United States Department of the Interior

FISH AND WILDLIFE SERVICE
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Department of the Air Force
23rd Wing, Detachment 1
Avon Park Air/Ground Training Complex
Avon Park Air Force Range, Florida 33825

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Counties:	Highlands and Polk

Dear Colonel Pechiney:

This document transmits the Fish and Wildlife Service's (Service) biological opinion based on our review of the U.S. Air Force (USAF) proposed Joint Integrated Fires Exercises (JIFE) action at Avon Park Air Force Range (APAFR) in Highlands and Polk Counties, Florida, and its adverse effects on the eastern indigo snake (*Drymarchon corais couperi*), Florida scrub-jay (FSJ) (*Aphelocoma coerulescens*), red-cockaded woodpecker (RCW) (*Picoides borealis*), and the Florida grasshopper sparrow (FGS) (*Ammodramus savannarum*) in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*).

The USAF also provided determinations of "may affect, not likely to adversely affect" for the wood stork (*Mycteria americana*), Audubon's crested caracara (*Polyborus plancus audubonii*), bald eagle (*Haliaeetus leucocephalus*), and Florida panther (*Puma concolor coryi*), and "no effect" for wireweed (*Polygonella basiramia*) and pigeon wing (*Clitoria fragrans*). The Service concurs with the USAF's "may affect, not likely to adversely affect" determinations and with the USAF's "no effect" determinations.

Acronyms and abbreviations used throughout this biological opinion are outlined in Table 1.

This biological opinion is based on information provided in the USAF's October 4, 2006, Biological Assessment (BA), the April 27, 2006, Final Environmental Assessment (EA), telephone conversations, and other sources of information. A complete administrative record of this consultation is on file in the South Florida Ecological Services Office, Vero Beach, Florida.

The Use of Best Scientific and Commercial Information by the Service

The Service uses the most current and up-to-date scientific and commercial information available. The nature of the scientific process dictates that information is constantly changing and improving as new studies are completed. The scientific method is an iterative process that builds on previous information. As the Service becomes aware of new information, we will ensure it is fully considered in our decisions, evaluations, reviews, and analyses as it relates to the base of scientific knowledge and any publications cited in our documents.

Specifically, there is one such document cited in this biological opinion the Service acknowledges has been affected in its cited form by new scientific information. The Service has taken these new sources of information into account when using this document to help guide our analysis and decisions. This document is the South Florida Multi-Species Recovery Plan (MSRP) of 1999 (Service 1999).

South Florida Multi-Species Recovery Plan

The MSRP was designed to be a living document and it was designed to be flexible to accommodate the change identified through ongoing and planned research and would be compatible with adaptive management strategies. These principals are set forth in both the transmittal letter from the Secretary of the Interior and in the document itself. As predicted, this is what indeed occurred in the intervening years since the MSRP was published. The Service uses the MSRP in the context it still presents useful information when taken in conjunction with all the new scientific information developed subsequent to its publication.

Consultation History

On February 9, 2006, the Service received a BA for the JIFE dated January 30, 2006. The BA identified 10 listed species that could be affected by the proposed JIFE training. The USAF provided determinations of "may affect, not likely to adversely affect" for the wood stork, Audubon's crested caracara, bald eagle, and Florida panther, and "no effect" for wireweed and pigeon wing. USAF determined the proposed JIFE "may adversely affect" four species: the eastern indigo snake, FSJ, RCW, and the FGS and requested initiation of formal consultation.

On February 27, 2006, the Service received a hard copy of the draft EA for the JIFE.

On April 24, 2006, the Service provided the USAF with a Biological Opinion for the JIFE to be conducted in May 2006. The Service concurred with the USAF's determinations of "may affect, not likely to adversely affect" for the wood stork, Audubon's crested caracara, bald eagle, and Florida panther and "no effect" for wireweed and pigeon wing. The Service stated that the proposed action was not likely to jeopardize the continued existence of the eastern indigo snake, FGS, FSJ, and RCW.

JIFE was conducted as described in the BA on May 1 and 7, 2006. Several wildfires were ignited as the result of ordnance used during the exercise and a total of 8,910 acres were burned. In a memorandum dated July 21, 2006, the USAF notified the Service that two FSJ nests along

with contents were consumed by fire. Since the allowable take of one FSJ nest was exceeded the USAF requested reinitiation of formal consultation.

On October 4, 2006, USAF submitted a new BA assessing the effect of future JIFEs in light of wildfires which occurred in May 2006. USAF included conservation measures to mitigate the effects of uncontrolled ordnance-related wildfires. As with the former BA the USAF provided determinations of "may affect, not likely to adversely affect" for the wood stork, Audubon's crested caracara, bald eagle, and Florida panther, and "no effect" for wireweed and pigeon wings. USAF determined the proposed JIFE "may adversely affect" the eastern indigo snake, FSJ, RCW, and FGS. The following biological opinion has been prepared in response to the BA.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

Proposed Action

The 23rd Wing, Detachment 1, Operation Location Alpha, proposes to conduct a semiannual JIFE at APAFR. These exercises may occur at any time though, typically, JIFEs will be scheduled for the first week in November and the first week in May. The exact timing will depend on a number of variables, including availability of assets, rotation schedules of military units, weather, and fire danger. This biological opinion will apply to all JIFEs held between November 1, 2006, and May 31, 2010. A report will be prepared, summarizing the effects of these exercises, and a new biological assessment will be required for future JIFEs after May 2010.

During JIFE small groups of soldiers, known as Tactical Air Control parties (TACPs) and Forward Observers (FOs), will be trained to coordinate ordnance delivery from aircraft and artillery on targets in simulated combat situations. The joint training exercise includes a variety of aircraft, helicopters, artillery, and ground-based troops. The emphasis of the exercise is coordinating the delivery of ordnance from aircraft and artillery by on-the-ground air controllers and FOs for a combined arms affect. Although some of the training activities have been assessed in the past, some elements are new or have been expanded. New elements include creating new mortar firing points and areas, firing artillery into a small, high-explosive (HE) impact area, and firing ground-based, inert rockets from a new location.

The proposed action involves two training operations: (1) Advanced Operations, which take place in the North Conventional (Bravo) and the North Tactical (Foxtrot) Ranges, and (2) Mid-level Operations, which take place in the South Tactical (Echo) Range (Figure 1). The Advanced Operations would coordinate the fire from aircraft, artillery, and mortars at targets in the north ranges. The Mid-Level Operations would coordinate fire from the same type of assets in the south range, but in less complex scenarios. The TACPs and FOs would remain on their respective ranges for training, while the aircraft, artillery, and mortar assets would be shared. Aircraft would move quickly and freely from the north and south ranges. The artillery would either relocate from one firing location to another in order to participate in the Advanced and Mid-Level Operations, or remain in the same firing location and participate in either operation

by pivoting. The mortars, due to their limited range, would have to relocate closer to the north ranges or the south range to participate in the Advanced and Mid-level Operations.

The JIFE is proposed for the first week of May and the first week of November, each year. The training scenarios could occur at any time in a 24-hour period, but since exercises must take place during both day and night conditions, the most typical scenario will have activities starting in the later afternoon and continuing until midnight. A JIFE could occur for up to 16 consecutive days, although the duration of past JIFEs has been significantly less. For example, the May 2006 JIFE was 7 days long (May 1 through 7). The JIFE in November 2006 is scheduled for 6 days (November 3 through 8).

Preparation and Staging

The exercise will be broken down into stages of progression. An advance party will arrive at APAFR 2 days prior to the field exercise to prepare and ensure that infrastructure is in place, which includes lodging, food service, sanitation, communications, safety, and insuring that the airfield, airspace, impact ranges, landing zones, firing points, and road networks are available and serviceable for the proposed action. The second stage will take up to 2 days and will include organization and assembly of participating units of weapon and personnel assets. Generally, the fixed-wing assets (airplanes) with their respective support vehicles and support personnel will stage at the MacDill Deployment Unit Complex (DUC) or the unit's home station, while rotary-wing assets (helicopter), unmanned aerial vehicles (UAVs), howitzers (canons), rocket launching vehicles, mortars, TACPs and FOs, and command center personnel would stage at APAFR. There would be the potential for all units, including their respective support vehicles and support personnel, to stage at APAFR, except for the support vehicles and support personnel for the fixed-wing bombers. Two howitzers would have the option of being air-dropped into drop zones and staged there.

Part of staging will include assembly of supplies and weapons platforms (aircraft, howitzer, High Mobility Artillery Rocket System [HIMARS], and mortar) for the exercise, as well as the central command post located in the hanger with communications in the airfield main tower. The supplies will include fuel, ammunition and ordnance, food, water, sanitation, support vehicles, communication and technological equipment, and tools and equipment for vehicles and weaponry.

The third will be operations, which is the actual participation of the personnel in the exercise. The operational training will last for a minimum of 7 days and a maximum of 9 days. There will be briefings and debriefings in between operational training periods.

The fourth stage will be a final debriefing and demobilization. Areas where high explosives that were known to fall outside of designated HE impact areas will be cleared by explosive ordnance disposal (EOD) teams within 30 days of completion of JIFE. Three days will be allowed for debriefing and demobilization.

Assets Used for the Joint Integrated Fires Exercises

The assets approved for use at APAFR and that will be used in the JIFE are categorized as air-based assets or ground-based assets. Air-based assets are further described as fixed-wing and rotary-wing assets. Fixed-wing assets are further described as fighter/attack aircraft, gunships, and bombers. The typical fixed-wing fighter/attack aircraft that would participate in the JIFE includes the F-22 Raptor, F-16 Falcon, F-15E Strike Eagle, S-3 Viking, F/A-18 Hornet, AV-8B Harrier, and A-10 Thunderbolt. The AC-130 Specter gunship would participate in the JIFE as would the B-2 bomber. While not limited to the following, the typical rotary-wing aircraft that would participate in the JIFE would include the AH-1 Cobra and the UH-1N Huey. Ground assets would include mortars (81 mm and 120 mm), howitzers (105 mm and 155 mm), and rocket-launching vehicles launching Reduced Range Practice Rockets (RRPRs).

Weapons and Ordnance

The types of assets with the number of maximum participating weapons platforms, personnel, and support vehicles that would participate in the JIFE are listed in Table 2. The number of ordnance expended by the proposed action over the current annual expenditures at APAFR is shown in Table 3.

Advanced Operations

The Advanced Operations will place the TACPs and FOs on static points, observation towers, and on any building within the mock village located in the Bravo and Foxtrot Ranges (Figure 1). From these locations, the TACPs and FOs are given the training scenario via radio communication. The scenarios include the availability of air (rotary and fix-wing) and ground (artillery and mortars) assets at any given time, along with the current activity and location of hypothetical opposition forces located in the ranges. With this information, the TACPs and FOs prioritize opposition targets and coordinate the available assets to deliver ordnance to the targets. The first day's training scenario would limit the TACPs and FOs to no more than two weapon platform types at any one time. Typical examples may be F-16s and F-15Es, A-10s and 81 mm mortars, and the B-2 and HIMARS. After the first day, the scenario would allow for multiple asset types at any one time and would allow the TACPs and FOs to observe and coordinate attacks from dynamic field positions in sport utility vehicles that would follow a prescribed convoy route.

Aircraft will expend their ordnance and munitions into the Bravo and Foxtrot Ranges as directed by TACPs, and then travel back to the APAFR airfield, MacDill DUC, or their home stations for rearmament and refueling to prepare for the next exercise. When an exercise is completed for the evening, the aircraft and associated support vehicles are maintained on the APAFR airfield or the MacDill DUC.

