of fires results in oak scrub habitat succeeding from its typical structure (short and sparse, with sandy openings and only a few tall pines) to a dense, tall structure (oaks many meters tall, closed canopy including many tall pines, leaf litter covering all ground surfaces). Florida Scrub-Jays clearly prefer the former; their numbers decline in the latter. Eventually, Florida Scrub-Jays disappear from long-unburned, overgrown scrub (Fernald 1989; Fitzpatrick et al. 1994, 1999; Percival et al. 1995; Stith et al. 1996; Thaxton and Hingtgen 1996; Woolfenden and Fitzpatrick 1990, 1996a; Toland 1999).

The threat of fire is more complicated than just suppression. Lightning-strike fire is often not suppressed, but small isolated patches embedded in inflammable habitat matrices rarely burn. The alternative is prescribed fire, but it is not easy to mimic nature. Even though we may never be able to mimic nature, prescribed fire is the best tool available. Prescribed fire also is dependent on safety (both to managers and the public), existing laws, regulations and permit requirements. Additionally, variation in ecological responses, differences in Florida Scrub-Jay responses at a landscape scale, and a continuing lack of knowledge regarding subtle influences of fire on habitat structure and community response (seasonality, patchiness, intensity) are important information needs. Learning and improving the efficacy of prescribed fire is critical because naturally occurring fire that has shaped Florida Scrub-Jay habitat is not coming back.

b. Overutilization for commercial, recreational, scientific, or educational purposes:

The Service is aware of only a few cases where Florida Scrub-Jays have been shot. One was in Volusia County, which was investigated and prosecuted under Migratory Bird Treaty Act (J. Oliveros, USFWS, pers. comm.). The Florida Fish and Wildlife Conservation Commission (FWC) investigated a case, in which three Florida Scrub-Jays were shot in Highlands County (N. Douglass, FWC, pers. comm.). It does not appear

that the small number and infrequent occurrence of Florida Scrub-Jays taken in this manner has had an impact on the species.

Ongoing and completed research efforts have resulted in the issuance of numerous scientific research permits covering activities including population monitoring, translocation of individuals, genetic analyses, and behavioral experimentations. These authorized activities are not considered as having a negative impact on the species.

c. Disease or predation:

As populations of Florida Scrub-Jays decline due to habitat loss, habitat degradation and associated lowered demographic performance, the threat of catastrophic disease and demographic impacts of chronic disease increase. It is likely that smaller populations of Florida Scrub-Jays are less genetically diverse lowering the probability of survival and increasing the risk of population-wide mortality events. If habitats are degraded and Florida Scrub-Jays become increasingly “stressed” small populations are more likely to succumb to chronic diseases and parasites, reduce demographic performance, and probably suffer from the “Allee effect” (Breininger 1999, Stephens et al. 1999). Furthermore, diseased individuals are more likely to be clinically ill reducing their ability to escape predators and exacerbating predation pressure.

Florida Scrub-Jays experience substantially elevated mortality during periodic episodes thought to represent epizootic outbreaks (Woolfenden and Fitzpatrick 1991). Based on analysis of antibodies, the most common diseases appear to be caused by encephalitic viruses. Antibodies consistent with an eastern equine encephalitis outbreak were found in 80% of sampled Florida Scrub-Jays in 2008 (Archbold Biological Station, unpubl. data), and antibodies responsive to Highlands J and St. Louis encephalitis are also routinely present. Additionally, 10% of Florida Scrub-Jays sampled from across the range in 2005 (n = 60) contained antibodies for West Nile virus. Avian malaria (*Plasmodium* spp. and *Haemoproteus* spp.) occurs in all sampled Florida Scrub-Jay populations, although insufficient data exists to evaluate whether these infections constitute any risk to individuals or populations. An avian pox (*Poxvirus avium*) outbreak in a Florida Scrub-Jay population in southwest Florida occurred after extensive rainfall and habitat damage caused by a hurricane (Miller and Faulhaber 2007).

