

**State wide assessment of Florida Scrub-Jays on
managed areas: A comparison of current populations
to the results of the 1992-93 survey**

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Dr Raoul K. Boughton

Morris Animal Post Doctoral Fellow
Avian Ecology Program
Archbold Biological Station
Avian Ecology Program
123 Main Drive
Venus, FL 33960

rboughton@archbold-station.org

863 465 2571 ext 227

Dr Reed Bowman

Program Director
Avian Ecology Program
Archbold Biological Station
Avian Ecology Program
123 Main Drive
Venus, FL 33960

rbowman@archbold-station.org

863 465 2571 ext 230

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Boughton, Raoul K.
Bowman, Reed

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Archbold Biological Station, 123 Main Drive, Venus, FL 33960

Avian Ecology Program

rboughton@archbold-station.org

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Front Cover: Banded Florida Scrub-Jay group at Archbold Biological Station. Photo: Reed Bowman

Executive Summary

This report details continued declines of Florida Scrub-Jay (*Aphelocoma coerulescens*) populations; a species in peril of extinction. Florida Scrub-Jays have declined to less than 10% of their historical, pre-European settlement numbers. Since 1992-1993, no comprehensive survey has been completed, but considerable evidence exists that populations have continued to decline, especially in unmanaged and suburban areas. This report seeks to examine how populations of Florida Scrub-Jays have fared on *public lands* that were acquired for the conservation of Florida's natural resources and managed to sustain those resources. We determined current (2009-2010) estimates of Florida Scrub-Jay populations at 198 managed land parcels and compare extant numbers with numbers determined during the 1992-1993 survey. We used a variety of data sources to estimate the current extent of xeric habitats on managed lands that are potentially capable of supporting scrub-jay populations. We provide estimates of current scrub-jay numbers for 192 of the 198 managed areas from surveys conducted in 2009 or 2010. Of the remaining 6 areas, our estimates of current numbers come from surveys conducted in 2006 or 2008. At 20 of the managed areas, no data were available from the 1992-1993 survey, thus we were able to obtain comparative data between 1992-93 and 2009-10 from 178 managed sites. At these sites, Florida Scrub-Jay populations declined by at least 1 group at 95 sites, populations remained the same at 37 sites, and increased by at least 1 group at 46 sites. Our best estimate of the current number of Florida Scrub-Jays on the 178 managed lands for which comparative data exist with 1992-1993 was 1,116 groups. In 1992-1993, the scrub-jay population on these 178 areas was 1,495 groups; thus current populations have declined by as much as 25%. On all 198 managed lands for which we obtained data in 2009-2010, we estimated a population of 1,253 groups. For 20 sites, no data were available for 1992-1993 and these sites supported 137 groups in 2009-2010. We don't know if these populations grew or declined, thus our estimate of a 25% decline is likely to be somewhat smaller or greater. However, the overall population decline, beyond just public managed lands, has been much greater. Populations of Florida Scrub-Jays on private lands, especially populations that were embedded in a suburban matrix, are likely to have suffered much greater declines. In 1992-93, 30% of all extant scrub-jays were estimated to live in a suburban matrix and in many places, these populations have declined by as much as 40-80%, and many small populations have been extirpated.

The amount of habitat that could potentially support FSJs on managed lands varied from a few acres to several thousand acres per site. For all 198 sites, the total amount of protected xeric communities that represent potential habitat for scrub-jays was 110,500 acres. Using a conservative estimate of carrying capacity (70% of the total acreage / 25 [the mean territory size required by a group of scrub-jays]) acres per breeding group), we determined that our public managed lands contain enough potential habitat to support as many as 3,094 groups of Florida Scrub-jays. As of 2009-2010, the extant population of 1253 FSJ groups on these lands represent well less than 50% of the potential carrying capacity. Thus, our managed lands have the potential to support much greater populations of Florida Scrub-Jays, and larger populations should have reduced extinction risk.

Most populations are smaller and more isolated from one another than they were historically. This increases extinction risk, even if some of these populations grow. The best and highest priority conservation strategy is to identify the core populations in each region and manage them effectively. Core populations are those with the greatest potential carrying capacity, where healthy populations are large enough that they are not at immediate risk of extirpation, and occur within a connected network of other scrub patches so that birds from the core can disperse and colonize sites where jay populations have declined or were extirpated. *Immediate* restoration and effective management of potential habitat in cores is necessary to prevent the extirpation of their jay populations. Once the cores are extirpated, re-establishing jay populations within that region will be infinitely more difficult. Loss of regional populations will decrease genetic diversity and increase overall extinction risks.

Fire is an essential management tool and, when coupled with mechanical treatments of scrub, can be used even at the urban interface with relative safety and can rapidly restore even extremely overgrown habitats to a structure appropriate for use by Florida Scrub-Jays. Longer-term restoration of the open, patchy structure of scrub may require more time and finesse. But if we hesitate, even by just a few years, local populations may become so diminished that their recovery is in grave jeopardy.

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Introduction

The Florida Scrub-Jay (*Aphelocoma coerulescens*) is a cooperative breeding species endemic to Florida (Woolfenden and Fitzpatrick 1996). It was listed as Threatened by the U.S. Fish and Wildlife Service in 1987 because of extensive population declines as a result of habitat loss to agricultural, residential, and commercial development, associated habitat fragmentation, and habitat degradation caused by fire exclusion and suppression. Conservation efforts for the Florida Scrub-Jay increased following severe population declines reported by Cox (1987). These declines were first observed early in the 20th century (Byrd 1927, Grimes 1940) and have been commented on continually throughout the century (Grimes 1943, Early 1952, Longstreet 1954, Sprunt 1946, Brigham 1973, Austin 1976, Woolfenden 1978, Cruickshank 1980, Fitzpatrick et al 1991, 1994, Stith 1996, Breninger et al 2003). In 1992-1993, the first and most comprehensive effort to survey the entire range of the Florida Scrub-Jay and determine both extant distribution and population numbers was undertaken. The survey reported approximately 4,000 breeding pairs, and showed that populations had been extirpated from 10 of 39 counties since the early 1980's (Fitzpatrick et al 1994). Based on a site-by-site comparison with Cox's (1987) data from the 1980's, Fitzpatrick et al (1994) concluded that as much as a 25-50% decline had occurred over the decade. Overall, considerable evidence exists that extant populations of Florida Scrub-Jays have declined to less than 10% of their historical, pre-European settlement numbers. Since 1992-1993, no further comprehensive surveys have been completed, but considerable evidence exists that populations have continued to decline, especially in unmanaged and suburban areas (Fitzpatrick et al 1991; Woolfenden and Fitzpatrick 1996; Bowman 1998; Bowman and Pruett 2009; Breninger et al 2003). This report seeks to examine how populations of Florida Scrub-Jays have fared on *public lands* that were acquired for the conservation of Florida's natural resources and managed to sustain those resources. We determined current (2009-2010) estimates of jay populations at 198 managed land parcels and compare extant numbers with numbers determined during the 1992-1993 survey.

Based on the frequency distributions of known Florida Scrub-Jay dispersals and the distribution of Florida Scrub-Jays during the 1992-1993 survey, Stith et al (1996) described 42 metapopulations; of these, 21 were comprised of fewer than 10 pairs and thus considered unlikely to persist, either because they were too small, too isolated, or both. However, 21 metapopulations consisted of 10 or more pairs and had some probability of long-term persistence. This spatial structure has recently been confirmed by genetic analyses that suggest at least 11 distinct genetic units exist (Coulon et al. 2008). The metapopulation structure conformed

to these genetic units; although several previously described metapopulations could comprise a single genetic unit. In only one case was a previously described metapopulation possibly shared between two genetic units. In this case, metapopulation #11 is west of the inter-coastal waterway and no genetic samples were taken from the middle of the unit. It is likely that the metapopulation belongs to the southern genetic and not the genetic unit to the east across the inter-coastal (see Coulon et al 2008). The important point relevant to the Florida Scrub-Jay is that population structure is a response to the life history of the species; year-round residency of breeders, strong territoriality and site fidelity, and very short dispersal distances. In fact, 85% of all dispersals occur within 3.5km of the natal territory and 99% within 8.3 km (Stith et al. 1996). In addition, Stith et al (1996) reported that scrub patches isolated by >12 km from other scrub patches were much less likely to be occupied (15% occupancy) than were well-connected scrub patches within 2 km of another patch (90% occupancy). Similarly, genetic analyses by Coulon et al. (2010) revealed that effective dispersal decreases as the proportion of scrub habitat in the landscape decreases, suggesting that although individual Florida Scrub-Jays may disperse farther as fragmentation increases, those that do so are less successful as breeders than those that disperse short distances. Together these results suggest that as scrub becomes increasingly fragmented, as extant patches become smaller and more isolated, and as FSJ populations within metapopulations are extirpated, the probability that vacant patches can be re-colonized greatly decreases and entire metapopulations being extirpated greatly increases.

Because no additional range-wide surveys have been conducted since 1992-1993, the extent and pattern of subsequent FSJ population changes, either increases or decreases, is not well understood. However, numerous site-specific surveys have been conducted on many, if not most, public and managed lands. Thus, our goals in this report were to 1) collect and collate existing FSJ survey data from as many sources as possible, 2) conduct surveys where those data were not available, 3) quantify current numbers of FSJs on managed lands, 4) compare those numbers to the 1992-1993 survey, 5) estimate population trends for all sites, meta-populations and within genetic units, and at each individual site, and 6) estimate the habitat carrying capacity for FSJs on managed lands based on pre-existing delineations of scrub habitats.

Methods

This analysis compiles current knowledge of Florida Scrub-Jay populations *only* on managed sites, both public and private. In all, 198 different sites under long-term conservation management were selected based on previous occurrences of Florida Scrub-Jays or extant scrub habitat that could support, if appropriately managed, Florida Scrub-Jays. These sites included Florida State lands (State Parks, State Forests, Water Management District lands, Wildlife and Environmental Areas, etc), Federal lands (National Forests, National Wildlife Refuges, military installations, etc), lands managed by Counties, and various other government entities, as well as a few private sites with conservation easements or otherwise in long-term conservation management. Of the 198 sites, 130 had been occupied by at least one individual FSJ during the 1992-1993 survey. Three very large sites, Cape Canaveral Air Station, Merritt Island National Wildlife Refuge and Ocala National Forest were not surveyed during 1992-1993, but their group numbers were estimated based on the amount of ‘available’ habitat and a carrying capacity estimated as one group per 10 hectares (25 acres). Estimated numbers for these three sites were 414, 502 and 449, respectively. Since not all the available habitat upon these sites was suitable during 1992-1993 and a relatively broad definition of what constituted “available” FSJ habitat was used, these are likely extremely high estimates relative to the probable occupancy at that time. Since 1992-1993, extensive research on jays has occurred at two of these sites. At Cape Canaveral, Stevens and Knight (2004) estimated the population size in 1995 as 123 groups, considerably lower than the estimate of 414 groups derived for the 1992-1993 survey, and unlikely to be a result of a natural population decline over only two years. Similarly, the population at Merritt Island National Wildlife Refuge may have been overestimated for 1992-1993 and no site-wide surveys were conducted at this site within many years of 1992-1993. Because we now have more accurate estimates of the extent of scrub habitat at both Merritt Island and Cape Canaveral, we base previous population numbers on the likely carrying capacity of those sites using a relatively conservative estimate based on 70% occupancy, with occupancy calculated as one group per 25 acres of habitat. Though conservative, it is a more realistic estimate of carrying capacity because some habitat is generally unsuitable for FSJ occupancy because it has recently burned or is long-unburned.