The two howitzers in the Karen or Joan Drop Zones (DZs) will fire up to eight rounds each into the Bravo Range on the first day of the operational training. After firing, they would be towed by heavy trucks from the Karen or Joan DZs to join the rest of the howitzers in either Firing

Points (FPs) 19 through 22 or FPs 8 through 12. The two howitzers will leave the Karen or Joan DZ by being towed by wheeled trucks cross-country until a tank trail is reached and then on tank trails to established roads. After joining the other howitzers, the unit will continue to conduct fire as requested by the FOs. The howitzers will remain together as a unit for the rest of the exercise.

The platoon of three rocket launchers would fire RRPRs from Oscar Range into the Bravo and Foxtrot Ranges.

All of the listed assets will be available to the TACPs and FOs for the Advanced Operations. All of the hypothetical opposition targets would be existing targets. All of the ordnance delivered by the assets to the targets are approved for use and have been used at APAFR. Ordnance delivered by asset to the Bravo and Foxtrot Ranges during the Advanced Operations for one JIFE is listed in Table 4. The B-2 would not deliver ordnance during the JIFE but would participate in the Advanced and Mid-level Operations in all other respects.

The Foxtrot Range is designed for training with bullets and inert ordnance. There are many approved targets for the various-sized bullets and inert ordnances. The targets and attack headings by aircraft are arranged in a manner that all the expended ammunition remains within the perimeter of the range.

The Bravo Range is designed for training with bullets and HE ordnance. High explosive ordnance includes artillery and mortar ordnance and HE ordnance from AC-130 gunship cannons, 2.75 HE rockets, and Hellfire rockets. The targets and attack headings by aircraft are arranged in a manner that all fragmentation is encompassed within the HE area of the Bravo Range (Figure 2). Artillery and mortars have designated targets and firing points that ensure that all fragmentation stays within the HE area. An RRPR inert rocket fired by the HIMARS is the one exception that allows inert ordnance to be fired into the Bravo Range. Other targets exist in the HE area of the Bravo Range that is designed for the use of bullets and inert ordnance only. The targets and aircraft attack headings are configured to keep the expended munitions within the perimeter of the Bravo Range.

The Hellfire rocket expenditures in the Bravo Range are limited to 48 per year. The Advanced Operations would expend up to 100 missiles per JIFE. The 100 annually would be in addition to the 48 that can currently be expended.

The RRPRs are limited to 81 annually. The JIFE would expend up to 300 RRPRs per JIFE in addition to the 81 that can currently be expended. The 300 RRPRs would be expended in the Foxtrot, Bravo, and Echo Ranges.

Mid-level Operations

The Mid-level Operations involves TACPs and FOs in static positions, including any of the buildings or areas within a mock village and scoring towers, located in the Echo Range (Figure 3). The general scenario is similar to the Advanced Operations with regards to the assets and target prioritizing. The Mid-level Operations are less complex, and more restrictive in the

availability of assets. On the first day of operational training, only single assets will be available at any one time. On the second day, only two types of assets will be available. The remaining operational training will have three assets available. AC-130 gunship will be firing a cannon with 40 mm HEs and a 105 mm training round, with a 40 mm equivalent explosive charge, into the small designated 40 mm surface-danger zone (SDZ) (Figure 4). All other aircraft, both fixed- and rotary-wing, will be available for firing their respective munitions and inert ordnance at the remaining inert-only targets located in the Echo Range outside the 40 mm SDZ.

The mortars will fire the three different types of ordnance on targets within the 40 mm SDZ impact area from the West, East, and North Mortar Firing Areas (MFAs). Three HIMARS rocket launchers will fire from Old Bravo Road and the western end of Alpha Grade into a designated RRPR area in the Echo Range. The 105 and 155 mm howitzers will fire from existing firing points at targets into the 40 mm SDZ.

All of the hypothetical opposition targets will be existing targets. All of the ordnance, except the 105 mm and the 155 mm HEs, have been used and are approved for use on the Echo Range. The 105 mm and 155 mm HEs will be new ordnance introduced to the HE area. The type of ordnance and assets available for the Mid-Level Operations for the Echo Range are listed in Table 5.

Training New to Avon Park Air Force Range

The May 2006 JIFE included new training not previously carried out at APAFR and new or expanded training not included in the one-time JIFE conducted at APAFR during May 2005. This included the addition of new or expanded firing locations, an increase in ordnance deliveries, placement of TACPs and FOs within the HE areas, and the use of howitzers for the first time. In November 2006 the F-22 Raptor “Stealth” aircraft will participate in JIFE for the first time.

Fire Management Conservation Measures

Prescribed fire and firebreak maintenance will be implemented prior to the spring JIFE to mitigate fires caused by ordnance used during the exercise. Existing accessible firebreaks will be prepared around the boundaries of the impact areas. Prescribed fire will be applied to the impact areas and adjacent areas that have enough fuel to carry a fire. These activities, particularly prescribed fire, are dependent on the mission schedule, weather, and available resources and availability of burn permits issued by the Florida Division of Forestry (Florida Department of Agriculture and Consumer Services 2004).

As part of standard operating procedures, the Fire Management Officer (FMO) will advise range operations personnel of the fire danger. Missions will be reviewed to determine if adjustments can be made to mitigate the risk of ordnance-ignited wildfire. In the event of ordnance fire(s) resulting from the JIFE training, the FMO will size-up the fire(s) the following morning and develop a response action with available resources. A response action may include counter-firing and/or direct attack with engines and a tractor-plow depending on the scheduled missions, the location of the fire, environmental conditions and the weather forecast.

During severe fire conditions, depending upon funding availability, one or more qualified plastic sphere dispenser operators and a helicopter with PREMO MK III brand incendiary fire lighter and "Bambi" water bucket will be staged and ready at APAFR to enhance fire control capability. This resource will be employed for wildfire investigation and reconnaissance. It will be used for counter-firing and assist resources on the ground with direct attack.

Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. The Service has determined that the action area for the proposed project is the 106,073 acres which comprise APAFR. In addition, because the impact area of Foxtrot and Echo Ranges clearly extends to the APAFR boundary (Figure 1), there is an unspecified area beyond these boundaries that could potentially be affected directly or indirectly from the proposed action.

STATUS OF THE SPECIES/CRITICAL HABITAT RANGEWIDE – Eastern indigo snake

Species Description

The eastern indigo snake is the largest non-venomous snake in North America, obtaining lengths of up to 8.5 feet (2.6 meters) (Moler 1992). Its color is uniformly lustrous-black, dorsally and ventrally, except for a red or cream-colored suffusion of the chin, throat, and sometimes the cheeks. Its scales are large and smooth (the central 3 to 5 scale rows are lightly keeled in adult males) in 17 scale rows at mid-body. Its anal plate is undivided. In the Keys, adult eastern indigo snakes seem to have less red on their faces or throats compared to most mainland specimens (Lazell 1989). Several researchers have informally suggested that Lower Keys eastern indigo snakes may differ from mainland snakes in ways other than color.

Critical Habitat

Critical habitat has not been designated for this species.

Life History

In northern Florida, eastern indigo snakes breed between November and April, with females depositing 4 to 12 eggs during May or June (Moler 1992). Young hatch in approximately 3 months and there is no evidence of parental care. Limited information on the reproductive cycle in south-central Florida suggests that the breeding and egg-laying season may be extended. In this region, breeding extends from June to January; egg laying occurs from April to July; and hatching occurs during mid-summer to early fall (Layne and Steiner 1996). Snakes in captivity take 3 to 4 years to reach sexual maturity (Speake et al. 1987). Female eastern indigo snakes can store sperm and delay fertilization of eggs. There is a single record of a captive snake laying five eggs (at least one of which was fertile) after being isolated for more than 4 years (Carson 1945). However, there have been several recent reports of

parthenogenesis by virginal snakes. Hence, sperm storage may not have been involved in Carson's (1945) example (P. Moler, Florida Fish and Wildlife Conservation Commission [FWC], personal communication 1998). There is no information on the eastern indigo snake lifespan in the wild, although one captive individual lived 25 years, 11 months (Shaw 1959).

The eastern indigo snake is a generalized predator and will eat any vertebrate small enough to be overpowered. Food items include fish, frogs, toads, snakes (venomous, as well as non-venomous), lizards, turtles, turtle eggs, small alligators, birds, and small mammals (Keegan 1944; Babis 1949; Kochman 1978; Steiner et al. 1983).

Population Dynamics

Eastern indigo snakes require a mosaic of habitats. A study in southern Georgia found that interspersion of tortoise-inhabited sandhills and wetlands improve habitat quality for the snake (Landers and Speake 1980). Eastern indigo snakes require sheltered retreats from winter cold and desiccating conditions, and often use burrows of the gopher tortoise (*Gopherus polyphemus*) when available (Speake et al. 1978; Layne and Steiner 1996). In habitats lacking gopher tortoises, snakes may take shelter in hollowed root channels, hollow logs, or the burrows of rodents, armadillos, or land crabs (Lawler 1977; Moler 1985a; Layne and Steiner 1996). Over most of its range in Florida, the eastern indigo snake frequents diverse habitats such as pine flatwoods, scrubby flatwoods, floodplain edges, sand ridges, dry glades, tropical hammocks, edges of freshwater marshes, muckland fields, coastal dunes, and xeric sandhill communities (Service 1999). Eastern indigos also use agricultural lands and various types of wetlands, with higher population concentrations occurring in the sandhill and pineland regions of northern and central Florida. In extreme south Florida (*i.e.*, the Everglades and Florida Keys), eastern indigo snakes are found in tropical hardwood hammocks, pine rocklands, freshwater marshes, abandoned agricultural land, coastal prairie, mangrove swamps, and human-altered habitats (Steiner et al. 1983). It is thought that they prefer hammocks and pine forests since most observations occur there and use of these areas is disproportionate compared to the relatively small total area of these habitats (Steiner et al. 1983).

Indigo snakes range over large areas and into various habitats throughout the year, with most activity occurring in the summer and fall (Smith 1987, Moler 1985a). In Georgia, the average range of the eastern indigo is 12 acres during the winter (December through April), 106 acres during late spring/early summer (May through July), and 241 acres during late summer and fall (August through November) (Speake et al. 1978). Adult males have larger home ranges than adult females and juveniles; their ranges average 554 acres, reducing to 390 acres in the summer (Moler 1985b). In contrast, a gravid female may use from 3.5 to 106 acres (Smith 1987). In Florida, home ranges for females and males range from 5 to 371 acres and 4 to 805 acres, respectively (B. Smith, Dynamac, personal communication, 2003). At the Archbold Biological Station (ABS), average home range size for females was determined to be 47 acres and overlapping male home ranges to be 185 acres (Layne and Steiner 1996).

Status and Distribution

The eastern indigo snake was listed as threatened on January 31, 1978, (43 FR 4028) due to population declines caused by habitat loss, over-collecting for the domestic and international pet trade, and mortality caused by rattlesnake collectors who gas gopher tortoise burrows to collect snakes.

Effective law enforcement has reduced pressure on the species from the pet trade. However, because of its relatively large home range, this snake is especially vulnerable to habitat loss, degradation, and fragmentation (Lawler 1977; Moler 1985a). The primary threat to the eastern indigo snake is habitat loss due to development and fragmentation. In wildland urban interface areas, residential housing is also a threat because it increases the likelihood of snakes being killed by property owners and domestic pets. Extensive tracts of undeveloped land are important for maintaining eastern indigo snakes.

The indigo snake ranges from the southeastern United States to northern Argentina (Conant and Collins 1998). This species has eight recognized subspecies, two of which occur in the United States: the eastern indigo and the Texas indigo (*D. c. erebennus*). In the United States, the eastern indigo snake historically occurred throughout Florida and in the coastal plain of Georgia and has been recorded in Alabama and Mississippi (Diemer and Speake 1983; Moler 1985b). It may have occurred in southern South Carolina, but its occurrence there cannot be confirmed. Georgia and Florida currently support the remaining endemic populations of the eastern indigo snake (Lawler 1977). The eastern indigo occurs throughout most of Florida and is absent only from the Dry Tortugas and Marquesas Keys and regions of north Florida where cold temperatures and deeper clay soils exist (Cox and Kautz 2000).