At Archbold Biological Station, four significant spikes in mortality have been documented over a 42-year study. These mortality events have resulted in atypically high adult and juvenile mortality, but the effects have been isolated. In late summer of 2008, for example, extraordinary mortality among all age classes was observed over a 3-month period,

coinciding with a greatly elevated population of mosquitoes known to be carriers of eastern equine encephalitis. This event began shortly after the passage of a tropical storm whose rains created or expanded many standing bodies of water in which mosquitoes could breed, and coincided with the high frequency of eastern equine encephalitis antibodies.

The above noted diseases are vector-borne and the primary vectors are mosquitos. Climate change models throughout the world show expanding range and numbers of disease vectors thus the extent, frequency and intensity of epizootics, as well as the intensity of baseline disease mortality may increase in all Florida Scrub-Jay populations.

The range-wide effects of disease have probably been underestimated because past disease outbreaks have only been observed in relatively large populations that are regularly monitored (e.g., Archbold Biological Station and some Brevard County populations). Nonetheless, ongoing monitoring of affected populations confirms that large Florida Scrub-Jay populations are more capable of rebounding from periodic mortality events resulting from epizootics. Smaller populations and/or those in poor quality habitat may take longer to rebound following a disease outbreak, and therefore be increasingly susceptible to extirpation from stochastic events and/or poor demographic performance typical of small populations.

Reducing the threat diseases and parasites pose to Florida Scrub-Jays would aid in maintaining large contiguous Florida Scrub-Jay populations. Reducing disease impacts is best achieved by increasing the size and demographic performance of Florida Scrub-Jay metapopulations.

d. Inadequacy of existing regulatory mechanisms:

At the time of listing, the Migratory Bird Treaty Act of 1918 (16 U.S.C. 703 et seq.) protected individual Florida Scrub-Jays from take throughout their range but did not protect their habitat. Regulations finalized in February 2007 authorized incidental take of migratory birds, including Florida Scrub-Jays, for military readiness training.

The National Wildlife Refuge System Administration Act (NWRAA) represents legislation that set up the administration of a national network of lands and water for the conservation, management, and restoration of fish, wildlife, and plant resources and their habitats for the benefit of the American people. Amendment of the NWRAA in 1997 required the refuge system to ensure that the biological integrity, diversity, and environmental health of refuges be maintained. The ability to meet these statutory requirements varies among refuges depending on local constraints.

The Florida Scrub-Jays is included in Florida Endangered and Threatened Species List as a Federally-designated Threatened Species. Florida State Law (Rule 68A-27.003, Florida Administrative Code) prohibits taking of individuals of threatened species, or parts thereof, or their nests or eggs, except as authorized. To eliminate the need for both a state and federal permit, activities that result in take of Federally-designated Threatened Species do not require a permit from the FWC when authorized by the Service (Rule 68A-27.007, Florida Administrative Code). To date, the FWC has not developed a regulatory program that ensures compliance with this statute. Instead, the FWC relies on the Service's implementation of the Act through sections 7 and 10 and enforcement of the prohibitions in section 9 of the Act.

On state wildlife management areas, regulations protect individual Florida Scrub-Jays because they are not listed as a game bird and therefore have no legal seasons established for taking. Wildlife management area regulations prohibit destruction or modification of habitat, except for management and restoration activities.

Many county governments have developed protective ordinances, but all such ordinances are based on compliance with the Act rather than local laws and therefore provide no additional protection. Within the current range of the Florida Scrub-Jays, several counties and municipalities have provisions for reviewing all development proposals for impacts to scrub and/or Florida Scrub-Jays and for referring projects that may potentially affect Florida Scrub-Jays to the Service for Act compliance. Several other counties occasionally invoke threatened and endangered species screening, depending on the level of controversy surrounding pending developments. The remaining counties do not have environmental resource staff dedicated to habitat protection and/or have not developed protective ordinances.

e. Other natural or manmade factors affecting its continued existence:

Suburban Demographic Sinks - As of 2018, it is estimated that less than a fifth of all extant Florida Scrub-Jays reside on tracts of habitat located in rural or suburban residential communities, where occupied patches of habitat are small, mostly privately owned, and bordering or interspersed with human dwellings, roads and parking lots, clearings, lawns, and nonnative ornamental plantings. Abundant data on Florida Scrub-Jays in these habitats has been gathered over the past decades, and most information points to the same conclusion: the data indicate that Florida Scrub-Jays occupying suburban residential communities – even in low housing density – are unlikely to persist long-term.