At Ocala National Forest, no site-wide surveys have been conducted either near the 1992-1993 or in recent years. In addition, it is difficult to estimate the amount of potential habitat because it is maintained by clear-cutting of sand-pine scrub; thus, it is nearly impossible to estimate either past or current population numbers or to determine population trends on this

largest and potentially most important of all public sites that can support FSJs. Virtually all of the potential habitat that occurs on Ocala National Forest could support FSJs if it were not simultaneously being managed for forest production. In total, over 236,000 acres of potential habitat exist within Ocala National Forest and its importance as a mega metapopulation (Stith et al 1996; Stith 1999) and persistent source for Florida Scrub-Jays cannot be overstated.

Extracting the 1992-1993 groups by site

During the 1992-1993 survey all groups were located during field surveys and a latitude and longitude recorded for each observation. This spatial reference gave us the ability, using GIS, to intersect each point representing a group with a polygon shapefile representing the boundary of each managed area. We undertook this approach because the survey data that was available to us for 2009-2010 was often an estimate for the entire site, without spatial coordinates for each group. We were able to convert the 1992-1993 point coverage to a site-specific population estimate that could be added as an attribute to a polygon shapefile of all managed sites and then compared with the current estimates.

A number of managed properties included in our current analysis were not surveyed in 92-93, in some cases because access was not available or because this was prior to their acquisition and they were unknown. In some cases, we were able to derive earlier population estimates for these sites from an unpublished report to the USFWS (Pranty et al 1998) and, specifically for St Sebastian River Preserve State Park from Breininger et al (2008; estimate of 45 groups in 2001). To assure we had a similar bench mark for each of these properties we added values as part of the 92-93 attribute data if they were derived by 1997 (Table 1). The estimate in 2001 for St Sebastian River Preserve was deemed to no longer be relevant for a 1992-1993 comparison. For 19 of the managed sites in our database, we had no data from the 92-93 survey or from any other sources. In many cases, these properties were not publicly owned or managed in 92-93 and were inaccessible or unknown.

Table1: Managed Properties with no FSJ count data in 1992-1993 spatial file but were derived or counted afterwards (see text for details).

NAME OF PROPERTY	Groups	Survey Date
Alafia River State Park	1	1991
Balm-Boyette Scrub	1	1994
Cross Bar Ranch Wellfield	2	1997
Crystal River P State Park	0	1992
Dicerandra Scrub Sanctuary	10	1993
Doris Leeper Spruce Creek Preserve	4	1993
Fred C. Babcock-Cecil M. Webb Wildlife Management Area	1	1995
Gamble Rogers Memorial State Recreation Area	0	1993
Golden Aster Scrub Nature Preserve	2	1997
Hickory Lake Scrub County Park	7	1995
Lake Woodruff National Wildlife Refuge	0	1993
Lower Wekiva River Preserve State Park	1	1993
Myakka State Forest	1	199?
Rock Springs Run State Reserve	10	199?
St Sebastian River State Preserve*	45	2001
Valkaria Scrub Sanctuary	17	1993
Withlacoochee State Forest	0	1992

*Not used for a 1992-1993 comparison

Boundaries of most managed areas were obtained from the March 29, 2010 Florida Natural Areas Inventory (FNAI) Managed Areas shapefile (available at: <http://www.fnai.org/gisdata.cfm>). However, in some instances we had to derive our own boundary data. Some sites were new and their boundaries were not included in the FNAI shapefile in these cases we contacted managers of the sites directly and requested current boundary files and these were added. In addition, several managed areas were actually comprised of multiple distinct parcels, each with a separate estimate of past and current jays, but the conglomeration of these sites was listed as a single management entity in the FNAI shapefile. For example, the Lake Wales Ridge Wildlife and Environmental Area is comprised of several distinct units (e.g. Lake Placid Scrub, Royce Ranch, etc). For each of these units, we developed a boundary file that was then re-named with the unit and management area (i.e., Royce Ranch, Lake Wales Ridge Wildlife and Environment Area). In total, we compiled boundary and FSJ data for 198 independent management areas.

Current FSJ groups by site

Over the last 10 years, monitoring of natural resources on public lands has become a greater priority. Periodic surveys for Florida Scrub-Jays have been conducted on many of the properties included in this report. However, these reports often are not easily accessible nor are

they compiled into regional or state-wide patterns or trends. We sought to compile all these data from all sources, in all formats, into a single database. For each site, we contacted the responsible manager or biologist and obtained results from the most recent Florida Scrub-Jay surveys conducted on their properties. In most cases, these surveys date from 2009 or 2010, thus they represent very recent estimates of FSJ population numbers. In addition, the range in survey dates was relatively narrow (2-3 years) thus comparisons with the 1992-1993 data represent a similar time span for all properties. In addition, we received population data for many sites via the JayWatch program of The Nature Conservancy. Where no current population surveys existed, we conducted our own survey if Florida Scrub-Jays had been previously reported from the site. If no previous records of Florida Scrub-Jays existed for a site, we conducted our own survey only if the site met at least one of three criteria. First, we contacted the local manager to determine if they had any data we had not yet reviewed suggesting FSJs had once been present on the site and if the site had scrub and how much. Second, we checked if potential habitat was present on the site based on the FNAI Focal Natural Communities (FNAI-FNC) an updated subset of the FNAI - Cooperative Land Cover Map, or habitat polygons recorded during the 1992-1993 FSJ survey. Finally, we examined high resolution aerial images of the site to see if a scrub signature was present. If FSJs had once existed on a site or scrub was present, and we had no land manager data, then we conducted a survey. Overall, we were able to obtain an estimate of current FSJ populations from 2009 or 2010 for nearly every of the 198 sites.

Defining Habitats

Delineating habitat is often context specific. The xeric habitats most associated with the occurrence of Florida Scrub-Jays are scrub, scrubby flatwoods, oak hickory scrub and coastal strand but these can vary in species composition and habitat structure among sites. In addition to these habitats, of primary importance to jays, other habitats can support scrub-jays depending on the distribution of these habitats with the primary habitats. When a landscape mosaic includes both these primary and secondary habitats, the overall carrying capacity of a site might be greatly increased. However, it is often difficult to accurately quantify the relative distribution, size, and extent of these different habitats within a single site. One useful description previously adopted has been that of the Type I, Type II and Type III quality habitat (Fitzpatrick et al 1991). Type I habitat is any upland habitat in which cover is comprised of more than 15% scrub oak species. Type II habitat is plant communities with at least some scrub oak but less than Type I, and Type

III is any upland or seasonal dry habitat within close proximity (1/4 mile) to type I or II habitats. Communities that can be classified as Type III habitats in which Florida Scrub-Jays might occur can include mesic flatwoods, xeric hammock, dry prairie, seasonal wetlands, coastal hammock and sandhill. These habitats can comprise part of the mosaic in which scrub or other primary habitats occur, but they tend to be occupied by jays only when they occur within close proximity to primary habitats. When these habitats occur in large, contiguous patches without Type 1 habitats, they do not constitute potential scrub-jay habitat. Because of the difficulty in quantifying the extent and distribution of these habitats at each of the managed sites, we have not included them in our estimates of the amount of potential habitat at each site. However, as we just observed, these habitats could be used by jays and could potentially increase the site-specific carrying capacity if they are evenly distributed among Type 1 habitats. Thus, we included only scrub, scrubby flatwoods, oak hickory scrub and coastal strand, in which most scrub-jay populations occur, in our estimates of potentially suitable habitat, which was used to determine site-specific estimates of carrying capacity. A good example site of a landscape that includes both primary and secondary habitats in the larger mosaic is Archbold Biological Station. Most occupied jay habitat at Archbold is comprised of scrub, scrubby flatwoods and oak hickory scrub, but the mosaic includes mesic flatwoods and seasonal wetlands, which often occur within the boundaries of scrub-jay territories. Based on the extent of just the primary habitats, we estimate a carrying capacity of 88 groups (Primary habitat x 0.70). However, the actual number of jay groups on this site is 116, and some potentially suitable habitat unoccupied because it has recently been burned or is long unburned. Similarly, on both the Atlantic Coast and in southwest Florida, small patches of scrub are embedded in mesic flatwoods. These patches tend to be too small to be classified as scrub by common habitat delineation approaches (FNAI, soil surveys, etc), yet these sites support scrub-jay populations that appear to far exceed their apparent carrying capacity (Breininger et al. 2003). For many of the same reasons related to secondary habitats mentioned above, we did not include Sandhill in our delineation of potential scrub-jay habitat. Sandhill is a savanna-like habitat with an open overstorey of longleaf pine (occasionally slash pine), a midstory of turkey oak (*Quercus laevis*) and a few other hardwood species and a groundcover dominated by herbaceous grasses, ferns, and wildflowers. The open canopy and grassy undergrowth give these habitats a park-like appearance and in general are not suitable for Florida Scrub-Jays. Several of the managed sites have large areas of contiguous sandhill (e. g., Chassahowitzka Wildlife Management Area, Withlacoochee State Forest, Marjorie Harris Carr Cross Florida Greenway State Recreation and Conservation Area) and these habitats are

unsuitable for Florida Scrub-Jays. Inclusion of this habitat in our estimates of carrying capacity would produce gross overestimates. Small patches of sandhill embedded in a matrix of scrub might be used by Florida Scrub-Jays (Fitzpatrick et al. 1991) but for the same reasons articulated above, are difficult to quantify and thus not included in our estimates of potential habitat. On the southern half of the Lake Wales Ridge, sandhill has a slightly different form, known as southern ridge sandhill or oak hickory scrub. This habitat has a greater proportion of scrub oaks and can provide suitable habitat for Florida Scrub-Jays when the structure is low and open. Although, more appropriate as Scrub-Jay habitat than classic sandhill it should be noted that even oak hickory scrub may have had long fire return intervals unsuitable for jays. Where oak hickory scrub occurred, we included in our delineation of potential habitat and in our estimates of site-specific carrying capacity. Because habitat composition varies among sites and because structure may vary with post-fire succession, some debate exists among the conservation community about how best to delineate specific habitats. For example, at Cape Canaveral Air Station, habitat has been delineated by two different methods. Coastal oak scrub, a potential habitat for Florida Scrub-Jays, will eventually succeed to coastal hammock after a long period of fire suppression. Because coastal hammock is relatively resilient to fire, it is not likely to succeed back to coastal oak scrub and coastal hammock is not suitable for jays. Thus, this particular habitat could be defined as potential habitat or not, depending on the post-fire succession. How these habitats are characterized can also have large impacts on the estimated carrying capacity of a site. In the specific instance of Cape Canaveral we have used the FNAI delineation of these habitats as coastal hammock and not coastal oak scrub, thus our estimates of carrying capacity are appropriately conservative. However, individual managers may decide to try reverse patterns of post-fire succession and potentially restore coastal hammock to coastal oak scrub. We feel this is a management decision that will include many factors (e.g., other species conflicts, management logistics, and historical evidence of past habitat associations). We also feel strongly that these decisions are best made by local managers most familiar with their sites and with the needs of the local and regional FSJ populations. However, our results demonstrate that the extant population of jays at most sites is far below the potential carrying capacity of even our conservative habitat estimates, suggesting that FSJ populations at most sites would greatly benefit from aggressive fire management that would transform habitat from potential to suitable. In only this way will FSJ populations have the opportunity to grow and recover.