Tasks identified in the recovery plan for this species include: habitat management through controlled burning, testing experimental miniature radio transmitters for tracking juveniles, maintenance of a captive breeding colony at Auburn University, recapture of formerly released snakes to confirm survival in the wild, educational lectures and field trips, and efforts to obtain landowner cooperation in conservation efforts (Service 1999).

To protect and manage this species for recovery, large expanses of land must be protected. Management of these lands must be directed towards maintaining and enhancing the diversity of plant and animal assemblages within these properties. Where these goals are achieved, eastern indigo snakes will directly benefit because of improved habitat conditions. Land managers are encouraged to utilize fire as a tool to maintain biodiversity in fire dependent ecosystems.

STATUS OF THE SPECIES/CRITICAL HABITAT RANGEWIDE – Florida scrub-jay

The FSJ was federally listed under the Act as threatened in 1987 due to loss, fragmentation, and degradation of scrub habitats throughout Florida.

Critical Habitat

Critical habitat has not been designated for this species.

Species Description

The FSJ is approximately 25 to 30 centimeters (cm) in length. They are similar in size and shape to the blue jay (*Cyanocitta cristata*), but differ significantly in coloration (Woolfenden and Fitzpatrick 1996a). Unlike the blue jay, FSJs lack a crest and have a pale blue head, wings, and tail. The throat is gray to whitish bordered by a streaked blue-gray breast band. The back and underside are pale gray in color. FSJ eggs are green in color and are flecked with brown.

Life History

The FSJ is a relict species of fire-dominated oak (*Quercus* spp.) scrub habitat that occurs on well drained sandy soils in peninsular Florida. The FSJ is endemic to the xeric oak scrub, rosemary (*Certatiola ericoides*) scrub, open sand pine (*Pinus clausa*) scrub, and open scrubby flatwoods on well-drained sandy soils in peninsular Florida (Fitzpatrick et al. 1991). FSJs depend on recurring fire to keep their habitat in suitable condition for raising their families. Without regular burning, low oaks shrubs grow into trees, leaving the birds exposed to hawks and other predators. At least 10 to 15 percent of the habitat must be bare sand for the birds to store acorns, which is a major food item (Fitzpatrick et al. 1991). Additional food items include small terrestrial invertebrates and vertebrates including frogs, lizards, snakes, bird eggs, and mice. A healthy scrub ecosystem burns approximately every 8 to 15 years. FSJs are extremely habitat-specific, sedentary, and territorial.

FSJs mate for life with breeding taking place usually at 2 years of age; however, breeding as late as 3 and 4 years of age is common. The breeding season is from early March through June, where typically three to four eggs will be laid in a nest constructed of twigs and palmetto (*Serenoa repens*) fibers. A new nest is constructed each year and is located approximately 3 to 10 feet off the ground in a shrubby oak. Usually a pair will raise only one brood annually; however, in the case of nest failures, additional clutches may be laid. These birds form family groups and fledglings remain with their monogamous parents in their natal territories as helpers. Although FSJs may live for more than 10 years (McDonald et al. 1996), most never travel more than a few miles from their birthplace. They do not migrate, but stay close to home, defending a year-round average territory size of approximately 25 acres per breeding pair against predators and other birds. The FSJ was listed as a threatened species in 1987 because of loss, fragmentation, and degradation of scrub habitats throughout Florida.

Population Dynamics

A statewide FSJ census was last conducted in 1992 through 1993, at which time there were an estimated 4,000 groups of FSJs left in Florida (Fitzpatrick et al. 1994). The FSJ was considered extirpated in 10 counties (Alachua, Broward, Clay, Miami-Dade, Duval, Gilchrist, Hernando,

Hendry, Pinellas, and St. Johns) and functionally extinct in 5 more counties (Flagler, Hardee, Levy, Orange, and Putman), where 10 or fewer pairs remained (Fitzpatrick et al. unpublished data). The species may have declined by as much as 25 to 50 percent during the 1980s (Fitzpatrick et al. 1994).

Countywide surveys of Brevard and Charlotte Counties have also revealed population declines. The 1992 through 1993 statewide survey estimated that on Federal lands within Brevard County, there were 860 pairs of FSJs. Surveys from non-Federal lands in Brevard County in 1993 and 1994 estimated 276 breeding pairs were present (Fitzpatrick et al. 1994). The FSJ population estimate on non-Federal lands dropped to 185 pairs in 1999 (Toland 1999). A countywide survey in Charlotte County showed similar numbers of FSJs overall, from 134 families in 1992 through 1993 to 135 families in 2001 (Miller and Stith 2002). The appearance of stability in the Charlotte County survey may be due to a more intensive survey effort on private property during the recent survey. Some metapopulations, such as the one known as Tippecanoe, have shown a decline of 33 families with 75 individuals in 1992 through 1993 to 10 families with 35 individuals in 2001. During the 1992 through 1993 survey, the coastal western metapopulation was estimated at 51 families with 117 individuals. These numbers dropped to 35 families with 89 individuals in 2001 (Miller and Stith 2002).

Results from Stith's (1999) metapopulation viability model included estimates of extinction, quasi-extinction (the probability of a FSJ metapopulation falling below 10 pairs), and an estimate of percent population decline. Twenty-one statewide metapopulations were ranked by the relative risk of extinction and quasi-extinction which provides a measure of susceptibility of each of these metapopulations (Stith 1999). The model predicted that five metapopulations have low risk of quasi-extinction (*i.e.*, low probabilities of extinction and quasi-extinction), two of the five, however, later experienced significant population declines. Eleven of the remaining 21 metapopulations were predicted to be highly vulnerable to quasi-extinction, if no additional habitats were acquired, and five were moderately susceptible. Three of the metapopulations evaluated (Flagler, central Lake, and south Palm Beach) were classified as highly vulnerable to quasi-extinction and had low potential for improvement since little or no habitat is available to acquire or restore.

Populations of the FSJ on APAFR are divided into four different groups. These four groups include the north and south bombing range ridges; a group occupying a ridge along the Kissimmee River; and a small group scattered throughout APAFR (Figure 8). From 1991 to 1999, the FSJ population on APAFR declined by 36.4 percent from 99 groups to 63 groups (USAF 2000). The population continued to decline to 51 groups from 1999 to 2001 (U.S. Navy [Navy] 2005). A small increase to 54 groups was observed during 2003, which was attributed to high survival of adults and juveniles, successful reproduction in 2002, and a large number of immigrants in 2003 (Navy 2005). An increase to 56 groups was documented in 2004 (Navy 2005). Currently there are 51 groups present (Bowman et al. 2006).

Status and Distribution

The status of FSJs rangewide varies depending primarily on the amount of habitat protected and managed (Stith 1999). Decreasing the vulnerability of susceptible metapopulations can be

achieved in some cases by acquiring and managing additional habitat within the metapopulation. Thus, in some areas of Florida, conservation measures for FSJs will involve protection and long-term management of additional suitable scrub habitat (Stith et al. 1996; Service 1999).

FSJs have declined in abundance and distribution due to habitat loss and fragmentation as a result of increasing urban and agricultural development. It is noteworthy that xeric uplands have declined by an estimated 70 to 85 percent since European settlement (Fernald 1989; Fitzpatrick et al. 1994 unpublished data). Habitat loss, fragmentation, and degradation due to fire exclusion affect the demography of FSJs. These influences are expected to increase the likelihood of localized extirpations in many areas throughout Florida.

Research on FSJs in urban areas has provided information on the demographic reactions to urban pressures (Bowman and Averill 1993; Thaxton and Hingtgen 1996; Bowman 1998; Bowman and Fleischer 1998; Breininger 1999). Thaxton and Hingtgen (1996) demonstrated that FSJ dispersal behavior was substantially different in urban settings than in natural scrub habitat. When compared with FSJs in natural conditions, both male and female urban FSJs exhibited dispersal characteristics different from birds in natural conditions. Males tended to disperse further because the likelihood of inheriting high quality habitat within urban areas was low. Females dispersed greater distances, at an earlier age in urban settings due to the lack of adjacent unoccupied habitat and single males. Single males typically established territories by breeder replacement. With increasing dispersal distance at a younger age, females are susceptible to increased mortality. Females dispersing from urban areas have a higher mortality rate than those dispersing from natural scrub areas (Thaxton and Hingtgen 1996). It is also suggested that habitat in suburban areas, if abandoned or unoccupied due to death of the mated pair, had a higher probability of remaining vacant, leading to the conclusion that populations in suburban areas were likely to decrease in size and eventually be extirpated.

Bowman and Averill (1993) evaluated demographic patterns of FSJs along a gradient from nearly complete residential development to undisturbed scrub and compared these patterns to those occupying undisturbed, unfragmented scrub. At the highest residential development density, FSJ territories and family group size was significantly smaller than in low density residential areas or natural scrub. They also found that FSJs in densely developed areas had significantly poorer nesting success than those occupying less densely developed areas or natural scrub. Bowman (1998) found that FSJs living in areas of dense residential development produced fewer fledglings than in other areas.

Overall, fledgling survival in residential areas (at any development density) has been found to be significantly lower than survival of fledglings in undisturbed, unfragmented scrub. Adult survival in densely developed areas is also thought to be lower than those living in less dense residential areas or native habitats. Like Thaxton and Hingtgen (1996), Bowman and Averill (1993) also concluded that habitat fragmentation associated with residential development and other urban uses increases mortality during dispersal.

Adverse effects of residential and other urban development on the demography of FSJs are likely, due to a combination of factors (Breininger 1999). Bowman and Averill (1993) alluded to the presence of “dangerous” habitats within suburban settings, including roads which increase

the likelihood of collisions with motor vehicles. Exotic turf grasses and ornamental shrubs and trees may increase a FSJ's vulnerability to predators and competitors and provide suboptimal nesting substrates. Overgrown scrub may also attract predators and competitors. Predictable food sources, such as birdfeeders, also tend to congregate FSJs and make them more susceptible to domestic predators. Malicious shooting of FSJs with pellet guns has also been documented in some residential areas.

In addition to the loss of xeric uplands within the action area, increasing fragmentation has resulted in fire exclusion and the subsequent degradation of many of the remaining parcels of xeric habitat. These xeric communities require periodic fire to maintain their ecological and biological functions and values. Urban and agricultural uses now interspersed between xeric upland habitats do not allow the natural periodicity or magnitude of fires that once spread across this xeric landscape. In most instances, fire suppression is practiced to protect human life and property. Lacking fire, xeric uplands tend towards more mesic conditions, which include denser vegetative canopies and more heterogeneous vegetative structure. Under these conditions, many of the species that evolved in presence of periodic fires and low structural diversity diminish in abundance and eventually are extirpated.

The distribution of FSJs provides a good indicator of xeric upland quality, particularly oak dominated scrub. In a synopsis of data collected during a statewide survey for FSJs, Bowman and Fleischer (1994) compared site-specific numbers of FSJs observed from 1992 to 1993 with FSJ surveys conducted from 1980 to1981 (Cox 1987). In most cases the numbers of FSJs observed in 1992 and 1993 declined from those observed in the 1980 to 1981 study and in many cases the decline was attributable to habitat degradation due to vegetative overgrowth. In a few instances, Bowman and Fleischer (1994) reported substantial increases in the number of FSJs were observed, which typically corresponded to areas that had been burned since the previous survey. Subsequent studies in Charlotte (Miller and Stith 2002) and Brevard Counties (Toland 1999) have shown similar results. Patchy fires with return intervals of 8 to 15 years are considered optimal to maintain habitat for FSJs. Growing season fires are preferred over winter fires since the timing allows FSJs to adjust their territorial boundaries and complete acorn caching before hawk migration occurs (Woolfenden and Fitzpatrick 1996b).