The primary issue in human-altered habitats such as partially completed residential communities is that fledgling survival is dramatically lower than in contiguous habitats of well-managed native scrub. It is possible that this pervasive demographic response is a consequence of predation by house cats, aerial predators, and collisions with motor vehicles. In addition, supplemental foods made available through bird feeders or domestic pet food induce Florida Scrub-Jays to breed early, but survival of these early nestlings is lower than later nestlings because insects, a primary food source of young Florida Scrub-Jays, are not yet abundant in early spring (Sauter et al. 2006). To make matters worse, non-native ornamental shrubs sometimes create hazardous nest sites for Florida Scrub-Jays because ornamental vegetation may not provide a sturdy nest structure and nests tend to be blown out of tall shrubbery (Bowman 1998). As a result of all these factors, recruitment of young in suburban landscapes is often extremely low (Bowman and Averill 1993, Bowman 1998).

Florida Scrub-Jay populations in suburban landscape settings are declining and disappearing all across Florida, and the only ones still appearing to be stable are those that are supplemented by immigration from surrounding areas. Florida Scrub-Jay populations situated within a matrix of human residential settlement will decline over time, owing to poor demographic performance.

Extirpation of Small Populations - An axiom of conservation biology is that tiny populations suffer high probabilities of extinction (Primack 2010). This sensitivity to population reduction has been modeled explicitly for the Florida Scrub-Jay since the early 1990s (Fitzpatrick et al. 1991, Stith 1999). Reduction in the size of many Florida Scrub-Jay populations is a substantial threat for the species today. As described above, many remaining populations, including genetically unique populations at the corners of the historical range limits of the species, are extremely small.

Inbreeding and Loss of Genetic Diversity - As populations become more isolated they receive progressively fewer immigrants. Populations begin to lose genetic diversity, and can diverge from one another in non-adaptive directions as a consequence of genetic drift. Non-scrub habitat gaps greater than about 3 miles have been shown to increase the rate of genetic divergence between adjacent Florida Scrub-Jay populations (Coulon et al. 2012). In very small populations (e.g., those containing fewer than 50 breeding individuals), offspring recruited into the population are more likely to breed with genetically related individuals, further reducing the genetic diversity of succeeding generations. Reduced fitness of individuals subjected to inbreeding depression is well documented across the biological world. Recent, published analyses confirm that inbred Florida Scrub-Jays experience reduced survival

compared with offspring produced by unrelated pairs (Chen 2016). The inevitable consequence of inbreeding depression is that tiny, isolated Florida Scrub-Jay populations face a much higher extinction probability than larger and more connected populations. It seems certain that many of the local extirpations documented since the 1980s have been accelerated by genetic factors.

Road Mortality - Urban development and associated roadway infrastructure create hostile environments for Florida Scrub-Jays and represent a growing management concern (Dreschel et al. 1990; Mumme et al. 2000). High-speed roads are particularly devastating to Florida Scrub-Jays because birds with territories adjacent to roads tend to forage on road shoulders and rights-of-way. Research along a two-lane paved road indicated that clusters of Florida Scrub-Jay territories found next to the roadside represented population sinks (breeder mortality exceeded production of breeding-aged recruits), which could be supported only by immigration (Mumme et al. 2000). Road impacts are likely to increase in the future as the human population of Florida expands and the resulting increase in roads intersect Florida Scrub-Jay habitat. Proximity to high-speed paved roads needs to be evaluated when considering the location of Florida Scrub-Jay conservation areas (Fitzpatrick et al. 1991; Woolfenden and Fitzpatrick 1996a).