Developing the FSJ_XericHabitats_2010 shapefile

The single most important criteria in determining the site-specific carrying capacity, is the amount of potentially suitable habitat. Actual population numbers are affected by the structure of the habitat (overgrown versus open and fire maintained), the size of the patch, and its landscape context (whether it's surrounded by forest, prairie, wetlands, and how well connected it is to other patches). All these parameters are important for managers to assess in determining population goals; however, for this report, we based our carrying capacity only on the amount of potential primary habitat. Florida Scrub-Jays are despotic and maintain discrete year-round territories that average 10 hectares and, unlike many species, a range of potential carrying capacities can easily be estimated if the area of potential habitat is known.

This contract did not include conducting on-the-ground surveys of all sites to delineate potential habitat. Instead, we used ESRI ArcGIS (V9.3.1 and 10) to quantify two existing datasets that delineate scrub distributions for the entire the state of Florida: a very recent delineation by the Florida Natural Area Inventory (FNAI –FNC 2010) and the habitat delineation associated with the 1992-1993 surveys. We found the FNAI delineated scrub polygons to be more accurate than the 1992-1993 polygons which often contained non-scrub habitat (i.e. fields, roads, lakes, etc.). The 1992-1993 scrub polygons were based predominantly on associated soil types and were delineated from county soil maps using digitizing techniques of the late 1980s. Additionally, the 1992-1993 data did not reflect recent changes to the landscape and scrub habitats.

We compared the two scrub delineations to each other by randomly selecting ten properties from a subset of the 198 sites: Alafia River State Park, Jordan Scrub Sanctuary, Little Manatee River, Malabar Scrub Sanctuary, Oscar Scherer State Park, Prairie Creek Preserve, Radnor, Sheraton Plaza Preserve, Sunray Tract Lake Wales Ridge Wildlife and Environmental Area, and the Tippecanoe Environmental Park (Table 2; see accompanying shapefile bundles for site details). We first compared variation in the area (hectares) of scrub habitat estimated by the two datasets. Following this, we visually inspected the accuracy of the delineations against current aerial images (most current imagery (2005-2009) available was collected from each counties land management department for each managed site) viewed in ESRI ArcMap (V9.3.1) from which we were able to interpret scrub habitats, including scrub, scrubby flatwoods, and occasionally sandhill. Relative to the amount of scrub estimated by our own image interpretation, the FNAI dataset tended to underestimate the amount of scrub on sites: ~60% of all estimates

were under-estimates and 30% were over-estimates). The mean under-estimate for each site was 63% and the mean over-estimate was 14%. The FNAI scrub polygons often followed obvious boundaries (i.e. roads, firebreaks, etc.) and where small patches of scrub habitat extended beyond these boundaries, they were excluded, resulting in some of the under-estimation.

Relative to our image interpretation, the 1992-1993 survey dataset tended to over-estimate scrub (~60% of all estimates were over-estimates and 40% were under-estimates). The mean under-estimate for each site was 45% and the mean over-estimate was 76%. Furthermore, the 1992-1993 polygon coverage contained obvious errors in georeferencing of scrub polygons, which were often inaccurate by several tens of meters.

Table 2: A comparison of xeric habitat estimates by different data sources. Xeric habitats include scrub, scrubby flatwoods, coastal strand, and oak hickory scrub also known as Southern ridge sandhill. (Source: FNAI-Florida Natural Areas Inventory; 1992-1993 FSJ survey habitat polygons; Manager – onsite manager estimate of scrubs; Aerial – Interpolation of scrub from recent aerial imagery)

Management Name	Estimates (ha)			
	FNAI	92-93	Manager	Aerial
Alafia River State Park	4.5	95.8	N/A	39
Jordan Scrub Sanctuary	52.6	112.3	N/A	71.1
Little Manatee River	203.1	98.9	N/A	195.8
Malabar Scrub Sanctuary	116.2	190.4	162	151.5
Oscar Scherer State Park	168.7	230	N/A	160.5
Prairie Creek Preserve	0	316.6	45	112
Radnor	32.9	24.4	23	24.4
Sheraton Plaza Preserve	0	0	24	17
Sunray	81	57.2	N/A	81
Tippecanoe Environmental Park	59	103.4	61	105.5

Because of the considerable inconsistencies with delineation of scrub in both datasets, we based our estimate of potential habitat, and thus our estimate of the site-specific carrying capacity, on the FNAI dataset, which was the most conservative and similar to our visual interpretations. In cases where the FNAI – FNC dataset showed that no xeric habitats (scrub, scrubby flatwoods, oak hickory scrub or coastal strand) occurred on a managed site from which xeric habitats occurred in the other data sources, we added the amount of habitat delineated by our own aerial interpretation (Table 3). For the specific case of Coastal Strand that was not included in the FNAI - FNC shapefile we extracted this habitat from the Cooperative Land Cover Map also distributed by FNAI and added it to our habitat shapefile. We stress that delineating habitat is nearly always subjective and the shapefile we include with these results (example Fig 1) should be used as a general guideline to the extent of these natural communities on each site,

but managers should review and adjust these estimates as necessary. We request that if managers find large discrepancies in the delineation of habitats, that they rectify the information in the appropriate GIS bundle and inform FNAI, USFWS and the authors.

Table 3: Sites where xeric habitats and/or Florida scrub-jays were previously reported but for which the FNAI dataset delineated no xeric scrub habitats.

Managed Site Name	County	Comments
Carter Creek Lake Wales Ridge National Wildlife Refuge	Highlands	All area is sandhill should be no scrub
Alva Scrub Preserve	Lee	Potential Scrub
Fred C. Babcock-Cecil M. Webb Wildlife Management Area	Charlotte, Lee	Seems to be no habitat, all mesic flatwoods
Buck Creek Preserve	Charlotte	Potential Scrub
Coconut Point Park	Brevard	Potential Scrub
Deer Prairie Creek Preserve	Sarasota	Potential Scrub
Fox Creek	Sarasota	Open pasture but no scrub habitat present
Gemini Springs Park	Volusia	Does not seem to be any scrub habitat
Headwaters at Duette Park	Manatee	Palmetto but little scrub
Hog Point Cove	Brevard	Potential Scrub
Lake Trafford Impoundment	Collier	May have been scrub, has been modified
Lemon Bay Park and Environmental Center	Sarasota	Overgrown, mostly forest, little scrub
Lori Wilson Park	Brevard	Potential Scrub
Maritime Hammock Sanctuary	Brevard	Currently maritime hammock
Prairie Creek Preserve (Charlotte County)	Charlotte	Potential Scrub
Prairie/Shell Creek	Charlotte	some habitat hard to delineate
River to Sea Preserve	Flagler, St Johns	Potential Scrub and Coastal Strand
Sheraton Plaza Preserve	St Lucie	Potential Scrub
Spessard Holland North Beach Park	Brevard	Hardly any scrub, Coastal strand on beach edge
Tippecanoe II Florida Scrub-jay Mitigation Area	Charlotte	Potential Scrub
Twin Shores Park	Brevard	Potential Scrub
Deep Creek Properties	St. Johns	Potential Scrub
Telegraph Creek Preserve	Lee	Potential Scrub

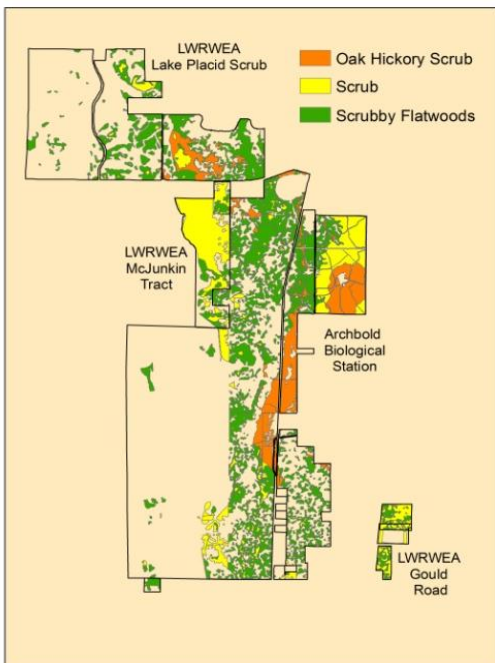


Figure 1: Xeric habitats of Archbold Biological Station and portions of the Lake Wales Ridge wildlife and environmental areas.

Carrying Capacity Estimates

Included with the associated digital database we have provided a simple estimate of site-specific carrying capacity of FSJs (70% Car). The estimate is based on the assumption that at any one time a managed site would have 70% of the available habitat in a suitable condition for use by Florida Scrub-Jays. Despite the best efforts of managers, some habitat is likely to be

unsuitable because it was recently burned or is too overgrown, thus it is unrealistic to assume that all habitat will be saturated at all time. We then divided the amount of habitat (potential

habitat x 70%) by the average amount of habitat used by a Florida Scrub-Jay group (~10ha or ~25acres). The population density of Florida Scrub-Jays can vary and populations sometimes have densities higher or lower than 10ha per group. We use 10ha because this is the mean territory size for Florida Scrub-Jays at Archbold Biological Station over the last 40years. It is representative of Florida Scrub-Jay density in natural, fire-maintained habitats and should be the benchmark and goal for all managed lands.

Provided data formats

Accompanying this document are several shapefiles. In addition, we bundle the different shapefiles by site so that managers can easily access all the relevant files for their particular managed area. These site specific bundles are all derived from the main data files. The first shapefile called the Florida Managed Areas _Florida Scrub-Jay_2010_Summary (FLMA_FSJ_2010_Summary) is a polygon shapefile of each managed area in the project. Each managed area has a series of attributes containing the raw data and manipulations that can be used to replicate the results of this report. The data code 9999 is used to designate missing unknown numbers. The second is the Florida Scrub-Jay Xeric_Habitats (FSJ_XericHabitats_2010) a polygon shapefile derived from FNAI compiled Florida Natural Communities and Cooperative Land Use Cover products (www.fnai.org) with additions from aerial interpretation. Aerial imagery for each site is also provided in the site specific bundles.

Results

Of the 198 management areas included in the accompanying shapefiles, we provide estimates of current FSJ numbers from surveys conducted in 2009 or 2010 for 192. Of the remaining 6 parcels, our estimates of current FSJ numbers come from surveys conducted in 2006 or 2008. The only site for which we do not provide a current estimate of FSJ number is the largest contiguous patch of scrub in the state: Ocala National Forest. Estimates from 1992-1993 were based on extent of habitat and not actual surveys and no recent, site-wide surveys of this site have been conducted. It was neither within the budget nor logistics of this project to conduct such surveys. However, because this single site has the greatest potential carrying capacity for FSJs of any other managed site in this species range, such a survey should be an extremely high priority.

Populations on managed lands currently range from 0 – 275 groups. Excluding Ocala National Forest, the largest FSJ population occurs on Merrit Island National Wildlife Refuge.

Only three managed areas have populations that exceed 100 groups; Merrit Island, Cape Canaveral Air Station and Archbold Biological Station. Excluding the 20 managed areas where no data were available from the 1992-1993 survey, of the 178 managed sites, FSJ populations declined by at least 1 group at 95 sites, populations remained the same at 37 sites, and at 46 sites the population increased by at least 1 group (Fig. 2). The mean distribution of population sizes differed significantly between 1992-93 and 2009-10 (Wilcoxon Signed Rank Test, $Z = -3.840$, $p < 0.01$) (Fig. 3). FSJs were absent from many more managed areas in 2009-2010 than in 1992-93. However, fewer managed areas consisted of only a single group in 2009-10 than in 1992-93, largely because many of these small populations were extirpated by 2009-10. On average, populations that grew increased by 4.11 ± 0.89 groups; populations that declined decreased by 5.98 ± 1.32 groups. In both increasing and decreasing populations, most population changes were small. Of increasing populations, 41.3% increased by only a single group and only three populations grew by more than 10 groups (Fig. 4). The McJunkin Tract of the Lake Wales Ridge WEA, grew from 7 to 22 groups. Similarly, at Archbold Biological Station, which is adjacent to the McJunkin Tract and both sites are managed under a similar fire regime, the population grew by 32, from 84 to 116 groups. Archbold Biological Station has a fire management plan and its goal over the last 20 years was to return all habitats to their natural fire regime. In 1992, 794 ha of potential scrub-jay habitat was within the appropriate range of time-since-fire; by 2009, that area had increased to 1242 ha, roughly corresponding to the increase in FSJ groups. The only other managed site for which we had data from both 1992-1993 and 2009-2010 that showed significant population growth was Seminole State Forest. This FSJ population grew from 18 to 44 groups. The FSJ population at Blue Springs State Park also grew from 1 to 10 groups.