Because of the factors described above, *i.e.* urbanization, fragmentation, and degradation of available habitat APAFR will continue to be vital to the recovery of FSJ in Central Florida. Management efforts at APAFR have focused on maintenance of existing habitats with prescribed fire and restoring scrub habitat to suitable condition by thinning pines and overgrown oaks (USFA 2000).

STATUS OF THE SPECIES/CRITICAL HABITAT RANGEWIDE – Red-cockaded woodpecker

The Service identified the RCW as a rare and endangered species in1968 and officially listed as endangered in 1970 (FR35:16047). With passage of the Act in 1973, the RCW received the protection afforded listed species under the Act.

Critical Habitat

Critical habitat has not been designated for this species.

Species Description

The current distribution of this non-migratory, territorial species (endemic to open, mature and old growth pine ecosystems) is restricted to the remaining fragmented parcels of suitable pine forest in 11 southeastern States; it has been extirpated in New Jersey, Maryland, Missouri, Tennessee, and Kentucky (Costa 2003). As of April 2003, there were an estimated 14,500 RCWs living in 5,800 known active clusters across 11 States (Service 2003a, unpublished data). This is less than 3 percent of the estimated abundance at the time of European settlement.

Despite the protection of the Act in 1973, all monitoring populations (with one exception, see Hooper et al. 1991) declined in size throughout the 1970s and into the 1980s. Although populations have become more fragmented and isolated, the RCW is still rather widely distributed. RCWs survive as very small (1-5 groups) to large (groups of 200 or greater) populations. Small populations in the interior are found in southeastern Oklahoma, southern Arkansas, and southeastern Virginia. The majority of the largest populations remaining are located in the longleaf pine (*Pinus palustris*) forest of the Sandhills of North Carolina and South Carolina, and the coastal plain longleaf pine forests of North Carolina and South Carolina, Georgia, Florida, and Louisiana; and loblolly (*P. taeda*)/shortleaf pine (*P. echinata*) forests of eastern Texas.

Life History

The RCW is a territorial, non-migratory, cooperative breeding species (Lennartz et al. 1987; Walters et al. 1988). It is unique in that it is the only North American woodpecker that exclusively excavates its roost and nest cavities in living pines. Usually, the trees chosen for cavity excavation are infected with a heartwood decaying fungus (*Phellinus pini*) (Jackson 1977; Connor and Locke 1982). The heartwood associated with this fungus and typically required for cavity excavation, is not generally present in longleaf and loblolly pines until 90 to 100 and 75 to 90 years of age, respectively (Clark 1992a; Clark 1992b). Each group member has its own cavity, although there may be multiple cavities in a cavity tree. The aggregate of cavity trees, surrounded by a 200-foot forested buffer, is called a cluster (Walters 1990). Cavities within a cluster may be complete or under construction and either active, inactive, or abandoned.

RCWs live in social units called groups. This family unit usually consists of a breeding pair, the current year's offspring and zero to four helpers (adults, normally male offspring of the breeding pair from previous years) (Walters 1990). Some populations have documented instances of female helpers (Walters 1990; Delotelle and Epting 1992; Bowman et al. 1998). A group may contain from one to nine birds, but never more than one breeding pair. Groups maintain year-round territories near their roost and nest trees. Subadult females from the current year's breeding season normally disperse, prior to the next breeding season, or driven from the group's territory by the group (see Walters et al. 1988, for additional sociobiological/cooperative breeding information).

RCWs forage almost exclusively on pine trees. Although in some habitat types they will use smaller pine trees as foraging substrate (Delotelle et al. 1987) they prefer pines greater than 10 inches in diameter at breast height (Service 1985; Hooper and Harlow 1986; Engstrom and Sanders 1997). Determining the number of pines required to provide the arthropod biomass necessary to meet their year-round dietary needs continues to be a challenging research problem. Many complex and interrelated factors undoubtedly contribute to the answer, including condition of the understory plant community, annual weather fluctuations, forest type, soils, physiographic province, season-of-year, and fire frequency and intensity. Recent studies have examined how prescribed burning in longleaf pine/wiregrass (*Aristida stricta*), ecosystems influences the structure and composition of groundcover, *i.e.*, herbaceous verses shrubby, size and fledglings produced (James et al. 1997, 2001). Research on how ecosystem processes, such as fire, affect the abundance and diversity of RCW prey in different pine habitats, still needs to be conducted. The number of acres required to supply adequate foraging habitat depends on the quantity and quality of tree stems available.

Population Dynamics

Long-term viability of a RCW population, in genetic terms, depends upon the presence of an adequate number of breeding individuals for the natural processes that increase genetic variability (*e.g.*, mutation and recombination) to offset the natural processes that decrease genetic variability (*e.g.*, genetic drift and inbreeding). Any prediction of a population's viability should not only be based upon these genetic factors, but also must consider the populations ability to survive population fluctuations due to demographic and environmental fluctuations (Koenig 1988) or environmental catastrophes. Although population models to calculate the population size needed to withstand such irregular events are not well developed, it is generally agreed that demographic and environmental fluctuations necessitate an increased number of breeding individuals to ensure the long-term persistence of a population in an area (Koenig 1988). Because of the cooperative breeding nature of the RCW, their populations may require fewer breeding individuals to meet demographic fluctuations. However, the spatial distribution of clusters within a population is important to withstand both demographic and genetic stochastic changes by facilitating dispersal and, therefore, gene flow (Letcher et al. 1998).

Reproductive rates, population density, and re-colonization rates may influence RCW population variability more than mortality rates, sex ratios, and genetic variability. RCWs exhibit relatively low adult mortality rates; annual survivorship of breeding male and female RCW is high, ranging from 72 to 84 percent and 51 to 81 percent, respectively (Lennartz and Heckel 1987; Walters et al. 1988; Delotelle and Epting 1992).

Regarding sex ratios, only two studies (Francis Marion National Forest and central Florida populations) report significantly different fledgling sex ratios than 50:50 (Gowaty and Lennartz 1985; Epting and Delotelle, unpublished data.); however, other populations report an unbiased sex ratio (Hardesty et al. 1997; LaBranche 1992; J. Walters 1990, unpublished data). Examination of data on fledgling sex ratios from other populations across the region reveals similar variability (R. Delotelle, unpublished data.). Because most managers and researchers do

not report significant differences from the expected 50:50 ratio, it is assumed that they are finding normal ratios. Reasons for the differences in sex ratios between the two populations initially discussed and most (presumably) other populations are uncertain, as are the implications for population variability.

RCW genetic research to date does not suggest that genetic variability is a serious concern at this time; however, genetic variability will decrease in small, isolated populations. RCWs exhibit inbreeding depression and inbreeding avoidance behaviors (Daniels 1997; Daniels and Walters 2000). Inbreeding is expected to affect population viability in populations of less than 40 potential breeding groups, and may be a significant factor affecting viability in isolated populations of 40 to 100 potential breeding groups as well. Immigration rates of two or more migrants per year can effectively reduce inbreeding in populations of any size, including very small ones. Stangel et al. (1992) reported no significant relationship between heterozygosity and population size (when 2 very small populations, of the 26 sampled, were removed from the analysis). Additionally, although allelic diversity was correlated with population size and had eroded in some small populations, most populations were still characterized by normal levels of genetic variability. Haig and Rhymer (1994) examining the genetic variation among 14 RCW populations concluded that RCWs do not appear to have major genetic differences among regional populations.

Reproductive rates for RCWs are variable. Although RCW groups produce broods fairly reliably, these broods are relatively small. This is because clutch size is modest and, more importantly, because partial brood loss is greater than in other species of primary cavity nesters in the United States (LaBranche and Walters 1994). Most clutches contain two to four eggs, although the range is one to five eggs. There is variation among populations in clutch size, with population averages ranging from 2.9 to 3.5 eggs. The average number of young fledged from successful nests is about two in northern populations. Broods of one to four are common, and rarely five young are fledged from a single nest. Because some groups do not nest and others fail in their attempts, the average number of young produced per group is about 0.5 fledgling less, ranging from 1.4 to 1.7 among populations and from 1.0 to 1.9 among years within populations. Productivity in Florida populations typically is somewhat less (averaging 0.9 to 1.6) due largely too greater partial brood loss. Walters et al. (1988) suggest that annual variation in reproductive effort may be associated with food availability, weather and cavity competition.

Although the relationship between RCW population variability and population density is not well understood, some aspects of population density as it relates to group size and population trend have been examined. Connor and Rudolph (1991) found that in sparse populations, as fragmentation increased, RCW group size and the number of active clusters decreased. Hooper and Lennartz (1995) suggested that populations with less than 4.7 active clusters within 1.25 miles, on average, had critically low densities that inhibited population expansion. Beyer et al. (1996) also speculated that low RCW densities (4.8 active clusters within 1.25 miles) on the Wakulla Ranger District, Apalachicola National Forest may have been implicated in that subpopulation's declining trend.

RCW populations can be increased dramatically because of their ability to re-colonize unoccupied habitat made suitable by providing the limiting resource of cavity trees, via artificial

cavities (Copeyon 1990; Allen 1991). Several recent examples of significant population expansions have been documented (Gaines et al. 1995; Franzreb 1999; Carlile et al. 2003; Doresky et al. 2003; Hagan et al. 2003; Hedman et al. 2003; Marston and Morrow 2003; Stober and Jack 2003); artificial cavity provisioning was the common denominator. Walters et al. (1992a) conclusively demonstrated that unoccupied sites remain so because they lack suitable cavities. Walters et al. (1992b) cooperative breeding ecological model for RCWs strongly suggests that individual RCWs are better off from a fitness perspective (first year survival, rate of successful dispersal, reproductive success at early ages) competing for a high quality territory (*i.e.*, one with cavity trees) than accepting a territory without this critical resource.

Prior to routine use of artificial cavities for stabilizing and expanding populations, most populations were declining and many had been extirpated (Baker 1983; Costa and Escano 1989). While acknowledging that most RCW populations have not increased on their own (in the absence of artificial cavities), it is equally important to point out that the two largest populations in the 1980s, the Francis Marion National Forest and the Apalachicola National Forest increased by approximately 10 percent between 1980 to 1981 and 1987 to 1988, and 1990 to 1991 (Hooper et al. 1991; R. Costa, Service, unpublished data). The common denominators in these landscapes were large population size (480 to 500 active clusters), dense populations, availability of well-distributed relic longleaf pines, and open park-like forests, were the result of frequent prescribed fire since the 1940s and 1950s.

Population stability, the ability of a species' populations to resist change or dramatic fluctuations over time, directly affects a species' sensitivity to the adverse effects of a proposed action. While many RCW populations have been extirpated, many others, some very small and seemingly demographically isolated, have persisted for a remarkable period of time, *i.e.*, 10+ years, although their long term survival is certainly not secure. This short term (10+ years) survival (stability is not an accurate description, as most of these populations have been slowly declining) of small populations is probably related to: long life span (10 year old birds are not uncommon); predation/exposure protection afforded by a permanent, secure roost chamber; relatively consistent number of fledglings per successful nest; dispersal ability (DeLotelle et al. 2003); and cooperative behavior at territory defense and raising young.

The majority of larger populations (50+ active clusters) is not increasing and can only be classified as stable, several are decreasing. The instability of declining populations is frequently related to poor habitat conditions (mid-story development, young forests with few potentially suitable cavity trees, habitat loss and landscape fragmentation), and the demographic isolation of individual groups and/or the intra-population distribution of groups, *i.e.*, density, brought about over time by the gradual loss and degradation of suitable habitat. Intensive management designed to improve habitat conditions at the critical resource, the cluster/cavity tree core area, has contributed to the stability of both large and small populations. Primary management has been the installation of artificial cavities and hardwood mid-story control. Additionally, the benefits afforded large, dense populations regarding potential breeding opportunities account, in part, for their stability.