Climate Change - “Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, sea level has risen, and the concentrations of greenhouse gases have increased. Human influence on the climate system is clear. This is evident from the increasing greenhouse gas concentrations in the atmosphere, positive radiative forcing (balance of incoming and outgoing energy), observed warming, and understanding of the climate system. Continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system. Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions” (IPCC, 2013).

The National Climate Team summarized the following scientific and ecological information on climate change and implications to the Service and staff from the 2014 publication entitled *Climate Change Impacts in the United States: The Third National Climate Assessment* (NCA) (NCA, 2014). This team also summarized the 2013 publication from the IPCC entitled *Highlights of the IPCC 5th Assessment Report: The Physical Science Basis of Climate Change (WG1), Summary for Policymakers* (IPCC, 2013). This information is further condensed with a primary focus on Florida. Florida is exceptionally vulnerable to sea level rise, extreme heat events, and hurricanes. With an ever-

growing population within Florida's coastal plain, annual visitors range from 10 to 15 million stressing the already decreasing water availability.

This climate change information is critical when conducting required Service analyses, conservation planning, and decision-making. Released by the White House on May 6, 2014, the NCA was prepared by a Federal Advisory Committee based on requirements of the Global Change Research Act of 1990.

Species and habitats vary in how they respond to increasing temperatures, and there is uncertainty in how exactly increasing temperatures will affect Florida Scrub-Jays. Possible impacts include:

- Some species are physiologically capable of tolerating increased temperature, some will be able to adjust behaviorally, some will shift their ranges if dispersal is possible, some will eventually undergo genetic changes, and some will respond in a combination of ways.
- Studies have shown that some species may initially benefit from the early stages of a warming climate, but then deteriorate.
- Although some species may tolerate or adapt to increasing temperatures, there may be thresholds beyond which they are unable to adapt quickly enough, creating a risk of local or range-wide extinction due to higher temperatures or combinations with other stressors.
- For a variety of reasons, populations within a species can vary in response to increasing temperatures. We seldom have the information to identify such differences in advance, thus analyses and planning typically assume that responses will be the same.
- Species that are more tolerant of increasing temperatures may be able to outcompete and displace other species in the same area. Some invasive species of plants and animals that tolerate higher temperatures already are increasing in abundance and/or distribution, and may become competitors or predators of native species, perhaps even displacing them.
- Habitat changes also will vary in relation to temperature. In many locations vegetation composition and structure is already changing. Changes will occur on different temporal and spatial scales, and will result in changes in habitat suitability for many species

- High temperatures and prolonged drought can increase the risk and extent of wildfires.

The common thread regarding weather predictions for Florida is that extreme events will become more extreme and more frequent. This will increase annual variation and likely increase annual variation in Florida Scrub-jay demographic rates. Increasing variation increases the strength of stochastic effects and typically has the greatest effects on small populations, hence greatly increasing their extinction risk.

Currently, not all climate change consequences relevant to Florida Scrub-Jays are predictable with absolute certainty such as possible negative effects of increase temperature along with drought on insect prey abundance or growth rate and acorn production of scrub oaks. Decreases in precipitation could make it more difficult to apply prescribed fire safely. Conversely, sea level rise along with extreme events (e.g. hurricanes) will certainly have negative impacts on coastal Florida Scrub-Jay populations.

D. Synthesis

The recently revised recovery plan, incorporating knowledge gained since the species listing, focuses on Florida Scrub-Jay population's range-wide resiliency, redundancy, and representation. The focal landscape approach in the recovery criteria identifies areas where current populations may have long-term viability while other populations have the potential for long-term viability with additional habitat acquisition and/or effective management. Maintaining population viability or improving a population's potential viability is the crucial recovery metric and PVA's are currently under development that will be utilized to inform species recovery.