Significant population growth also occurred at two sites that were not surveyed in 1992-1993, largely because the sites were not publically owned and extremely overgrown with little potential for occupancy by FSJs. Both sites have since been acquired as public lands and extensive habitat restoration has occurred on both (see discussion for further details of these case studies). At the Lyonia Preserve in Volusia County and the Halpata Tastanaki Preserve in Marion County, extant FSJ population now number 31 and 30 groups, respectively (Table 4).

Of the 95 populations that declined, 40% declined by only a single group and 77% declined by five or fewer groups (Fig. 4). However, the proportion of populations that showed relatively large declines (≥ 10 groups) was greater than the populations that showed large increases (13% vs 7%). A total of 12 populations declined by more than 10 groups. The largest

decline occurred at Merritt Island National Wildlife Refuge (109 groups), but this population is still the largest FSJ population outside of Ocala National Forest. The population at Avon Park Air Force Range declined by 42 groups, from 98 to 57 groups, but also remains one of the larger populations on public lands and the population has actually been increasing in recent years (up from 49 groups in 2006). Another significant decline occurred at the Carter Creek Tract of the Lake Wales Ridge WEA. This population declined by 32 groups, from 35 to 3 and is at great risk of extirpation. Similarly, the FSJ population at the Disney Wilderness Preserve declined by 28 groups, from 37 to 9. These declines have shifted once large populations that should have enjoyed relatively long-term population viability into the ranks of the most threatened.

A total of 54 managed areas at which at least one FSJ group occurred during the 1992-1993 survey had been extirpated by 2009-2010. The vast majority of these had consisted of only a single FSJ group in 1992-93 and 49 (90.7%) consisted of fewer than five groups (Fig. 5). However, two populations that consisted of at least 10 groups in 1992-93 were extirpated by 2009-10. Al Bar Ranch (Pasco County) and Rock Springs Run State Preserve (Lake County) declined by 21 and 10 groups, respectively. At 15 managed areas, new populations of FSJs existed in 2009-2010 when none were detected in 1992-1993 (Tab. 4). Similar to extirpations, most new populations were very small; 14 of 15 (94%) were \leq three groups (Fig. 5). At Prairie Creek Preserve in Charlotte County, recent aggressive fire management has resulted in a population of six FSJ groups occupying small patches of scrub embedded in pine flatwoods.

Our best estimate of the current 2009-2010 range-wide population of FSJs on 198 different managed lands is 1,253 groups. However, we only have robust comparative data between 1992-93 and 2009-10 for 178 of these managed sites. In 1992-93, on these 178 sites, the total FSJ population was 1,495 groups. Our best estimate of the current 2009-2010 number of Florida Scrub-Jays groups on these same 178 sites was 1,116 groups; thus on these sites populations have declined by 25.4%. Although we estimated the population on these 178 sites at 1,116, we estimated the total number of scrub-jay groups on all 198 sites for which we had data at 1,253.

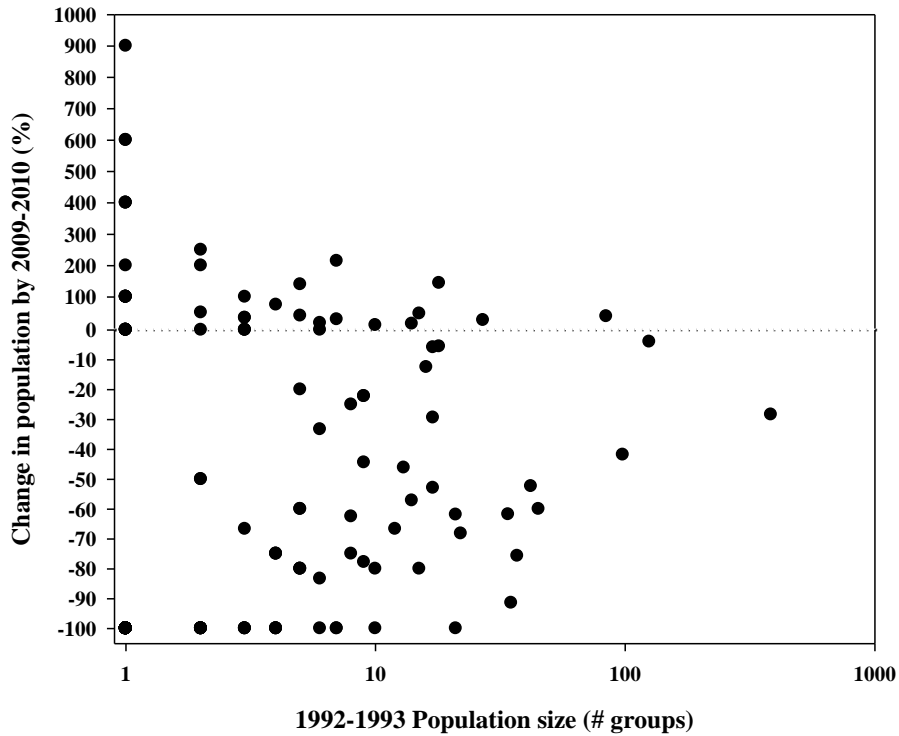


Figure 2: Population changes for each of 178 sites where 1992-1993 survey data was available. Note log scale on x-axis and change in scale on y-axis.

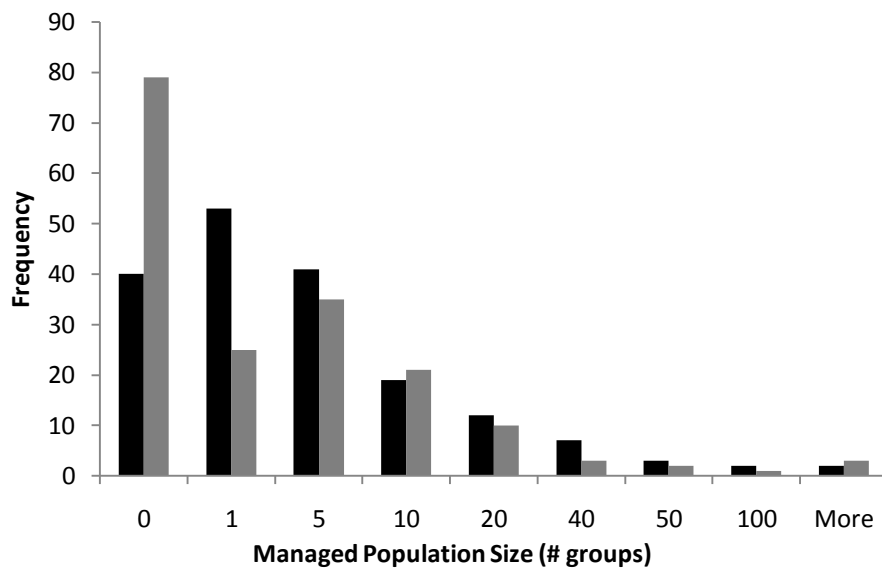


Figure 3: Frequency of FSJ population sizes for 178 managed areas in 1992-93(black) and 2009-10 (gray)

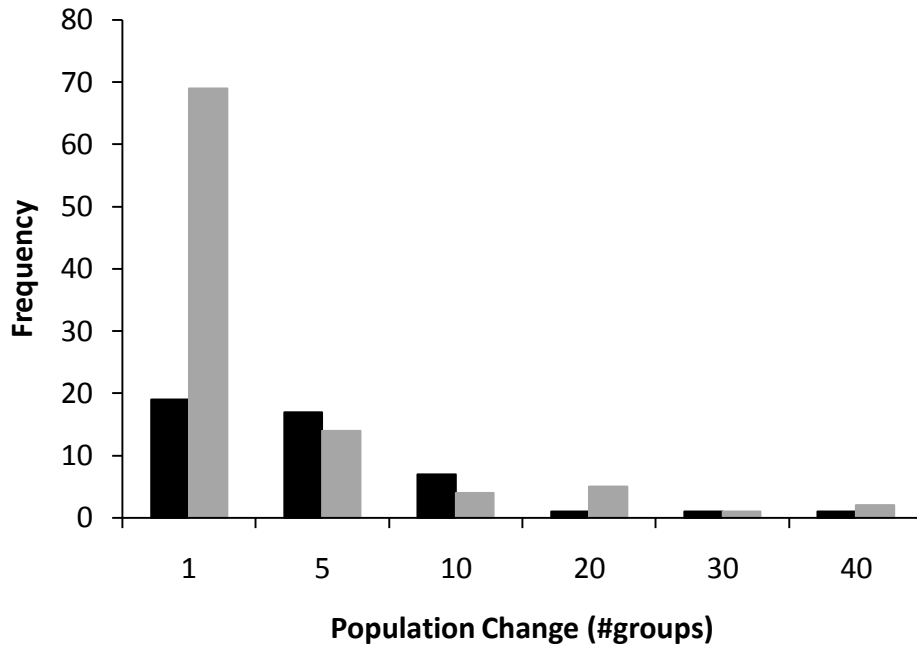


Figure 4: Frequency of changes in population size increases for populations that increased from 1992-93 (black) and populations that decreased (gray; see Appendix I)

Table 4: Management sites not surveyed in 1992-1993 with current group size

Management Name	Current Groups
Atlantic Ridge Ecosystem	4
Atlantic Ridge Preserve State Park	1
Conner Preserve	0
Crooked Lake Prairie	1
Estero Bay Preserve State Park	0
Etoniah Creek State Forest	1
Halpata Tasthanaki Preserve	30
Indrio North Savannahs	1
Kissimmee Prairie Preserve State Park	2
Lake Monroe Conservation Area	4
Lake Panasoffkee	1
Lower Peace River Corridor	1
Lyonia Preserve	31
Rotunda Community Park and Preserve	1
Sheraton Plaza Preserve	2
St. Sebastian River Preserve State Park	45
Turkey Creek Sanctuary	0
Wabasso Scrub Conservation Area	4
Well Field Scrub-jay Habitat	8
Whaley Conservation Easement	0