Status and Distribution

The precipitous decline of RCWs was caused by an almost complete loss of habitat. Approximately 920,000 (Costa 2001) to 1.5 million (Conner et al. 2001) groups of RCWs inhabited southeastern forests prior to European settlement. Fire-maintained old growth pine savannahs and woodlands that once dominated the southeast (92 million acres pre-European settlement; Frost 1993), on which the woodpeckers depend, no longer exist except in a few small patches (<3.0 million acres today; Frost 1993). Longleaf pine ecosystems, of primary importance to RCWs, are now among the most endangered systems on earth (Simberloff 1993; Ware et al. 1993).

Loss of the original pine ecosystems was primarily due to intense logging for lumber and agriculture. Logging was especially intense at the turn of the century (Frost 1993). Two additional factors resulting in the loss of the original pine systems in the 1800s and earlier were exploitation for pine resins and grazing of free-ranging hogs (Wahlenburg 1946; Frost 1993). Later in the 1900s, fire suppression and detrimental silvicultural practices had major impacts on primary ecosystem remnants, second growth forests, and consequently on the status of RCWs (Frost 1993; Ware et al. 1993; Ligon et al. 1986, 1991; Landers et al. 1995). Additionally, longleaf pine suffered a widespread failure to reproduce following initial cutting, at first because of hogs and later because of fire suppression (Wahlenburg 1946; Ware et al. 1993).

At APAFR, all RCW groups occur in longleaf pine (*Pinus palustrus*) habitat, though historically they occurred in slash pine (*P. elliottii* var. *densa*). The distribution of longleaf pine at APAFR is patchy with small tracts scattered throughout a matrix of habitat types unsuitable or of low habitat value for RCWs. The distribution of longleaf pine that has potential as RCW habitat has been delineated and managed as habitat management units (HMUs). The HMUs are managed for RCW nesting and foraging and include all areas currently occupied by RCWs and those areas that have potential to support the RCW. Current management practices in RCW HMUs include prescribed burning, mechanized vegetation treatments, and planting of longleaf pine. In addition, translocation of the RCW and cavity augmentation with artificial cavities is a part of the habitat management plan (USAF 2000). To date, APAFR has translocated 32 RCWs, and to date, 20 of the translocated birds have successfully entered the breeding population (Gilson, 2006). The entire RCW population at APAFR is surveyed annually (Navy 2005).

In 2006, 25 active RCW clusters were documented at APAFR (Gilson 2006). This is similar to the number of clusters (n = 21) reported from APAFR during the mid-1970s, suggesting that the population has remained stable (USAF 2000). RCW clusters are distributed throughout the range but are concentrated in the north-central, northeast, and east portions of the range (Figure 9).

APAFR, along other Federal lands, contains the majority of existing RCW populations and, as such, plays a crucial role in the recovery of the RCW in south Florida (Service 2003a). APAFR is a designated essential support population because it supports one of the largest remaining populations in the ecologically unique South/Central Florida Recovery Unit (Service 2003a). Furthermore, the decline and local extirpation of RCWs on private lands, such as adjacent

River Ranch (Gilson 2006), continues despite efforts to establish conservation partnerships with private landowners.

Rangewide Trend

In the 1990s and through today, in response to intensive management based on a new understanding of population dynamics and new management tools, *e.g.*, artificial cavities and translocation, most public land populations, and those private land populations in partnerships with the Service, were stabilized and many showed increases. Other populations remain in decline and most have small population size, *i.e.*, <50 active clusters.

New Threats

There are no known "new" threats to RCWs, although the potential exists for such threats, *e.g.*, impacts of exotics, such as imported fire ants and the West Nile virus. The current primary threats to species viability all have the same basic cause: lack of suitable habitat. On public and private lands, both the quantity and quality of RCW habitat are affected by past and current fire suppression and detrimental silvicultural practices. Serious threats stemming from this lack of suitable habitat include: (1) insufficient numbers of suitable cavities and continuing net loss of cavity trees (Costa and Escano 1989; James 1995; Hardesty et al. 1995); (2) habitat fragmentation and its effects on genetic variation, dispersal, and demography (Conner and Rudolph 1991); (3) lack of foraging habitat of adequate quality (Walters et al. 2000; James et al. 2001); and (4) fundamental risks of extinction inherent to critically small populations from random demographic, environmental, genetic, and catastrophic events (Shaffer 1981, 1987).

STATUS OF THE SPECIES/CRITICAL HABITAT RANGEWIDE – Florida grasshopper sparrow

The FGS is one of four North American subspecies of the grasshopper sparrow, and is endemic to the dry prairie region of central and southern Florida. Based on declines in suitable habitat and population size, the National Audubon Society placed the FGS on its blue list in 1974. The FGS was listed as endangered by the State of Florida in 1977. The Service listed the FGS as endangered on July 31, 1986, due to habitat degradation and loss, primarily as a result of conversion of native dry prairie vegetation to improved pasture (51 FR 27495).

Critical Habitat

Critical habitat has not been designated for this species.

Species Description

The FGS is a small, short-tailed, flat-headed sparrow averaging 13 cm in total length (Vickery 1996). The top of its head is mostly blackish with a light median stripe. The remainder of its dorsum is mainly black, edged with gray, and streaked with brown on the nape and upper back. Adult FGSs are whitish underneath, unstreaked, with a buff throat and breast. Juvenile FGSs have streaked breasts. The ventral color pattern resembles that of the Bachman's sparrow (*Aimophila aestivalis*). The rectrices of the FGS are pointed, the lores are light gray to

reddish-yellow, and the bend of the wing is yellow. Its bill is thick at the base, and its feet are flesh-colored (Vickery 1996).

The FGS is marked with a longer bill and longer tarsi than the northern subspecies, *A. s. pratensis*. The FGS also has a much darker, blackish dorsum than *A. s. pratensis*, with more grayish flanks (T. Dean, Service, personal communication 2002). Adult Henslow's sparrows (*A. henslowii*) and Le Conte's sparrows (*A. leconteii*) are similar in appearance to the FGS, but they both have ventral streaking, which is lacking in adult FGS (Stevenson and Anderson 1994). Although the juveniles of these three different subspecies would be difficult to distinguish visually from one another, only the FGS breeds in Florida. Therefore, there is no overlap in juvenile distribution.

During the breeding season, male and female FGSs can be distinguished in the hand by the presence of a cloacal protuberance in the male or a brood patch in the female. Gender may also be determined based on wing chord length and body weight, but this method is not reliable due to some degree of overlap between the genders. Female FGSs are generally smaller and proportionally heavier than males (Delany et al. 1994).

The FGS is most easily located and identified by its song, which is among the weakest of any North American bird (Stevenson 1978). Nicholson (1936) described it as being indistinct and as having a definite insect-like quality, which gave rise to the bird's common name (Sprunt 1954). The song starts as three low-pitched notes followed by a longer, higher-pitched "buzz" (Vickery 1996). FGSs sing while perched upon dead palmetto leaves, dead oak twigs, staggerbush (*Lyonia* spp.), and tarflower (*Befaria racemosa*) between 15 and 90 cm in height (Nicholson 1936; Delany et al. 1995). They may also sing from the ground (T. Dean, Service, personal communication 2002).

Life History

FGSs are endemic to dry prairie habitats within central and southern Florida, and are strongly habitat-specific, occupying only the native fire-maintained dry prairie vegetation community and a few semi-improved pasture sites that superficially resemble the dry prairie community and were presumably dry prairie prior to conversion to pasture. The dry prairies are relatively flat and are moderately to poorly drained. The soils typically consist of 0.3 to 1.0 meters of acidic, nutrient-poor quartz sands overlying a high clay subsoil or organic hardpan (spodic horizon) (Florida Natural Areas Inventory [FNAI] and Florida Department of Natural Resources [FDNR] 1990; Abrahamson and Hartnett 1990). Both the heavy subsoil and hardpan reduce the movement of water below and above their surfaces (FNAI and FDNR 1990). Thus, dry prairies may become flooded for short periods during the rainy season, but remain dry for the remainder of the year. The water table in these prairies is normally found between several centimeters and a meter below the soil surface.

FGS habitat consists primarily of large, expansive patches of contiguous native dry prairie vegetation that have been regularly maintained with fire. Dry prairie vegetation is composed of a diverse variety of species, including grasses, forbs, and shrubs. Orzell and Bridges (2004) report, that over 650 vascular plant taxa have been recorded within dry prairies. Habitat

characteristics that are important for FGSs include a high percentage of bare ground cover and low vegetation height (30 to 70 cm) (Delany et al. 1985). Both of these characteristics are maintained by frequent fire. Some dry prairies may be artifacts of clear-cutting, unnaturally frequent burning, livestock grazing, and alteration of hydrology (Abrahamson and Hartnett 1990).

When compared with habitat of other grasshopper sparrow subspecies, that used by *A. s. floridanus* is characterized by a larger percentage of shrub and bare ground, a smaller percentage of tall vegetation, and less litter (Delany et al. 1985). Because the sparrows are ground-dwelling birds, they usually require at least 20 percent bare ground for unrestricted movement and foraging, but need enough vegetation to provide nesting cover (Whitmore 1979; Vickery 1996). Large areas of prairie habitat, possibly greater than 4,000 hectares (ha) (9,884 acres), are needed to maintain self-sustaining populations of FGSs (Perkins 1999; Perkins and Vickery 2001).

FGSs can be reproductively successful in pastures dominated by non-native sod-forming grasses (Mulholland and Small 2001). However, as pastures become intensively managed and native vegetation components and bare ground are eliminated, FGS populations may decrease or disappear (Delany and Linda 1994). Little is known about what characteristics of pastures dominated by non-native species may result in occupancy by FGSs. Field observations have revealed use of non-native habitats including bahia pastures with nearly 100 percent ground cover (T. Dean, Service, personal communication 2002). FGSs appear to prefer pasture sites containing some structural diversity, such as bunchgrasses (*Andropogon* spp., *Aristida* spp, *Schizacyrium* spp.), small shrubs (*Asimina* spp., *Myrica cerifera*, *Serenoa repens*, and others), and forbs (*Eupatorium* spp., *Solidago* spp., and others) (T. Dean, Service, personal communication 2002). Appropriate management of bahia pastures to maintain grasshopper sparrow habitat remains largely unknown.

FGSs are secretive by nature, and have few behaviors or characteristics that enable them to be readily located or identified. They are almost exclusively terrestrial, spending nearly all of their time on the ground. During the breeding season, male FGSs perch, sing, and perform short territorial display flights for a few hours each day. Females are rarely seen, and can only be regularly observed when carrying food to nestlings. Outside of the breeding season, FGSs become much more secretive than during the breeding season, and generally do not vocalize or fly except in response to disturbance. In general, FGSs prefer to avoid disturbances by running along the ground and generally only fly if a potential predator approaches within 2 to 3 meters. FGSs form pair bonds during the breeding season, but remain solitary for the remainder of the season, and rarely interact with other FGSs outside of the breeding season.

During the breeding season, FGSs form breeding aggregations within suitable habitat (Delany 1996), and individual male sparrows set up territories within the breeding aggregations. Territories tend to be widely and irregularly spaced, often with undefended space between adjacent territories. Territories are rarely tightly-packed within a prairie area. Territory density has been shown to be related to the time since habitat has burned. Shriver (1996) and Shriver and Vickery (2001) report significant declines in territory density as time since fire increases. Delany et al. (1995) found mean breeding territory size for FGSs at APAFR to be 1.80 ha

(4.45 acres); with a maximum size of 4.82 ha (11.91 acres). As the time since last fire increases, territories are reported to be established less frequently (Walsh et al. 1995), and FGS home ranges become larger (Delany et al. 1992). Male FGSs defend their territory boundaries from the time territories are established through incubation (Delany et al. 1995). After the young hatch, territory defense becomes less rigorous (Smith 1968). Adult FGSs exhibit strong site-fidelity to nesting territories, although individuals have been observed traveling as far as 4 kilometers (km) (0.62 mile) from the nesting territories during winter months. The great majority of males (86 percent [Delany et al. 1995]; 100 percent [Dean 2001]) remain on the same territory in consecutive years.