Florida Scrub-Jay populations range-wide have continued to decline since species listing. The 5-year review concluded in 2007 noted populations continued to decline based on the 1992-93 statewide survey. A comparative study between 1992-93 and 2009-10 analyzing populations on managed conservation lands showed a 25% decline during this timeframe. The extant population of Florida Scrub-Jays was less than 50% of the potential carrying capacity on these lands. Florida Scrub-Jays once occupied 39 counties in peninsular Florida. As of 2015, post-breeding surveys suggests 13 of the original 39 counties lack occupancy on public conservation lands.

Coulon (2008, 2010, and 2012) described 10 genetic units, in which most individuals are more similar to other individuals within the genetic unit than to individuals in a different genetic unit. The genetic units were congruent with metapopulations previously described by Stith (1996) based on dispersal behavior. It also demonstrated the mechanisms by which fragmentation influences the genetic spatial structure. Habitat fragmentation forces Florida Scrub-Jays to disperse greater distances while actually traversing fewer Florida Scrub-Jay territories. Effective dispersal distances (gene flow) actually decreases as fragmentation increases, likely

because birds that disperse greater distance have lower lifetime reproductive success. These results suggest that fragmentation will always bear a cost, forcing birds to disperse farther and suffer reduced lifetime fitness. Inbreeding is higher in fragmented habitat and reduced gene flow decreases effective population sizes, thus potentially increasing the costs of inbreeding and genetic drift.

Habitat loss resulting from economic activities continue to pose a significant threat to Florida Scrub-Jay populations. Continued habitat fragmentation coupled with degradation from fire suppression and lack of effective management will result in smaller and smaller potential landscape occupancy. Smaller, isolated populations have an increased risk associated with periodic disease outbreaks and decreased fitness from inbreeding depression.

The revised recovery plan criteria provides a strategy for focusing and prioritizing future recovery actions to overcome the stressors associated with these threats. Population Viability Analyses currently under development will assist and guide future habitat and population management decisions. This review documents a baseline for the focal landscape population's current resiliency for future reviews.

In conclusion, the Florida Scrub-Jay remains secure on many managed conservation lands throughout its historical range and is not likely to be in danger of extinction throughout all or a significant portion of the range within the foreseeable future and therefore should remain a threatened species.

III. RESULTS

A. Recommended Classification:

 X **No change is Needed**

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

1. Conduct a range-wide population survey.

2. Habitat Management and Restoration

Florida Scrub-Jays are habitat specialists. Within potentially suitable scrub oak habitat, management of all habitat parcels using prescribed fire at appropriate intervals must constitute the primary means of conserving Florida Scrub-Jays. Fire suppression and inadequate habitat management are the overriding causes of habitat degradation throughout the species' range, creating urgent need for habitat restoration and management in every focal landscape.

2.1 Manage existing habitat using prescribed fire and, when necessary, mechanical treatment to maintain appropriate vegetative structure. Land managers should refer to the Scrub Management Guidelines for Peninsular Florida by Florida Fish

and Wildlife Conservation Commission and Florida Natural Areas Inventory for detailed management recommendations. These recommendations include the appropriate fire return intervals and optimal habitat structure for Florida Scrub-Jays. Management should occur at the appropriate scale. Land managers should aim for mosaic burns that have both spatial and temporal variability and, except in the very largest habitat parcels, should take steps to avoid burning extensive habitat without leaving patches of unburned scrub as refugia for Florida Scrub-Jay territories during the immediate post-fire period.