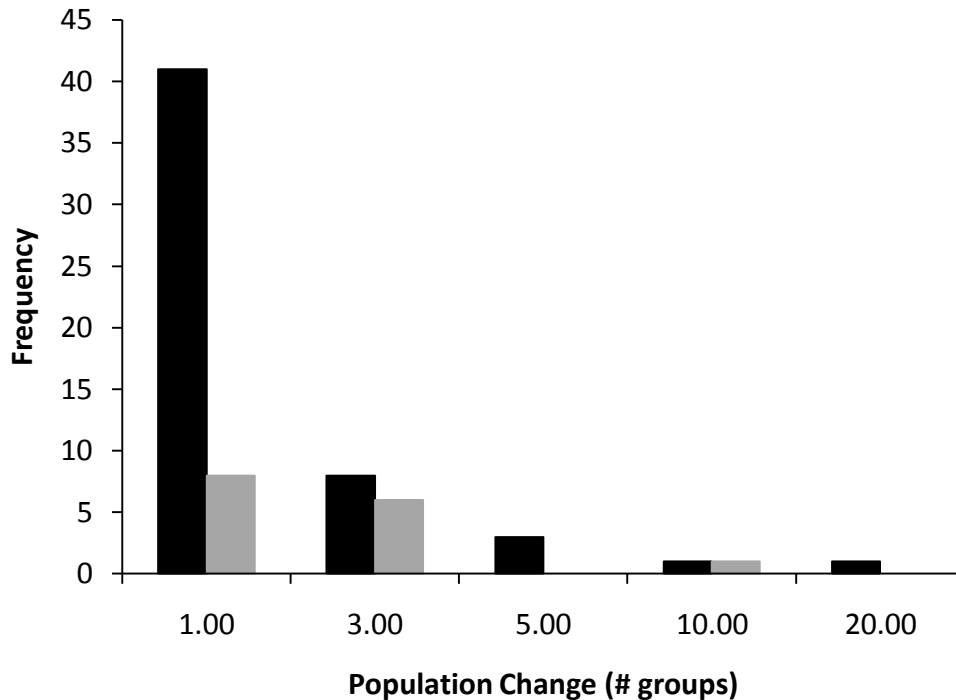


Figure 5: Frequency of changes in population sizes among populations that existed in 1992-93 (black) and were extirpated and sites where FSJs were absent in 1992-1993 but present 2009-10 (gray) (see Appendix I)

Carrying Capacity

The amount of habitat that could potentially support FSJs on managed lands varied from a few acres to several thousand acres (Appendix I). For these 198 sites, in total, the protected xeric communities that represent potential habitats for FSJs equaled 110,500 acres. Based on our conservative estimate of carrying capacity, these lands could support as many as 3,094 groups of FSJs. As of 2009-2010, only 1,253 FSJ groups occurred on these managed lands, well less than 50% of the potential carrying capacity (Fig. 6). Among individual sites, the difference between extant population and carrying capacity ranged from sites that were far more than 100 groups below carrying capacity to a few sites that were as many as 28 groups above carrying capacity. Excluding the 32 sites that have less than 20 acres of potential habitat, the FSJ population was below the potential carrying capacity at 138 of 166 sites (83.1%; Fig. 7). In contrast, only 28 sites (16.9%) were at or above carrying capacity. On average, FSJ populations on managed sites were more than 14 groups below carrying capacity, but some populations have a relatively large potential for growth. Four managed site had the potential to grow by more than 100 groups and 24 sites had the potential to grow by as many as 20 groups. Nearly 40% (55 of 138) of managed

sites currently below carrying capacity have the potential to grow by as much as 10 groups from their mean extant size of 12 groups, thereby increasing their potential size to more than 22 groups. This could considerably decrease extinction risk even among isolated sites and greatly decrease those risks where these populations still occur within a connected network of other sites.

Of the 28 managed sites where FSJ populations were at or above carrying capacity, FSJ populations averaged 4 groups above carrying capacity. At only seven sites were FSJ populations more than 3-4 groups above carrying capacity (See Appendix I and discussion for more details).

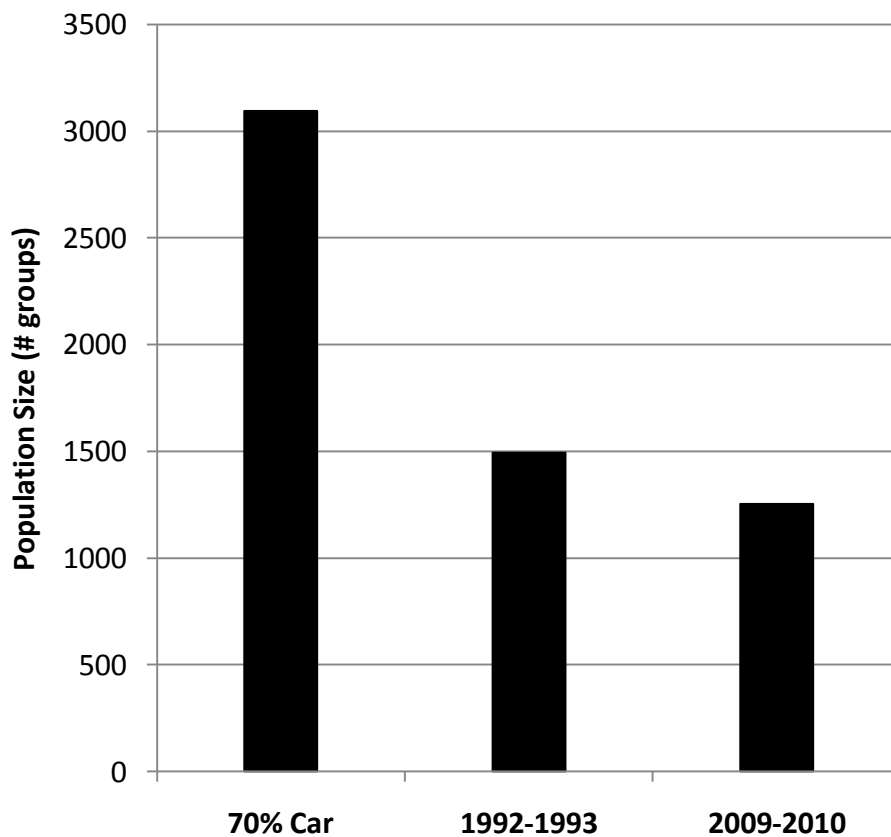


Figure 6: Comparison of Florida Scrub-Jay populations in managed areas to a habitat derived potential carrying capacity for all 198 sites.

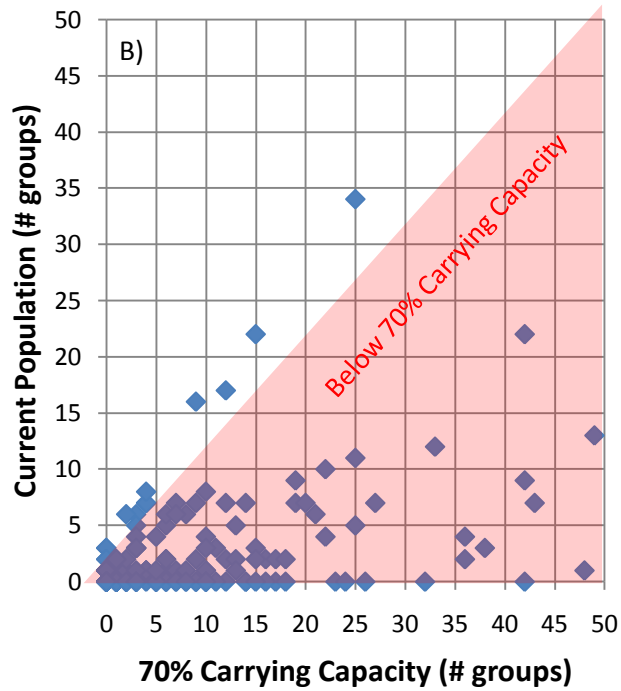
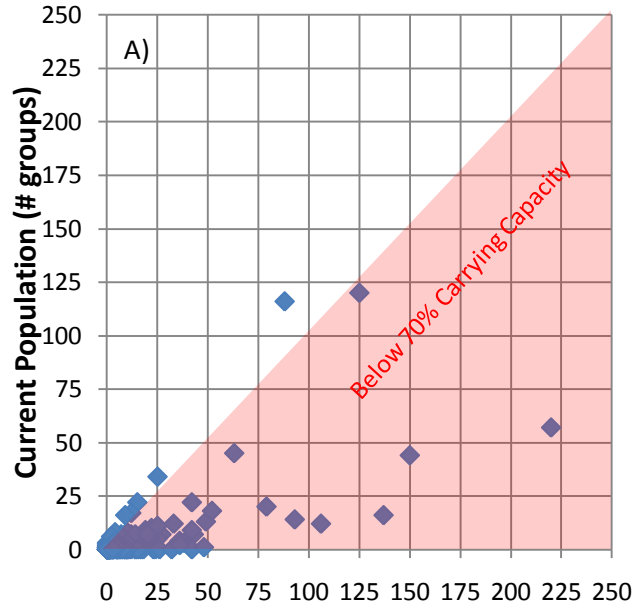


Figure 7: A comparison of current Managed Site populations to the carrying capacity of the site. The red triangle highlight depicts populations below carrying capacity. A) All populations except Merrit Island B) Exploded view of grid for the lower left 4 cells of A.

Discussion

The Florida Scrub-Jay has a fragmented and discontinuous distribution throughout its range, largely reflecting the distribution of Florida's scrublands (Myers 1990). The "island-like" distribution of scrublands (Webb 1990) has likely influenced the biogeography of Florida's biota and certainly that of the Florida Scrub-Jay. Based on the distribution of populations during the 1992-1993 survey, Stith et al (1996) described 42 separate metapopulations of FSJs, each separated by more than 12 km of unsuitable habitat. Of these, half (21) consisted of fewer than 10 groups and were considered unsustainable. Stith et al (1996) and others (Root et al 1998) predicted that small populations, especially those that were isolated, and those that were embedded in burgeoning suburban developments, and even those on managed lands in which the habitat was fire-suppressed and overgrown, were likely to decline and even be extirpated. The results of our compilation of surveys conducted on managed lands in 2009-2010 appear to support those predictions. Despite two decades of ambitious acquisition of sensitive conservation lands, largely through a sequence of hugely successful state-funded land acquisition programs (Conservation and Recreation Lands program [CARL, 1979-1990, Florida Preservation 2000 [1991-2000] and Florida Forever [2001-2010]), populations of Florida Scrub-Jays have continued to decline on most managed lands.

The Five-Year Review for the Florida Scrub-Jay (USFWS 2007) stated that nearly 280,000 acres of scrub habitat had been acquired and protected. Based on our use of the FNAI habitat designations overlaid with our managed areas polygons, we estimate this total acreage to be 347,335 acres, which also includes the entire potential habitat within Ocala National Forest. The carrying capacity of these lands could be as high as 6631 groups and is four to five times larger than the current FSJ population on managed lands (depending on the estimate you use for the current population at Ocala National Forest). Thus it seems likely that our land acquisition efforts over the last several decades have been enormously successful in protecting populations of Florida Scrub-Jays. Various indices exist to measure the additional protection gained for endangered species through land acquisition efforts. Turner et al. (2006) developed an index that measured the degree to which a network of reserves contributed to the long-term persistence of particular species. They ranked the Florida Scrub-Jay as among those species protected sufficiently to have little concern about their long-term persistence. Yet despite this apparent increase in protection, FSJs on the Lake Wales Ridge declined throughout the 1990s and 2000s. Within the 47 managed areas for which we have data on the Lake Wales Ridge, the FSJ population declined by 23%, from 545 groups to 421 groups. FSJ populations were extirpated on

9 of those managed areas, and the size distribution of populations shifted noticeably downward. In 1992-1993, 15 managed areas supported >10 groups; by 2009-2010 only 10 areas had populations this large. Thus it seems clear that habitat protection alone is not adequate to sustain FSJ populations.