Male FGSs generally begin singing in mid-March. Their singing usually diminishes by late June, although they continue to sing through August (T. Dean, Service, personal communication 2002). Following summer burns, males may sing more frequently than they do in unburned areas (Vickery 1996; Shriver 1996; Shriver et al. 1996). Males may sing throughout the day, although they sing more frequently from sunrise to 0900 and 15 minutes before sunset (Vickery 1996). FGSs have two distinctly different songs (Vickery 1996), and when establishing breeding territories, they are reported to sing the shorter primary song (Smith 1959); the sustained, or secondary song, is thought to play a role in attracting a mate and maintaining a pair bond (Vickery 1996).

FGSs begin nest-building activities approximately 4 weeks after the onset of territorial singing (Vickery 1996). Nests are located on the ground in shallow (<3.2 cm deep) excavations in the sand substrate (Delany and Linda 1998a; Delany and Linda 1998b); the rims are level or slightly above the ground. The nests are dome-shaped and constructed of narrow-leaved grasses and grass-like monocots, such as wiregrass, bluestems (*Andropogon* spp.), and yellow-eyed grass (*Xyris* spp.). The outer diameter averages 10.3 cm, the inside diameter averages 6.9 cm, and the height averages 7.7 cm. The mean orifice width is 5.1 cm (Delany and Linda 1998a). Nests are typically shielded by dwarf shrubs (*i.e.*, saw palmetto) and dwarf live oak, rather than grass clumps as reported for other subspecies, and nest opening directions are randomly oriented (Delany and Linda 1998a). Nests are placed within patches of dense vegetation, surrounded by an area of more open vegetation, possibly to provide visual shielding from potential predators while still allowing adults easy access to nests from the ground (Delany and Linda 1998a). When delivering food to nestlings, adults alight on the ground 2 to 5 meters from the nest and proceed to the nest on foot.

Egg-laying is reported to begin as early as late March (McNair 1986) and breeding activities may extend into September (Vickery and Shriver 1995; Perkins 1999). Most nests contain 3 to 5 eggs with a mean of 3.71 (McNair 1986; Smith 1968). Perkins et al. (2003) report mean clutch sizes of 3.47 (n = 17) at APAFR, 3.56 (n = 9) at Three Lakes Wildlife Management Area (TLWMA), and 3.75 (n = 4) at Kissimmee Prairie Preserve State Park (KPPSP). Eggs are white, smooth, slightly glossy, and lightly speckled and spotted with reddish-brown markings. These markings are generally sharp and well-defined, either scattered over the entire egg or concentrated toward the large end.

Female FGSs incubate their eggs 11 to 12 days (Nicholson 1936). Perkins et al. (1998) reported that it takes an average of 13.5 days between the fledging of a successful nest and the first egg of

a new attempt. If a nest is destroyed, the female may make a new one in approximately 10 to 12 days (T. Dean, Service, personal communication 2003). Considering the duration necessary to complete a single reproductive cycle, three to four successful clutches are possible within a single breeding season (Vickery 1996; Perkins 1999) and multiple clutches are common (Vickery 1996). Nesting activity late in the season regularly occurs, and Perkins (1999) reported a nest with eggs in late August that would not have fledged until mid-September. Breeding activity has been reported to increase following summer fires (Shriver 1996; Shriver et al. 1996; Shriver et al. 1999; Shriver and Vickery 2001).

FGS hatchlings are altricial and are brooded by the female for up to 9 days (Vickery 1996; Perkins et al. 1998). When young hatch, both male and female become more defensive to human and other intrusions (Smith 1963). Non-parental attendants have been reported for *A. s. pratensis* (Kaspari and O'Leary 1988), but complete information on their function or the extent of cooperative breeding is not available. This behavior has not been documented in FGSs.

Both parents continue to provide care after young fledge from the nest, though the amount of time they do so before the young become independent is poorly documented (Vickery 1996). In Florida, fledglings are reported to aggregate in loose flocks with no parental care 3 to 4 weeks after fledging (Vickery 1996). After juveniles leave the natal territory, little is known about their behavior, but the few recaptures of independent juveniles that were originally banded as nestlings suggest that juveniles may travel widely across the landscape (T. Dean, Service, personal communication 2002; Miller 2005).

During the non-breeding season, FGSs appear to expand their scope of movements. As determined through radio telemetry, the average home range size during the non-breeding season was 29.0 ha (71.7 acres), with individual home ranges varying from 1.0 to 173.6 ha (2.5 to 428.9 acres) (Dean 2001). In addition, nearly 40 percent of individuals used more than one spatially distinct home range during the course of the non-breeding season. These home ranges were not mutually exclusive, however, and home ranges of many different individuals overlapped (Dean 2001). A FGS originally banded as a juvenile at Bravo Range in APAFR was recaptured at KPPSP 6.5 years later, over 27 km (16.8 miles) from the original capture site. This bird is the first marked individual to leave one of the six extant populations and be recaptured in another, and this movement constitutes a record for overall distance traveled by an individual FGS (Miller 2005).

Barriers to movement include forested edges and even sparsely stocked pine flatwoods. One radio-marked FGS crossed a forested slough that was at least 100 meters wide, indicating that such features may not represent complete barriers to movement. However, during a radio-telemetry study, FGSs regularly encountered these features and only one individual ever ventured to cross one (Dean 2001). The width and density of the forested habitats certainly affect the likelihood of FGS movement across them.

FGSs forage on the ground or just above it. An examination of the contents of 10 stomachs of FGSs from the Kissimmee prairie region found 69 percent "animal matter" (insects) and 31 percent vegetation (Howell 1932). Identified insects included grasshoppers, crickets, beetles, weevils, and moths and their larvae, with a few flies and bugs. Sedge seeds, as well as some star

grass (*Hypoxis* spp.) seeds, composed most of the vegetation found in the diet (Service 1988). FGSs switch to a seed-dominated diet during the non-nesting season, but still consume some animal matter (Vickery and Dean 1997).

Population Dynamics

FGSs are capable of breeding during the first spring after hatching and are assumed to breed every year. Several studies (Shriver 1996; Perkins 1999) have suggested that not all singing males are paired, with as many as 15 to 23 percent of males identified as unpaired (Vickery and Perkins 2001). The difficulty of observing female sparrows makes accurate determination of sex ratios, pairing, or the lack of pairing, difficult.

Considering the number of potential nesting attempts and the productivity per nest, the maximum productivity per pair could reasonably be expected to exceed 13 young per pair each year, though this level of productivity is likely uncommon. Nest success (defined as fledging at least one young) rates are generally low, and nest success rates range between 11 and 38 percent. Accounting for the number of nesting attempts and observed nest success, Vickery and Perkins (2001) report an average annual productivity per pair of 2.8 to 3.5 young per year. Nest predation is the most common cause of nest failures, with snakes and mammals accounting for the majority of observed depredations (Perkins 1999). The large reproductive potential combined with variability in depredation and nest failure rates may result in widely varying reproductive success among years.

Little is known about the timing, extent, or frequency of dispersal by juvenile sparrows, though most agree that juveniles are the most likely group to disperse (Vickery and Perkins 2001). This represents one of the most important remaining information gaps about FGS ecology. Genetics studies indicate little genetic differentiation among spatially distinct populations, suggesting either relatively regular movement of individuals among the disjunct populations, or recent isolation of the populations (Delany et al. 2000). In 2003, Miller (In Press) documented the first known dispersal between disjunct populations when a FGS originally banded as a juvenile on OQ Range in APAFR was recaptured at KPPSP. Besides this one observation, there are no empirical data available to calculate rates of dispersal among populations. The number of dispersing individuals may be too low to have a demographic effect on any of the populations, but may be sufficient to maintain genetic diversity (Delany et al. 2000).

Estimates of annual adult male survival rates range between 0.24 and 0.83 for different populations and different years (Delany et al. 1993; Perkins and Vickery 2001). Average adult annual survival rates are 0.48 and 0.53 at APAFR and TLWMA, respectively. Delany et al. (1993) estimated a pooled annual survival rate of 0.59 at APAFR. These results suggest that annual adult survival rates are variable, with an average slightly above 50 percent. Juvenile survival rates have never been directly estimated, but Perkins and Vickery (2001) estimated the average juvenile survival rate to be 0.35 through indirect calculations. Results of a 3-year banding study indicate a mean life expectancy of 1.95 years for male birds that are at least 1 year old (n = 48) (Delany et al. 1993). The longevity record for FGSs is 7 years (Dean et al. 1998; Miller 2005). Because there is no information on the survival and life expectancy of females, it can only be assumed that female survival rates approximate those of males.

Studies at APAFR and TLWMA have recorded several predation events for radio-marked adult FGSs. Potential or probable predators include mammals, snakes, and birds (Perkins et al. 1998; Dean 2001). The main cause of adult mortality appears to be predation, primarily by wintering raptors (T. Dean, Service, personal communication 2002). The majority of adult mortality probably occurs during the winter when migrant raptors occur in large numbers in central Florida. Red-shouldered hawks (*Buteo lineatus*) are the only common raptor that occurs in dry prairies during the breeding season and they do not regularly prey on birds (K. Meyer, University of Florida, personal communication 1999). Loggerhead shrikes (*Lanius ludovicianus*) are known to prey on adult FGSs year-round, but FGSs are not common prey and are only rarely captured. Other predators known to take eggs or nestlings include the striped skunk (*Mephitis mephitis*), spotted skunk (*Spilogale putorius*), raccoon (*Procyon lotor*), longtailed weasel (*Mustela frenata*), foxes (*Urocyon* sp. and *Vulpes* sp.), cats (*Felis* spp.), feral hogs (*Sus scrofa*), snakes, and possibly armadillos (Vickery 1996).

Status and Distribution

The current known range of the species is limited to Highlands, Okeechobee, Osceola, and Polk Counties. Early records for abundance and distribution of FGSs are scarce, though it is believed that the species was once more numerous and widespread than it is today (Delany 1996). Howell's (1932) observations of FGSs suggest that population numbers were greater during the early 1930s. Breeding colony size at that time was apparently 3 to 19 pairs, although precise survey data for the early 20th century are not available (Howell 1932; Smith 1968; McNair 1986). Apparently, FGS numbers were never constant or predictable. Nicholson (1936) noted that "grasshopper sparrows do not occupy all apparently suitable habitats, and the species fluctuates considerably in abundance from year to year." This is further supported in the final rule that added FGSs to the list of endangered species, which stated that "The habitat needs of the species are specific, and its presence in any one area over a long term cannot be predicted or assured" (51 FR 27492).

Because the FGS is closely associated with dry prairie habitats, trends in the amount and condition of dry prairie habitat within central Florida probably mirror the trends in the rangewide FGS population. Estimates of the historical and current extent of dry prairie within central Florida vary greatly. Florida dry prairie, the only place where FGSs occur, is ranked as a G2 (globally imperiled) community type (FNAI and FDNR 1990; Grossman et al. 1994). Noss et al. (1995) considered ungrazed dry prairie of Florida to be an endangered ecosystem (greater than 98 percent habitat loss and continued threat). In central Florida, within the range of the FGS, there continues to be a reduction in area and fragmentation of high-quality dry prairie and an even greater reduction in the number of sites that have been consistently burned and that have minimal human disturbance (Cole et al. 1994; Bridges 1997).

Obtaining consistent estimates of historical and existing areas of dry prairie vegetation is difficult. Kautz et al. (1993), based upon calculations from an early vegetation map of Florida (Davis 1967), estimate that 0.83 million ha (2.05 million acres), or 5.9 percent, of pre-settlement Florida was covered with dry prairie. By 1989, they estimate that 0.56 million ha (1.38 million acres) of dry prairie remained. Although this figure includes areas outside the

historic range for dry prairie given in Davis (1967), it represents a loss of 0.27 million ha (667,181.9 acres), or 33 percent, of the original area.