- 2.2 Accomplish habitat restoration within focal landscapes in those areas that increase the carrying capacity or connectivity of existing habitats. Special attention should be paid to restoring vegetation structure in the largest, most contiguous patches of habitat, and secondarily to smaller surrounding patches. Eliminate barriers to dispersal such as dense forest stands. Restoring and maintaining sandy openings within larger scrub patches are also important. Reducing pine densities to fewer than one tree per acre is optimal, but Florida Scrub-Jays can tolerate up to two pines per acre. Maintaining the latter density may be helpful in some scrubby flatwoods that lack sandy openings, because limbs cast from pines can create sandy openings during fires. Allow snags to remain. Maintain buffers of 1,000 ft from Florida Scrub-Jay territory boundaries and densely forested areas where feasible to reduce the risk of predation on Florida Scrub-Jays. Restore and maintain naturally low and open plant communities between tracts of oak scrub, thereby facilitating dispersal of Florida Scrub-Jays between adjacent tracts of occupied habitat.
- 2.3 Implement aggressive fire-based management plans on public lands and where needed assist in the development or refinement of management plans (adaptive management). Also, assist in identifying impediments to adequate fire management and addressing them through resources, policies, and training.
- 2.4 Participate in regional working groups, prescribed fire councils, and other organizations to share knowledge and best practices, speed the adaptation of improved techniques, and promote the use of adaptive management.
- 2.5 Evaluate land managers on a holistic overview of their land management program. This should include not only acres burned, but also the quality of the burn, type of habitat burned, and adherence to recommended fire return intervals. Evaluation based strictly on acreage encourages land managers to focus on easily burned habitats, rather than those most in need of management and restoration.

3. Habitat Protection and Acquisition

Long-term persistence of Florida Scrub-Jays relies on securing long-term protection of habitat and the acquisition of properties that can be managed long-term to promote connectivity.

3.1 Public lands

Protect existing habitat on public lands, particularly in focal landscapes, and emphasize that Florida Scrub-Jay management should be highest priority on these lands.

3.2 Private lands

Within focal landscapes, promote conservation easements and mitigation banks to protect existing habitat on private lands. Conservation on private lands within focal landscapes may be especially important for maintaining connectivity and providing suitable habitat for dispersal events via stepping stones between conservation lands.

3.3 Land Acquisition

3.3.1 Acquire properties that will increase the size of or connectivity among core, support, and auxiliary areas within focal landscapes (terminology defined in Species Status Assessment Florida Scrub-Jay 2019).

3.3.2 Acquire properties that are “optimum boundary” areas and buffer habitats adjacent to existing conservation lands.

3.3.3 Acquire or protect private inholdings within key mega-parcel areas in focal landscapes to facilitate restoration and management of existing adjacent public lands.

4. Population Management

Most Florida Scrub-Jay populations are small and well below carrying capacity. These small populations are particularly susceptible to extinction, thus intervention and management is necessary to increase their long-term persistence. Land managers should be encouraged to take a regional approach and all managers within genetic units/focal landscapes should align their goals and activities.

4.1 Prioritize and implement translocations to focal landscapes, concentrating on those in which proper habitat and conditions appear to exist but are persistently below carrying capacity because of absence of immigrants. Translocation has the potential to mitigate several of the problems associated with small population size. Individuals to be translocated should be from stable or growing populations on conservation lands; small, isolated populations outside focal landscapes that are unlikely to persist; or those considered “taken” by Service consultations.

4.2 Use translocation to augment small populations on conservation lands. In areas with sufficient habitat, translocation can be used to augment existing populations, increasing their long-term persistence. Translocation can also be used for genetic

rescue in populations known or likely to be suffering from inbreeding depression, and for demographic rescue in populations that may be suffering Allee effects.

- 4.3 Use translocation to reintroduce Florida Scrub-Jays to areas where they have been extirpated after necessary habitat restoration has occurred. These translocations should aim to establish a relatively stable population in a short period of time. Avoid creating small populations vulnerable to stochastic events.
- 4.4 Mitigate the effects of unnaturally high densities of predators, disease, or parasitism.
- 4.5 Reduce the density of pines to one per acre, to reduce aerial predation.
- 4.6 Remove novel predators, such as cats, directly, and actively discourage/prohibit feral cat colonies in any area near Florida Scrub-Jay habitat. Advertise the importance of keeping domestic cats indoors.

5. Population Monitoring

Monitoring is critical to evaluate the success of conservation actions.