Habitat degradation as a result of fire suppression or infrequent fire now poses more of a risk to long-term persistence of FSJs than habitat loss (USFWS 2007). Although we were not able to assess fire management patterns on all managed areas included in this report, we were able to assess this for a subset of sites on the Lake Wales Ridge. The Lake Wales Ridge Wildlife and Environmental Area is comprised of 20 distinct management areas that occur on the Lake Wales Ridge. Of these 20 sites, FSJs were absent on four of them in 1992-1993 and were extirpated from one additional site by 2009-2010. FSJ populations declined on 10 of the sites and increased on 5 of the sites. Fire management has been relatively aggressive at all five of the sites where populations increased and, at one of these sites, the FSJ population is well above the site's carrying capacity. Of the 10 sites where FSJ populations declined, only two were managed (Fig. 8). Many of the other sites are known as “megaparcel” where private in-holdings are scattered

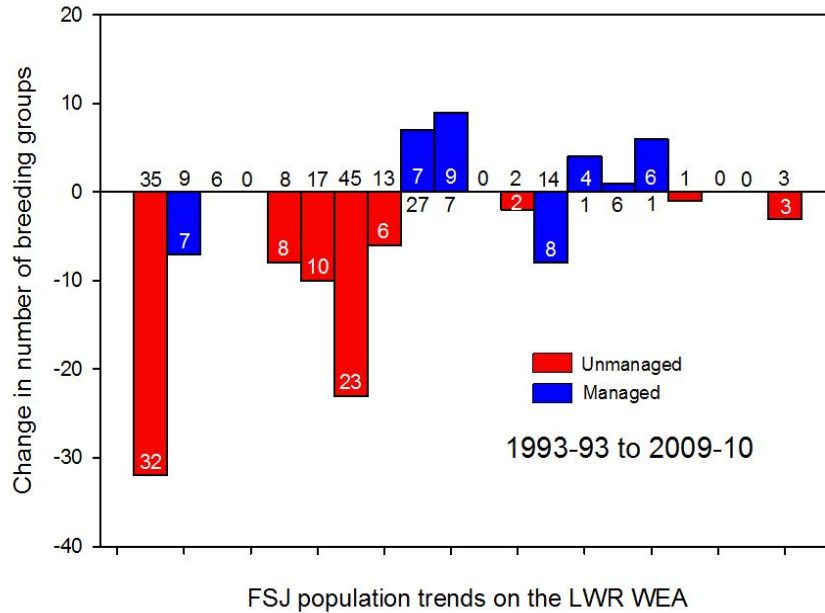


Figure 8: FSJ population trends of managed and unmanaged parcels of the Lake Wales Ridge Wildlife and Environmental Areas.

within public lands, thus preventing effective management. At the two sites where scrub was effectively managed but FSJ populations declined, one was relatively isolated and thus not likely to benefit from immigration and the other site was adjacent to a site that was restored, where the

FSJ population grew by the same number that the other site declined, suggesting jays just simply moved from one site to the other. These patterns, although local, suggest that many of the population declines observed over the past 15-20 years have resulted from a lack of management rather than habitat loss. However, these declines have resulted in smaller and more isolated populations, and may ultimately increase the extinction risk of extant populations and hamper the responses of populations when effective management is implemented and suitable habitat conditions restored.

Recent work on the genetic structure of FSJs describes 10 genetically differentiated groups throughout their extant range (Coulon et al. 2008). These groups are largely consistent with the dispersal-defined metapopulations (Stith et al 1996), which assumed very limited dispersal ability. Some genetic groups comprise more than one metapopulation, likely because these genetically similar metapopulations were fragmented only recently by habitat loss. The combined reconstructions of population structure based on genetics and dispersal-mediated demographic connectivity provide a robust depiction of the current genetic and demographic organization of this species, reflecting past and present levels of dispersal among occupied habitat patches. By maintaining viable populations of all genetically differentiated and geographically isolated populations in these 10 genetic groups, we could preserve what remains of genetic variation in this dwindling species. However, patterns of decline are not consistent among these genetic groups (Table 5). Some groups have grown since 1993 but most have declined. In addition, the prospect for recovery based on habitat currently in managed areas varies among these genetic groups. In only 6 of the 10 genetic groups does the total carrying capacity of potential habitat in managed areas exceed 100 groups. In two (Genetic Groups H [Cedar Key] and K [southern Charlotte, Lee, Hendry, and Collier counties]), the potential habitat in managed areas is capable of supporting only 22 and 25 FSJ groups, respectively. In these cases continued acquisitions or conservation of private habitat is a priority if the genetic unit is to be recovered. Others have less recovery potential because they are already close to carrying capacity. Genetic Group G, which encompasses a relatively few populations in Volusia County isolated from Ocala National Forest by the St. Johns River, is already at 96% of its carrying capacity. This genetic group also experienced considerable population growth from 1992-93 and its extant population size of 45 birds in a reasonably well-connected landscape has a relatively high probability of long-term persistence.

Table 5: Summary of FSJ population trends by FSJ Genetic Unit.

FSJ Genetic Unit	Managed Areas ¹	Total Carrying Capacity	Managed Areas with FSJ populations		Total Groups		% Carrying Capacity	
			1992-93	2009-10	1992-93	2009-10	1992-93	2009-10
A	26	110	20	15	71	55(100) ²	64.5	50.0(91.0)
B	47	1092	38	32	545	421	50.0	38.6
C	17	618	13	11	566	424	91.6	68.6
D	25	513 ³	16	9	119	110	23.2	21.4
E	16	55	15	11	50	39	91.0	70.9
F	24	275	16	15	30	50	10.9	18.2
G	4	47	1	3	1	45	2.1	95.7
H	1	22	1	1	3	4	13.6	18.2
I	17	156	11	10	73	40	46.8	25.6
J ⁴								
K	7	25	5	2	8	5	32.0	20.0

¹ Represents number of managed areas in 2009-2010. In many cases, the number of managed areas in 1992-93 was fewer, but the carrying capacity reflects current managed areas.

² We provide a separate estimate with and without St. Sebastian River State Preserve. This site was not surveyed in 1992-93.

³ Genetic Unit D includes Ocala National Forest and this site is not included in our estimates of number of Managed Areas or Total Carrying Capacity. The Carrying Capacity for ONF alone is estimated to be 6631 groups alone.)

⁴ We exclude this genetic unit because it was anomalous, embedded within genetic unit D and consisting of only a single site with very few FSJ groups.

Meta-population dynamics predict that small populations will go extinct and be recolonized. The smaller the population, the higher the risk of local extinction and the more isolated the population, the lower the probability of recolonization. Thus as the populations within our genetic groups become smaller and more isolated, the greater the overall risk of extinction and the lower probability of recolonizing events. Our results demonstrate that many of the medium sized (10-40 groups) and larger (50-100 groups) populations are becoming smaller, with 50% and greater reductions occurring on many managed lands. Coupled with greater

fragmentation and habitat loss outside of managed areas, the probability of immigration and colonization events to extirpated sites is likely decreasing. Unfortunately, a high probability of extinction exists for small populations even when the habitat is appropriately restored. For many different species, once populations are allowed to fall below some threshold size (<10 groups in FSJs) local extinction probabilities are high (Gilpin and Soule 1986, Thomas 1990) and specifically so for the Florida Scrub-Jay (Woolfenden and Fitzpatrick 1991; Root 1998, Breininger et al 1999). Of the 198 sites included in this report, most of which have the potential habitat to support at least some FSJs, 83 have never had or no longer have Florida Scrub-Jays, a further 94 have 10 or less groups upon them. Thus, at 177 (89%; 177 of 198) managed sites, jay populations are absent or have recently been extirpated or the populations are so small that they are at immediate threat of extinction if isolated from other populations. At only 21 sites (11%, 21 of 198) do populations exceed 10 groups. Of these, only 12 have populations that exceed 20 groups and only 4 that exceed 50 groups. The populations that exceed 50 groups occur in only two genetic units: 2 populations from genetic unit B, the Lake Wales Ridge (Archbold Biological Station and Avon Park Air Force Range) and 2 populations from genetic unit C, northern Atlantic coast (Merritt Island National Wildlife Refuge and Cape Canaveral Air Station). Although all but one of these sites is federal property, two are managed by the Department of Defense, in which habitat management and endangered species conservation are subsidiary priorities to national defense. That said, management on both sites has been adequate to sustain their populations, but at both sites the current population is considerably below the site-specific carrying capacity. Of course, the jay population at Ocala National Forest (genetic unit D) also exceeds 50 groups. Therefore other than genetic units B, C and D the extant population sizes are probably small in all other genetic units. The one reassuring statistic is that most of these genetic units are also far below their carrying capacity, suggesting the possibility of recovery if extinction does not occur first.

These previously presented data pertain only to managed areas. Outside of managed areas it is likely that the decline of Florida Scrub-Jays has been much greater. In 1992-1993, 30% of the extant population occurred in a suburban matrix and demographic rates of FSJs in suburban habitats are much reduced from those in well-managed wildlands (Bowman 1998, Breininger 1999). In many areas of the state, suburban FSJ populations have declined by 50-100% since the 1992-93 survey. If we assume an averaged decline of 70% in suburban habitats and 1200 groups occurred in suburban habitats in 1992-93, then fewer than 400 of these FSJ groups are likely still

to persist. It's possible that these declines have been much greater. Jays outside of managed areas and suburban areas could occur on either privately managed habitats but it is more likely these privately owned habitats are unmanaged for FSJs. It is clear from the data we presented from the Lake Wales Ridge that declines in unmanaged habitats were greater than in managed habitats. Coupled with a 26% decline in managed areas, we might conclude that overall, in managed, unmanaged and suburban habitats, a decline of ~ 35-40% at minimum has occurred since 1992-93. From this, we project that the current population of FSJs numbers around 2400-2600 groups. Of course, this excludes Ocala National Forest where we have neither a clear idea of current population size nor of recent population trends.

The Path to Recovery

Because of the decreased size of most populations in most genetic groups and the increasingly fragmented spatial structure of scrub, the immediate need is to identify the core population(s) within each genetic group. These cores will be those populations that have the greatest potential carrying capacity, where extant populations are large enough so that they are not at immediate risk of extirpation and can colonize habitat as it is restored, and occur within a connected network of other scrub patches that have the potential to support FSJ populations. For these cores, an *immediate* improvement of habitat will be necessary to increase the probability of population growth. Further decreases in population size or connectivity will likely condemn us to an eternal strategy of translocation, assuming any source populations exist, to ensure populations grow on restored sites. Appropriate management conducted while FSJs still occur in the larger, connected landscape can result in large, growing populations which, in some cases, appear to have rescued one or more genetic groups from the risk of eminent extirpation. Below we provide a number of case studies where management resulted in significant population increases.

Halpata Tastanki Preserve, Marion County, Genetic Group D (pers. comm. Mary Barnwell)

This site was not surveyed in 1992-1993, notably because the site did not appear to have any scrub based on the mapping methods used to delineate potential FSJ habitat. Initially, this site was longleaf pine and sandhill which was logged, and then converted to semi-improved pasture. The site is currently owned and managed by Southwest Florida Water Management District. Monitoring FSJs became a priority in 1997 and during that first year only 2 groups of FSJs were observed. Since 2000, habitat restoration has included 1,150 acres of

mechanical treatment and an increased use of fire. Additionally, approximately 170 acres of former pine plantation has been cut to enhance habitat connectivity and reduce edge effects. Patches of restored oak scrub occur within a matrix of sandhill. A total of 18,966 acres has been burned since ~1999 and most burn units are on 2-3 year rotations, but onsite managers also burn some management units up to once a year to keep open sandy patches. This might be too frequent a regime for scrub, but is appropriate for sandhill. This regime keeps the sandhill habitat open, but fires burn into the scrub less frequently. The result is fire-maintained scrub of suitable structure embedded in a relatively open matrix that can support some jays and facilitate movement of jays throughout the population. This appears to be a textbook example of ecosystem management, where the fire regime appropriate for the dominant cover type is initiated and fire achieves its natural return intervals of embedded habitat based on fuel loads and fire conditions.