Aerial surveys of dry prairie habitat indicated that only 156,000 ha (385,482.8 acres) of dry prairie habitat existed in 1995 (Shriver and Vickery 1999), an 81 percent decrease from the 0.83 million ha (estimated from 1967 (Davis 1967). FGS habitat loss is due to conversion of dry prairie to improved pasture (Layne et al. 1977) and agricultural uses such as citrus groves (Davis 1967; Mealor 1972; DeSelm and Murdock 1993), pine plantations, exotic sod-forming grasses, row-crops, and, historically, eucalyptus (*Eucalyptus* spp.) plantations. Conversion of dry prairie to citrus groves may represent the single greatest threat to existing prairie remnants. Lack of burning may have degraded additional prairie habitat.

Delany et al. (2005) reported that efforts to identify dry prairie remnants through remote sensing indicated a remaining dry prairie area of 64,821 ha in Florida, with the majority of the remaining prairie occurring on conservation lands. Follow-up surveys of 12 privately-owned dry prairie areas failed to locate any FGSs that had not been previously documented. Delany (2006) conducted additional detailed assessments of the habitat condition of dry prairie patches through helicopter surveys, and reported that 44,933 ha of dry prairie remained in a condition that represented potential FGS habitat, with 69 percent of this area occurring on existing conservation lands.

In general, endemic habitat specialists with restricted ranges, such as the FGS, are sensitive to many environmental factors, including hydrological changes and degradation or loss of habitat. Changes in hydrological management regimes that render nesting areas too wet during the nesting season may affect the FGSs ability to reproduce. Overgrazing may eliminate plant species necessary for foraging and reproduction, as well as limit the amount of available cover to conceal nests. In native dry prairies, lack of management or inappropriate fire management practices can lead to overgrown breeding areas or sites with woody plant invasion. These conditions can rapidly lead to habitat conditions that are unsuitable for FGSs.

Records of FGS occurrence and abundance are sparse, making accurate assessment of historic populations nearly impossible. Between 1927 and 1945, many sightings of FGSs were recorded for Kenansville in Osceola County; Basinger and a location south of Fort Drum in Okeechobee County; and a site south of Lake Hicpochee and an area southeast of Immokalee in Hendry County. There appears to be a gap in FGS records between 1945 and the early 1960s. Records for the 1960s include a site north of Lake Okeechobee in Okeechobee County and a site south of Brighton in Glades County. In the early 1970s, records note a site west of Lake Okeechobee with no county specified and a site southwest of Kenansville (Service 1988).

Before the FWC, formerly the Florida Game and Freshwater Fish Commission, began conducting surveys for the FGS in the 1980s, the historic sightings identified above gave little insight into FGS abundance (Delany et al. 1985; Stevenson and Anderson 1994). Since that time, more detailed survey information has become available, and at least cursory information on abundance was provided in most subsequent reports of FGS occurrence. However, thorough and consistent surveys were not regularly conducted at occupied sites until the early 1990s.

During 1980 to 1982, the FWC conducted surveys of previously recorded FGS locations and searched other areas of potential habitat (Delany et al. 1985). Of the seven sites where FGSs had been previously reported, only one was found to support FGSs during the 1980 to 1982 surveys. Additional searches of potential habitat that has not been previously surveyed for FGSs documented their presence in six additional locations (Delany and Cox 1986). Additional surveys were conducted in 1984 and documented sparrows at these same sites, but also recorded FGSs at one new site and found FGSs at one site where they had been absent in 1982 surveys, for a total of nine occupied sites (Delany and Cox 1986). Assuming that all males recorded during these surveys were mated, a minimum total population size of 282 individuals resulted (Delany and Cox 1986).

In 1989 to 1992, the same sites where FGSs had been recorded during 1984 were again visited by FWC personnel. Only three of the sites still supported FGSs, two of which were on public lands (Delany and Linda 1994). All six abandoned sites were pasture that had been improved for cattle grazing or sod production. The three occupied sites, some of which had been managed to support cattle grazing, had been burned at 2- to 3-year intervals. Fires may have preserved the suitability of these habitats. Several additional areas of potential FGS habitat were also surveyed during 1989 to 1992 and FGSs were found at two new sites, including an additional population on public lands (Echo Range on APAFR), for a total of five sites. These early surveys provided good information on FGS occurrence and distribution, but did not accurately represent abundance at each site since surveys of available habitat were not comprehensive where FGSs were located (M. Delany, FWC, personal communication 2005).

Since the 1989 to 1992 surveys, occasional surveys of limited sites have been conducted whenever opportunities arise. These surveys have resulted in the discovery of five additional properties where FGSs occurred. Nesting FGSs were located on a site in Okeechobee that was proposed for development in 1992 (Turner and DeLotelle 1992), but FGS surveys have not been conducted on the site since 1992. One additional small population of FGSs was located in 1997 (Delany et al. 1999) on APAFR (Bravo Range) and one population was found on private lands in 2001 (Biological Research Associates 2001). FGSs were also documented on a private ranch immediately adjacent to the area occupied by FGSs on TLWMA (Perkins and Vickery 2001) and these birds are presumed to be functionally part of the TLWMA population. A small population of FGSs were also reported on the National Audubon Society's Ordway-Whittell Kissimmee Prairie Sanctuary in the early 1990s, and FGSs on the site were intensively monitored from 1993 to 1999 (Shriver 1996; Perkins 1999).

Since the early 1990s, several additional sites where FGSs had occurred have been abandoned. On the Ordway-Whittell Kissimmee Prairie Sanctuary, hydrologic impacts that resulted from installation of a dike on adjacent property artificially flooded the site starting in 1996. By 1999, the FGS had been extirpated. Since acquisition by the Florida Department of Environmental Protection (DEP), restoration of adjacent habitat to establish a corridor between the property and the larger prairies of the KPPSP has improved habitat and FGSs were recorded again in 2002. However, breeding activity has not been documented since then. Surveys conducted by FWC and Service staff in 2002 of Bright Hour Ranch in DeSoto County where FGSs were reported by Delany and Linda (1994) failed to locate FGSs and they are presumed to be extirpated from this site (Service, unpublished data).

In 2001 to 2002, Vickery and Perkins (2002) conducted FGS surveys on some private lands that had been identified as potential FGS habitat and where they could gain access in an attempt to locate additional FGS populations. These surveys failed to locate any additional sparrow populations. In 2002 to 2004, Delany et al. (2005) also conducted surveys on private properties that had been identified as potential FGS habitat, and again, these surveys failed to locate additional FGS populations.

Since Delany's first efforts to assess FGS populations rangewide in the early 1980s (Delany et al. 1985), surveys have recorded a general decline in the distribution and occurrence of FGSs. Of the 14 sites where FGSs have been documented to occur, only 5 remain occupied, and 4 of these are on public lands. In addition, recent surveys of private lands have failed to document FGSs, on other sites. Despite several survey efforts, there have been no records of FGSs outside of the upper Kissimmee River basin since the early 1990s, and this represents a large reduction in the species' distribution. Additional surveys are needed to confirm this change in distribution.

Today, three large tracts of publicly-owned land contain the largest and most-studied populations of FGSs. There is one population at KPPSP, which now includes the Ordway-Whittell Kissimmee Prairie Sanctuary (managed by the National Audubon Society until ownership was transferred in 2001). This preserve, acquired in 1996, has the largest contiguous block of dry prairie in public ownership (more than 12,000 ha [29,652.5 acres]) and the largest known population of FGSs. It also provides a corridor between other protected sites. There is another population of FGSs at TLWMA, which has approximately 2,500 ha (6,177.6 acres) of suitable, occupied habitat, and another disjunct patch of suitable habitat (861 ha [2,127.6 acres]) where FGSs did not occur, but to which FGSs were translocated in 2001 and 2002 (Dean and Glass 2001a). There are three populations at APAFR, which has approximately 2,400 ha (6,177.6 acres) of suitable FGS habitat. Survey efforts during the 2003 breeding season failed to detect any FGSs in one of the three population sites at APAFR (Bravo Range). One FGS was detected during 2004 surveys, but the future of this population is quite tenuous. Efforts to improve habitat suitability conducted in 2005 at APAFR included mechanical treatment of woody vegetation and removal of pine plantations adjacent to dry prairie sites. These efforts will result in a larger area of potential FGS habitat through continued restoration and maintenance.

Surveys for FGSs have been conducted regularly at KPPSP since 1999 (Mulholland and Small 2001) at TLWMA since 1991 (Dean and Glass 2001b) and at APAFR since 1982 (Delany et al. 2001). Monitoring efforts from 1999-2004 indicate that the total population size at these three primary sites ranged from approximately 340 to 640 individuals, though the population sizes are variable among years. In 2003, surveys estimated the population size at these three sites at under 350 individuals, largely due to declines at APAFR and KPPSP. This was the lowest total population estimate recorded. In 2004, estimates of the overall population were higher than in 2003 at TLWMA and KPPSP, while APAFR populations remained essentially unchanged (P. Miller, DEP, personal communication 2004; J. Tucker, ABS, personal communication 2004; S. Glass, FWC, personal communication, 2004). In 2005, FGS population size estimates were down from 2004 at TLWMA and KPPSP, and relatively unchanged at APAFR. (P. Miller, personal communication 2005; J. Tucker, personal communication 2005; M. Delany, FWC, personal communication, 2005).

FGS numbers have remained relatively stable at TLWMA since monitoring was initiated in 1991, although a population decline was documented during 1996 to 1998 (Dean and Glass 2001b). The FGS population reached a recorded low of 168 birds in 1998, down from a high count in 1993 of 220 individuals. By the year 2000, the population had rebounded to 280. Reasons for the population decline and subsequent recovery are unknown and may simply represent a normal range of variability in the population. Surveys conducted in 2004, revealed 124 singing males in the primary population, and 6 to 7 singing males in the translocation area (Steve Glass, FWC, personal communication 2005,). If a 1:1 sex ratio is applied to the singing males, the current FGSs population at TLWMA is estimated at 262 birds. In 2005, 114 males were detected in the primary population, and 2 males were reported in the translocation area for a total estimated population size of 232 individuals (M. Delany personal communication 2005).

The total population size reported at APAFR during 2002 was 162 sparrows (Delany 2002) distributed between three disjunct populations (Bravo, Echo, and Delta Trail Area-OQ Ranges), with the largest of the three (Echo Range) supporting over 100 sparrows. In 2003, the FGS population at APAFR declined significantly. ABS personnel conducted monitoring in 2003 and, before the completion of the second of three survey repetitions, surveyors were alarmed by the small number of sparrows they were hearing. After completing the second of three rounds of the surveys, a total of seven male FGSs had been detected. After all routine surveys had been completed, as well as additional intensive surveys; a total of 12 male sparrows had been detected. No sparrows were detected in the smallest population (Bravo Range) and the remaining 24 sparrows were distributed between two populations (Delta Trail Area-OQ and Echo Ranges).

The FGS populations have been in decline at APAFR since the late 1990s (Delany et al. 2001). Between 1997 and 2002, the population on Bravo Range declined from 43 to 8 individuals, the population on Echo Range declined from 142 to 104 individuals, and the population on Delta Trail Area-OQ Range declined from 113 to 50 individuals. The total population on APAFR in 2002 was 162 individuals, half of the total population estimated in 1997 (298 FGSs). However, the declines in FGS populations at APAFR detected during the 2003 breeding season were all over 80 percent, which is significantly greater in magnitude than declines in previous years (Service 2003b). Based on annual survival rates reported by Perkins and Vickery (2001) of 48.2 to 53.3 percent, the rate of decline during 2003 at APAFR is consistent with complete reproductive failure and nearly doubles the normal adult mortality rate.