- 5.1 Prioritize and promote annual post-breeding season surveys on managed lands and newly restored areas. These surveys provide annual population estimates and key indices of reproductive success. They also facilitate detection of new populations of Florida Scrub-Jays, or of alarming declines within existing ones.
- 5.2 Continue and expand question-driven, long-term monitoring of Ocala National Forest, which holds the largest Florida Scrub-Jay population, focusing on gaining precise information about productivity, survival, and dispersal among timber blocks of different sizes and successional conditions.
- 5.3 Complete mandated post-translocation monitoring. These data are needed to determine the efficacy of translocations.
- 5.4 Increase and improve Audubon's Jay Watch program. This program contributes quality monitoring data, and its expansion into a range-wide citizen science program will be of crucial importance to the success of Florida Scrub-Jay recovery.
- 5.5 Work with key landowners to monitor populations on private lands, especially large ranches in rural landscapes. Relatively little is known about Florida Scrub-Jays on large private properties, and this information would complement what is known on public lands.

6. Research

Although the Florida Scrub-Jay is extensively studied, much remains to be learned. Research priorities include demographic monitoring, translocation, demography and genetics of small populations, dispersal in fragmented landscapes, and best practices for habitat management.

- 6.1 Demographic monitoring is needed to measure demographic responses to habitat management. Intensive demographic monitoring of color-banded individuals, including monthly censuses, in certain populations also is recommended.
- 6.2 Translocation is a useful tool for population management, but best practices for Florida Scrub-Jay translocation are still being developed. Answering the following questions will help optimize demographic responses to translocation:
 - What are the impacts of translocations on source populations?
 - How does the demography of recipient populations change after translocation?
 - To what degree can translocation be used to reduce inbreeding and provide so-called “genetic rescue” for small populations?
 - What are the optimal genetic pools (i.e., local versus distant, same genetic unit versus a different one) for maximizing the effectiveness of translocations?
- 6.3 The demography and genetic processes characterizing small Florida Scrub-Jay populations is incompletely understood. Research on the following questions are of particular urgency:
 - How does population size affect levels of genetic variation, and at what size do inbreeding effects begin to reduce average reproductive success within these populations? What cost-effective genetic markers are best suited for assessing the genetic health and resilience of local populations?
 - What impacts do Allee effects have on reproductive success and movement/settlement patterns? Does a minimum population size exist below which dispersing Florida Scrub-Jays refuse to settle despite the availability of good habitat?
 - What explains the apparent persistence of certain populations in areas where Florida Scrub-Jays have exceeded carrying capacities and suburbanized habitat settings, whereas in most areas such conditions lead to rapid population crashes?

6.4 Florida Scrub-Jays are poor dispersers and hesitant to cross non-scrub habitat during dispersal:

- What is the exact behavior pattern of Florida Scrub-Jays dispersing across unfavorable habitat, and how do different levels of fragmentation affect dispersal behavior?

6.5 The creation and maintenance of sandy openings, particularly in restored scrub is a frequently encountered management challenge. The relative effectiveness of methods for gap creation and maintenance, as well as the optimal size and distribution of these gaps has yet to be determined.

7. Outreach

Species conservation requires the support of partners from federal, state and local governments, non-government organizations, and the public.

7.1 Continue to promote scrub working groups throughout the state. The scrub working groups bring representatives from federal, state, and local agencies, non-government organizations, and the public to promote land management, habitat restoration, population management, scientific research, and public outreach.

7.2 Increase public support for prescribed fire and hardwood control.

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5-YEAR REVIEW
Florida Scrub-Jay (*Aphelocoma coerulescens*)

Current Classification Threatened

Recommendation resulting from the 5-Year Review

 X No change is needed

Review Conducted By: Todd Mecklenborg, North Florida Ecological Services Office,
Jacksonville, FL

FIELD OFFICE APPROVAL:

Acting Lead Field Supervisor, U.S. Fish and Wildlife Service

Approve _____ Date _____
For Jay B. Herrington