We can't definitely state how this population grew from 2 pairs in 1997 to nearly 30 in 2010. It is possible that some of this was due to intrinsic population growth as management improved habitat suitability for FSJs. In addition, it is likely that immigration occurred from nearby populations from both private and public lands. Unfortunately, future immigration may be hampered by development in the larger landscape surrounding the preserve. Long-leaf forest plantations on its northern boundary, development along the southern boundary and a road expansion on its eastern boundary all could limit FSJ movement to and from this site.

Seminole State Forest, Lake County, Genetic Group D (Pers. Comm. Ralph Risch)

Seminole State Forest was purchased under Florida's Conservation and Recreational Lands (CARL) program and since 1990, managed by the Florida Division of Forestry, with the goal of protecting and maintaining the native biological diversity of the many ecosystems that comprise the state forest. The FSJ population on Seminole State Forest increased from 18 groups in 1992-93 to 44 groups in 2010, primarily because of habitat restoration and enhancement, and increased effort to locate individual groups in a widely dispersed population. Habitat restoration has occurred on approximately ~1500 acres of the total ~5500 xeric scrub acres that occur on the forest. Approximately, ~1100 acres of restored scrub is currently occupied by FSJs. Another 500 acres was former pasture on scrub soils and is recovering back into scrub; these areas support 12 groups of FSJs. When potential habitat is overgrown, FSJs will frequently use atypical, but open habitats. Since 2006, a further 1300 acres has been restored and is now suitable for FSJs with a

few resident groups. Since 2006, a census of all FSJs on Seminole State Forest has been conducted every six weeks and as many birds as possible have been banded (typically 80-90% of FSJs are banded at any given time). Efforts to find all patches of usable scrub in the forest have been ongoing. Population growth has likely resulted from intrinsic growth in response to improved habitat conditions but some may also be attributable from immigration from nearby areas. Immigration has decreased over time, coinciding with declines of smaller populations in the larger landscape. Continued growth of this core population could provide a source for FSJs to emigrate back to restored habitats or as a source for birds for translocations.

Lyonia Preserve, Volusia County, Genetic Group G

Lyonia Preserve is a 360 acre joint project of the Volusia County Land Acquisition and Management division and the county school board to restore and maintain scrub habitat. Since 1994, both fire and mechanical means have been used to restore the low and open structure preferred by scrub species. Prior to 1994, this site had a dense canopy of sand pine and no FSJs were present. Restoration efforts began in 1994 and FSJs quickly appeared on the site, likely immigrants from nearby suburban populations in Deltona. The population grew rapidly to the point today where it numbers over 30 groups. This is likely above the carrying capacity of this site, but may be maintained by continued immigration from declined but not yet extirpated suburban populations. It is likely that when immigration pressure is relaxed, the population will stabilize closer to its carrying capacity.

Manatee Wellfield, Duette Preserve, Manatee County, Genetic Group F

The ~1000 acre Manatee Wellfield is owned by Mosaic Fertilizer. As mitigation for impacts resulting from a Section 10 HCP permit, much of this property was placed in a long-term conservation easement and aggressive habitat restoration ensued. Adjacent to the Wellfield was the Duette Preserve, owned and managed by Manatee County. As part of its mitigation, Mosaic began a decades-long translocation project, first moving helpers and individual birds from the permitted site and then moving entire families as those sites were mined. Leveraged by the aggressive habitat management occurring on the Wellfield, Manatee County began its own aggressive scrub restoration program. On both sites, over 5,000 acres of scrub has been restored

and is suitable for FSJs. Following the onset of translocations in 2003, the population grew slowly, reaching only 6 groups by 2008. However, by the end of 2008 translocation methods were changed which increased the success rate and much of the recently restored habitat was reaching suitability for jays. Between 2008 and 2011, the population grew from 6 groups to 29; of these 23 are comprised of translocated birds or their direct descendants. Six groups are comprised of birds that emigrated from overgrown and suburban habitat in the larger landscape. The total carrying capacity of these sites exceeds 100 groups and if continued their restoration will likely eliminate serious extinction risk for this genetic unit.

These examples demonstrate that aggressive habitat management can result in increases in local populations of Florida Scrub-Jays, but only when a source of immigrants is available. These sources can be large, self-sustaining populations or they can be suburban populations that are likely in decline, but from which birds readily emigrate. However, suburban sources of colonists are finite and as suburban populations decline, their utility in larger- scale metapopulation dynamics declines as well.

Fire is an essential tool and can potentially be coupled with mechanical treatment to rapidly return extremely overgrown habitats to a structure appropriate for use by Florida Scrub-Jays (Menges and Gordon 2010). We stress that management action to restore overgrown scrub for Florida Scrub-Jays needs to begin *immediately* so that remaining local populations in and around managed sites do not further dwindle to unrecoverable levels. We provide data in this report so that managers can identify site-specific population goals based on extant habitat. Managers must determine how much of this habitat is suitable and how much requires restoration. The rate at which restoration proceeds should be based on the potential for recolonization of those habitats. In landscapes where large, source populations of jays occur in a well-connected network of scrub patches that facilitate dispersal, restoration can be of lower priority. But in those landscapes where source populations may be declining or ephemeral, such as suburban populations, then restoration of nearby managed lands should begin as quickly as possible. The results of this report, suggest the vast majority of sites will require immediate amelioration.

Using their knowledge of local patterns of land use and the size, number, and distribution of extant jay populations on non-managed private lands, especially suburban populations, managers need to quickly develop regional strategies (by the genetic unit) that will;

- 1) Increase core populations on managed sites in each of the 10 genetic units.
- 2) Improve regional connectivity by facilitating movements among core populations and smaller satellite populations.

The goal should be to increase populations of Florida Scrub-Jays on currently managed lands from the present 1253 groups closer to their carrying capacity of over 3000 groups. Only then might the recovery of this Threatened species potentially seem feasible.

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Appendix I - Florida Scrub-Jay Statewide Managed Areas Assessment

MANAME	CUR_GRP	CUR_INDS	LASTYEAR	92_93_GRP	CHNG_GRP	TOT_S	70_CARCAP
Al Bar Ranch	0	0	2010	21	-21	360.69	10
Alafia River State Park	0	0	2010	1	-1	11.09	0
Allan David Broussard Catfish Creek Preserve State Park	13	57	2009	34	-21	1748.89	49
Alva Scrub Preserve	2	5	2010	1	1	26.57	1
Amberjack Environmental Park	1	2	2010	3	-2	135.24	4
Apollo Eleven Park	0	0	2010	1	-1	9.54	0
Archbold Biological Station	116	342	2010	84	32	3134.55	88
Archie Carr National Wildlife Refuge	0	0	2010	3	-3	28.47	1
Atlantic Ridge Ecosystem	4	12	2010	9999	9999	114.76	3
Atlantic Ridge Preserve State Park	1	2	2010	9999	9999	15.33	0
Avon Park Air Force Range	57	155	2010	98	-41	7859.25	220
Babcock Ranch Preserve	0	0	2010	0	0	181.93	5
Balm-Boyette Scrub	0	0	2010	1	-1	828.76	23
Bayonne Site	0	0	2010	1	-1	18.70	1
Beker	0	0	2009	1	-1	620.86	17
Blue Spring State Park	10	42	2009	1	9	800.07	22
Bright Hour Watershed	8	32	2010	21	-13	342.63	10
Brohard Beach and Paw Park	1	2	2009	1	0	4.18	0
Buck Creek Preserve	0	0	2010	1	-1	44.18	1
Buck Lake Conservation Area	7	15	2009	4	3	413.89	12
Cameron Preserve	0	0	2010	1	-1	90.90	3
Camp Blanding Military Reservation	2	2	2010	0	2	339.08	9
Canaveral National Seashore	7	28	2008	22	-15	1532.25	43
Cape Canaveral Air Station	120	318	2006	123	-3	4456.54	125
Capron Ridge Sanctuary	3	12	2009	1	2	16.91	0
Carlin Park	1	3	2009	1	0	28.03	1
Carter Creek Lake Wales Ridge National Wildlife Refuge	0	0	2009	0	0	0.00	0
Carter Creek Tract_Functional Lake Wales Ridge Wildlife and Environmental Area	3	10	2009	35	-32	1372.37	38
Caspersen Beach County Park	3	6	2010	3	0	5.29	0
Cedar Key Scrub State Reserve	4	9	2009	3	1	779.72	22
Charlotte Harbor Preserve State Park	5	14	2009	9	-4	909.30	25
Chassahowitzka Wildlife Management Area	0	0	2010	0	0	496.39	14
Clements Tract Lake Wales Ridge Wildlife and Environmental Area	2	4	2009	9	-7	203.61	6
Coconut Point Park	0	0	2010	1	-1	30.74	1
Coconut Point Sanctuary	1	2	2010	0	1	49.18	1
Conner Preserve	0	0	2010	9999	9999	34.93	1
Crooked Lake Prairie	1	1	2009	9999	9999	164.31	5
Crooked Lake West - Stuart Tract	5	19	2009	1	4	214.29	6
Cross Bar Ranch Wellfield	0	0	2010	2	-2	42.38	1
Deep Creek Properties	1	3	2010	0	1	170.45	5
Deer Prairie Creek Preserve	1	2	2010	1	0	72.17	2
Dicerandra Scrub Sanctuary	2	4	2010	10	-8	41.35	1

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MANAME	CUR_GRP	CUR_INDS	LASTYEAR	92_93_GRP	CHNG_GRP	TOT_S	70_CARCAP
Disney Wilderness Preserve	9	29	2009	37	-28	1483.58	42
Doris Leeper Spruce Creek Preserve	0	0	2010	4	-4	865.49	24
Duette Park	12	0	2010	5	7	3791.86	106
Ellis (Royal Trails)	0	0	2010	0	0	58.68	2
Enchanted Forest Sanctuary	1	2	2010	0	1	116.92	3
Estero Bay Preserve State Park	0	0	2010	9999	9999	82.61	2
Etoniah Creek State Forest	1	2	2009	9999	9999	1007.15	28
Fisheating Creek Wildlife Management Area	1	4	2009	0	1	346.34	10
Fisheating Creek/Lykes Brothers Conservation Easement	22	58	2010	15	7	1516.10	42
Fisheating Creek/Smoak Groves Conservation Easement	7	25	2010	1	6	152.99	4
Flamingo Villas Lake Wales Ridge National Wildlife Refuge	9	33	2009	7	2	687.02	19
Flutie Conservation Area	1	3	2010	0	1	17.83	0
Flying Eagle Ranch	0	0	2009	1	-1	280.99	8
Fox Creek	1	1	2010	1	0	0.00	0
Fox Lake Sanctuary	1	2	2010	5	-4	228.04	6
Fred C. Babcock-Cecil M. Webb Wildlife Management Area	0	0	2010	1	-1	0.00	0
Gamble Rogers Memorial State Recreation Area at Flagler Beach	0	0	2010	0	0	9.85	0
Gemini Springs Park	0	0	2009	0	0	0.00	0
Golden Aster Scrub Nature Preserve	1	3	2010	2	-1	261.21	7
Gould Road Tract Lake Wales Ridge Wildlife and Environmental Area	4	22	2009	6	-2	191.48	5
Green Swamp	2	2	2008	5	-3	430.74	12
Grissom Parkway	3	9	2009	3	0	105.42	3
Half Moon Wildlife Management Area	8	28	2009	17	-9	126.51	4
Halpata Tastanaki Preserve	30	110	2009	9999	9999	95.22	3
Hatchineha Ranch	2	7	2009	1	1	476.08	13
Headwaters at Duette Park	0	0	2010	1	-1	40.64	1
Helen and Allan Cruickshank Sanctuary	6	24	2009	2	4	94.11	3
Henscratch 27 Tract Lake Wales Ridge Wildlife and Environmental Area	0	0	2010	0	0	179.98	5
Henscratch Conservation Easement	0	0	2010	1	-1	324.35	9
Henscratch Tract_Functional Lake Wales Ridge Wildlife and Environmental Area	2	6	2009	8	-6	559.48	16
Hickey Creek Mitigation Park Wildlife and Environmental Area	3	7	2009	3	0	110.74	3
Hickory Lake Scrub County Park	0	0	2010	7	-7	36.31	1
Highland Park Estates Tract_Functional Lake Wales Ridge Wildlife and Environmental Area	12	26	2010	17	-5	1175.58	33
Highlands Hammock State Park	4	9	2009	12	-8	1273.01	36
Highlands Ridge Tract_Functional Lake Wales Ridge Wildlife and Environmental Area	18	45	2010	45	-27	1851.98	52
Hobe Sound National Wildlife Refuge	0	0	2010	2	-2	323.62	9
Hog Point Cove	2	6	2010	0	2	11.23	0
Holmes Avenue Tract_Functional Lake Wales Ridge Wildlife and Environmental Area	7	20	2009	13	-6	964.11	27
Hunters Brooke Conservation Easement	1	4	2009	0	1	3.27	0
Hypoluxo Scrub Natural Area	0	0	2010	1	-1	97.42	3
Indrio North Savannahs	1	6	2010	9999	9999	32.18	1
Jack Creek	1	3	2009	5	-4	469.00	13

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MANAME	CUR_GRP	CUR_INDS	LASTYEAR	92_93_GRP	CHNG_GRP	TOT_S	70_CARCAP
Jonathan Dickinson State Park	20	54	2009	42	-22	2836.37	79
Jordan Scrub Sanctuary	6	13	2009	6	0	282.23	8
Juno Dunes Natural Area	1	1	2010	5	-4	357.48	10
Jupiter Inlet Lighthouse Outstanding Natural Area	0	0	2009	3	-3	63.24	2
Jupiter Ridge Natural Area	2	5	2010	1	1	205.19	6
Kissimmee Chain of Lakes	0	0	2010	2	-2	366.35	10
Kissimmee Prairie Preserve State Park	2	5	2009	9999	9999	753.90	21
Kissimmee River	0	0	2010	4	-4	416.37	12
Kohn Conservation Easement	0	0	2010	6	-6	19.77	1
Lake Apopka Restoration Area	2	5	2009	1	1	2.43	0
Lake Blue Tract Lake Wales Ridge Wildlife and Environmental Area	0	0	2010	0	0	62.68	2
Lake June-in-Winter Scrub State Park	7	35	2009	9	-2	663.15	19
Lake Kissimmee State Park	7	22	2008	2	5	483.18	14
Lake Lizzie Conservation Area	0	0	2009	0	0	200.30	6
Lake Manatee Lower Watershed	2	10	2006	0	2	597.06	17
Lake Manatee State Park	0	0	2010	1	-1	164.49	5
Lake Monroe Conservation Area	4	12	2009	9999	9999	564.61	16
Lake Panasoffkee	1	0	2009	9999	9999	570.91	16
Lake Placid Scrub Tract Lake Wales Ridge Wildlife and Environmental Area	34	120	2009	27	7	892.65	25
Lake Trafford Impoundment	0	0	2010	1	-1	0.00	0
Lake Wales Ridge State Forest	16	63	2009	14	2	4876.68	137
Lake Woodruff National Wildlife Refuge	0	0	2010	0	0	189.79	5
Lakeland Highlands Scrub	1	1	2009	2	-1	290.24	8
Legacy Trail	0	0	2010	1	-1	255.25	7
Lemon Bay Park and Environmental Center	0	0	2009	1	-1	28.65	1
Little Manatee River	0	0	2010	1	-1	29.14	1
Little Manatee River (SWFWMD)	3	11	2009	0	3	531.39	15
Little Manatee River State Park	2	4	2009	1	1	649.91	18
Loggerhead Park	0	0	2010	1	-1	0.02	0
Longleaf Pine Preserve	0	0	2010	0	0	634.03	18
Lori Wilson Park	0	0	2010	1	-1	10.64	0
Lower Peace River Corridor	1	3	2009	9999	9999	117.43	3
Lower Wekiva River Preserve State Park	0	0	2010	2	-2	210.68	6
Lyonia Preserve	31	144	2009	9999	9999	309.41	9
Malabar Scrub Sanctuary	0	0	2010	7	-7	347.76	10
Manasota Scrub Preserve	1	2	2009	1	0	2.14	0
Maritime Hammock Sanctuary	0	0	2010	0	0	0.00	0
Marjorie Harris Carr Cross Florida Greenway State Recreation and Conservation Area	14	48	2009	16	-2	3316.91	93
McJunkin Tract Lake Wales Ridge Wildlife and Environmental Area	22	66	2010	7	15	543.75	15
Merritt Island National Wildlife Refuge	275	0	2009	384	-109	13707.17	384
Messana Tract Lake Wales Ridge Wildlife and Environmental Area	0	0	2010	0	0	50.36	1
Micco Scrub Sanctuary	3	6	2009	15	-12	123.75	3

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MANAME	CUR_GRP	CUR_INDS	LASTYEAR	92_93_GRP	CHNG_GRP	TOT_S	70_CARCAP
Mike Roess Gold Head Branch State Park	0	0	2010	0	0	153.42	4
Moody Branch Mitigation Park Wildlife and Environmental Area	3	10	2009	2	1	390.94	11
Moss Park	0	0	2010	0	0	194.92	5
Mountain Lake Cutoff Lake Wales Ridge Wildlife and Environmental Area	0	0	2010	0	0	87.88	2
Myakka River	1	2	2010	0	1	126.73	4
Myakka River State Park	0	0	2010	4	-4	244.19	7
Myakka State Forest	1	3	2009	1	0	21.60	1
North Buck Lake Scrub Sanctuary	0	0	2010	1	-1	51.17	1
North Peninsula State Park	4	10	2009	5	-1	357.59	10
North Sebastian Conservation Area	7	30	2009	5	2	154.48	4
Old Miakka - O'Neil Property	0	0	2010	1	-1	69.38	2
Orange Blossom Tract_Functional Lake Wales Ridge Wildlife and Environmental Area	0	0	2010	2	-2	96.57	3
Oscar Scherer State Park	17	43	2009	18	-1	422.67	12
Oyster Creek Regional Park	0	0	2010	1	-1	10.00	0
Palatlakaha River Park	0	0	2010	1	-1	20.26	1
Paw-Paw Preserve	0	0	2010	0	0	3.02	0
Platt Branch Mitigation Park Wildlife and Environmental Area	6	14	2009	14	-8	201.88	6
Port Orange City Forest	0	0	2010	0	0	489.08	14
Potts Preserve	6	0	2009	8	-2	758.80	21
Prairie Creek Preserve (Charlotte County)	6	14	2010	0	6	253.38	7
Prairie/Shell Creek	5	14	2010	1	4	108.33	3
Radnor	1	1	2009	4	-3	81.40	2
River to Sea Preserve	0	0	2010	0	0	12.88	0
Rock Springs Run State Reserve	0	0	2010	10	-10	935.09	26
Rookery Bay National Estuarine Research Reserve	0	0	2009	2	-2	393.27	11
Ross Prairie State Forest	3	7	2009	8	-5	366.27	10
Rotunda Community Park and Preserve	1	2	2010	9999	9999	11.78	0
Royce Unit Lake Wales Ridge Wildlife and Environmental Area	5	19	2009	1	4	454.00	13
Saddle Blanket Scrub Preserve	2	5	2009	2	0	519.18	15
Salt Lake Wildlife Management Area	4	12	2009	3	1	107.56	3
Sand Lakes Conservation Area	0	0	2010	2	-2	47.01	1
Savannas Preserve State Park	7	19	2009	9	-2	731.20	20
Scottsmoor Flatwoods Sanctuary	0	0	2010	1	-1	108.20	3
Scrub Conservation Bank	0	0	2010	3	-3	102.39	3
Seabranck Preserve State Park	0	0	2009	4	-4	572.17	16
Seacrest Scrub Natural Area	0	0	2010	0	0	53.37	1
Sebastian Scrub Conservation Area	1	3	2009	0	1	6.38	0
Sebastian Stormwater Park	1	5	2009	4	-3	2.28	0
Seminole State Forest	44	97	2010	18	26	5357.90	150
Shamrock Park and Nature Center	2	5	2010	5	-3	37.59	1
Sheraton Plaza Preserve	2	9	2006	9999	9999	51.44	1
Sherwood L. Stokes Preserve/Lake Marion	0	0	2009	0	0	9.02	0

Appendix I - Florida Scrub-Jay Statewide Managed Areas Assessment

MANAME	CUR_GRP	CUR_INDS	LASTYEAR	92_93_GRP	CHNG_GRP	TOT_S	70_CARCAP
Silver Lake Tract Lake Wales Ridge Wildlife and Environmental Area	7	20	2009	6	1	242.44	7
South Babcock	1	2	2009	1	0	77.59	2
South Lake Conservation Area	2	6	2010	1	1	57.69	2
South Venice Lemon Bay Preserve	6	19	2009	3	3	60.03	2
Spessard Holland North Beach Park	0	0	2010	1	-1	0.00	0
Split Oak Forest Mitigation Park Wildlife and Environmental Area	0	0	2009	1	-1	544.72	15
St. Sebastian River Preserve State Park	45	130	2009	9999	9999	2232.35	63
Starkey Wilderness Park	0	0	2010	1	-1	1502.69	42
Sun N Lake Tract_Functional Lake Wales Ridge Wildlife and Environmental Area	7	21	2009	1	6	323.02	9
Sunray Tract Lake Wales Ridge Wildlife and Environmental Area	0	0	2010	3	-3	201.69	6
Telegraph Creek Preserve	0	0	2010	1	-1	108.15	3
Ten Mile Ridge	0	0	2010	1	-1	2.97	0
Three Lakes Wildlife Management Area	1	3	2009	4	-3	1729.85	48
Tiger Creek Preserve	0	0	2009	1	-1	329.51	9
Tippecanoe Environmental Park	1	2	2010	6	-5	147.09	4
Tippecanoe II Florida Scrub-jay Mitigation Area	3	6	2010	0	3	99.02	3
Tubbs Tract Lake Wales Ridge Wildlife and Environmental Area	0	0	2010	1	-1	40.93	1
Turkey Creek Sanctuary	0	0	2010	9999	9999	72.50	2
Twin Shores Park	0	0	2010	0	0	15.29	0
Upper Hillsborough	0	0	2010	1	-1	26.39	1
Upper Lake Marion Creek Watershed	0	0	2009	0	0	63.67	2
Upper Lakes Basin Watershed	11	45	2009	10	1	891.49	25
Valkaria Scrub Sanctuary	16	51	2009	17	-1	334.78	9
Wabasso Scrub Conservation Area	4	15	2009	9999	9999	44.69	1
Weeki Wachee Springs State Park	0	0	2010	0	0	367.41	10
Weekiwachee Preserve	0	0	2010	0	0	1158.77	32
Wekiwa Springs State Park	0	0	2009	2	-2	293.35	8
Well Field Scrub-jay Habitat	8	23	2010	9999	9999	497.30	14
Whaley Conservation Easement	0	0	2010	9999	9999	198.86	6
Withlacoochee State Forest	2	6	2010	0	2	1302.55	36