In 2004 and 2005, the FGS populations at APAFR remained relatively stable with 3 to 4 males in the Delta Trail-OQ Range area, and 8-12 males in the Echo Range area. (J. Tucker, personal communication 2006). Point count surveys performed in 2006 detected 7 singing males in Echo Range and OQ Range during the breeding season (USAF 2006). Five additional singing males were detected outside the point count survey areas. No male FSGs were detected in Bravo Range or in the Delta Trail area north of Kissimmee Road.

Concurrent with the decline at APAFR, the FGS population at KPPSP declined by 44 percent in 2003, from 234 in 2002 to 129 singing males (P. Miller, DEP, personal communication 2003). This is the first year there has been a significant decline at KPPSP since monitoring was initiated in 1999. Surveys conducted in 2004, revealed 107 singing males in the primary prairie site

where the point-count arrays are established (up from 87 in 2003) (Paul Miller, DEP, personal communication 2005). Because the entire site was not surveyed, the 107 birds represent the minimum population size. If a 1:1 sex ratio is applied to the singing males, the minimum FGS population at KPPSP is estimated at 214 birds. During 2005, only 68 males were recorded on standardized surveys (P. Miller personal communication 2005), which equates to a total minimum population estimate of 176 individuals. This is the lowest number recorded in recent years. This represents a decline from 2004, and the total number is lower than that estimated in 2003. The 2002 surveys reported 66 males, but surveys in that year included approximately 20 fewer count points across a smaller area of prairie. Poor survey conditions may have resulted in a lower-than-average detection rate (P. Miller, personal communication 2005), but this possibility cannot be thoroughly evaluated.

Although declines of the magnitude observed since 2003 may have been a normal part of the biology of the FGS, the combination of population fluctuation, the currently reduced distribution and amount of available habitat, and smaller population size may threaten the persistence of this subspecies. No one has thoroughly screened FGS for diseases or blood parasites; however, the prevalence of West Nile Virus, Eastern Equine Encephalitis, and St. Louis Encephalitis are on the rise in Florida and should be considered. In February 2006, a radio-tagged FGS died at KPPSP as a result of a species of *Mycobacterium*, which causes tuberculosis (S. Terrell, Disney's Animal Kingdom, personal communication 2006). The species of mycobacterium has not yet been identified, and the prevalence of this disease remains unknown.

Outside of public lands, much of the additional suitable FGS habitat is found on a few large, private cattle ranches. These ranches support FGSs, but the extent of the population there is largely unknown. Large conservation easements have been obtained on the Bright Hour Ranch in DeSoto County and at Fish-Eating Creek in Glades County. Although the habitat at Fish Eating Creek is in good condition and within the extant range of the FGS, surveys have not documented FGSs utilizing either conservation easement (Vickery and Perkins 2001; Service, unpublished data). The future of the dry prairie landscape is currently dependent upon the management and protection of native rangelands on cattle ranches in south-central Florida. Conversion of native prairie vegetation for agricultural or development purposes continues to occur, and continues to pose a threat to the FGS (Service, unpublished data).

Habitat management, development, and land conversion are of serious concern on private lands. The open vegetative dry prairie community preferred by FGSs was historically maintained by lightning-induced fires. These fires occurred primarily during the summer growing season between June and August. Many of the remaining dry prairies are ecologically degraded due to fire suppression. Deviation in fire intensity, fire return interval, and seasonality from the natural fire regime of frequent growing-season burns is perhaps the most significant management factor determining vegetation structure and composition of dry prairie communities (Dye 1997; Bridges 1997). Loss of groundcover species, changes in pine density and recruitment, invasion of non-constituent oaks, and excessive shrub growth have been documented from dry prairies with long periods (circa 35 years) of fire exclusion (Dye 1997). When dry prairie is frequently burned, saw palmetto is typically of small stature and sparsely distributed, but it tends to increase in stature and density when fire is absent or infrequent. Although fire is beneficial to the FGS

and necessary to maintain its habitat, FGS densities decline two or more years following a burn event (Vickery and Shriver 1995).

Some ranchers use prescribed burns to improve pasture lands for cattle (Vickery and Shriver 1995). Native central Florida rangelands (*i.e.*, dry prairies and flatwoods) are typically burned by ranchers annually or biennially during the winter or early spring months to stimulate forage growth, nutrition, and palatability for cattle during the lean winter months (Abrahamson and Hartnett 1990; Sullivan 1994). Ranchers also burn native pastures to maintain openness, reduce shrub cover, reduce fuel accumulations, and improve wildlife habitat (Abrahamson and Harnett 1990). In addition to fire, roller-chopping may be used to alter the vegetative composition and structure within prairie habitats. Roller-chopping in winter may initially produce the fastest reduction of shrub cover and increased herbaceous growth (Fitzgerald et al. 1995). However, the remaining biomass is greater after roller-chopping than after a burn. It is important to note that roller-chopping cannot fully replace the function of fire, since wiregrass is dependant on summer fires to complete its reproductive cycle. Allowing wiregrass to bloom, results in greater seed production, which may increase winter forage for the FGS. In addition, roller-chopping disturbs the soil, thereby producing conditions that increase invasion by exotic invasive plant species.

ENVIRONMENTAL BASELINE – Eastern indigo snake

The environmental baseline includes the effects of past and present impacts of all Federal, State, or private actions and other human activities in the action area; the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation; and the impact of State or private actions, which are contemporaneous with the consultation in progress.

Status of the Species within the Action Area

A current study is examining the distribution and abundance of the indigo snakes, and how APAFR-related actions and public land uses at the range affects the species. Although the study is ongoing, preliminary telemetry results show that indigo snakes occur in the southwest portion of the Foxtrot target impact area, the northwest portion of the Alpha impact area along the perimeter of Alpha, and the west side of Echo impact area. Occurrence of indigo snakes outside of these impact areas includes the area adjacent to Bravo Road, along Kissimmee Road, and west of Bravo target impact area (Figure 5). The preliminary mean home range size for males and females is 457 acres and 247 acres, respectively.

Management of the indigo snake is through general management and maintenance of the habitat, and by implementing the Service's *Draft Standard Protection Measures for the Eastern Indigo Snake* (Service 2004). Indigo snakes have been documented in the northwest corner of the Alpha impact area, and along the perimeter of Alpha, including Alpha Road. Because indigo snakes use a variety of habitats, and have very large home ranges, indigo snakes may occur throughout the project area.

Factors Affecting Species Environment within the Action Area

Past and ongoing Federal actions affecting the indigo snake within the action area include four recent actions the Service has formally consulted on regarding training exercises at APAFR. A biological opinion was issued on May 5, 2005, for the JIFE at APAFR and incidental take was estimated to be 21.4 male and 39.69 female indigo snakes. A second Biological Opinion was issued on June 7, 2005, for the Navy Air-to-ground Bombing exercise at APAFR and incidental take was anticipated not to exceed 11 snakes annually. A third Biological Opinion was issued on September 22, 2005, for the Multiple Launch Rocket System (MLRS) exercise at APAFR and incidental take was anticipated not to exceed six snakes annually. A fourth Biological Opinion was issued on April 24, 2006, for JIFE at APAFR and incidental take was estimated to be 14.6 indigo snakes. The incidental take for all four activities was expected to be in the form of harm, harassment, and direct mortality.

In a letter dated November 5, 2004, the Service recommended that the USAF request consultation on the existing level of military activity currently taking place at APAFR (*e.g.*, cattle grazing, other military training, timber management, hunting, fishing, camping, controlled burns, prison operations), as our records do not show that such a consultation has taken place. In addition, the Service indicated that it would be to the USAF's advantage, as it would automatically require separate consultation for other armed services activities that would be distinct from USAF actions. APAFR is currently in informal consultation under section 7 of the Act with the Service on the draft update to the 2001 Integrated Natural Resources Management Plan (INRMP) 2004 to 2009. In addition, the USAF is in informal consultation on their Endangered Species Management Plan (ESMP) to address all listed species present on APAFR. The Service has recommended the USAF request formal consultation and submit complete initiation packages for these two plans.

The mission of APAFR is to provide a training infrastructure that allows air and ground forces to practice the latest combat training techniques and procedures safely, efficiently, and realistically, and to design training facilities that meet training needs. The 23rd Wing, at Moody Air Force Base, Georgia, is responsible for operating APAFR. This unit is an element of the Air Combat Command. The range is used for bombing practice by USAF units throughout the southeast. The USAF currently uses APAFR for inert/practice and HE ordnance delivery. The purpose of the JIFE is to train TACPs and FOs in coordination of ordnance delivery from aircraft and artillery by for a combined arms effect. Although many aspects of the JIFE occur at APAFR, the JIFE is the first exercise to combine them into a joint exercise. In addition, the JIFE introduces specific types of HE and inert ordnance not previously used on some ranges.

EFFECTS OF THE ACTION – Eastern indigo snake

This section includes an analysis of the direct and indirect effects of the proposed action on eastern indigo snakes, including beneficial effects, interrelated and interdependent actions, and species response to the proposed action.

Factors to be Considered

Indigo snakes have been documented north of Foxtrot Range, northwest of Brave Range, and west and north of Echo Range. Because indigo snakes use a variety of habitats, and have very large home ranges, indigo snakes may occur throughout APAFR. This action will take place when the snakes are likely to be present in the area. The duration of each JIFE will be up to 16 consecutive days in November and again in May. This constitutes a total of up to 32 days per year. Potential effects to indigo snakes due to inert/practice and HE ordnance delivery actions, ground support activities, or ordnance-ignited wildfires include mortality, habitat destruction and habitat degradation. The action may also cause snakes to leave the area, abandon den sites, and possibly miss foraging and mating opportunities. Individual snakes fleeing the area may be more vulnerable to predation. Potential direct effects to the indigo snake or its habitat include: (1) direct injury (including harm and harassment) or mortality due to exploding ordnance or fire; and (2) temporary loss or degradation of vegetation cover for foraging, breeding, and dispersing due to fire. Potential indirect effects include: disturbance from HE ordnance, target maintenance, construction of additional infrastructure; and fragmentation of indigo snake habitat adjacent to the impact areas.

Analyses for Effects of the Action

Direct Effects

Direct effects are those effects that are caused by the proposed action. The direct effects evaluated by the Service include: (1) direct injury (including harm and harassment) or mortality; and (2) loss or degradation of available habitat for foraging, breeding, and dispersing. Juvenile indigo snakes are particularly vulnerable since they utilize thick vegetation for cover. The direct effects that this project may have on indigo snakes within the action area are discussed below.

Injury and Mortality: It is not possible to estimate the density of indigo snakes at APAFR using existing data. However, a study conducted by Layne and Steiner (1996) at ABS, which is approximately 23 miles south of APAFR and contains similar habitat, estimated a population density of 2.6 indigo snakes (1.9 males, 0.7 females) per 100 ha (247 acres). Indigo snakes at ABS have been observed in all natural and man-altered habitats with no apparent habitat preferences (Layne and Steiner 1996). The ratio of adult males to adult females was estimated to be approximately 4:1 (males:females). The juvenile sex ratio was closer to 1:1. These estimates were consistent with other studies of captive snakes and museum specimens (Smith 1941; Duellman and Swartz 1958; Moulis 1976).

The impact areas likely overlap with several snake home ranges. Based on population density estimates at ABS, we have estimated that as many as 66.3 adult snakes (male and female) may be present within the Echo Range impact area and as many as 36.6 adult snakes (male and female) may be present within the Bravo/Foxtrot Range impact area. Though not all available habitats will necessarily be occupied, it is reasonable to expect that the combined impact areas would support all or portions of as many as 102.9 indigo snake ranges.

It is difficult to determine the number of snakes that will be directly harmed or killed by each JIFE. However, due to the scattered nature of the targets within the ranges and the risk of ordnance-ignited wildfire, the Service estimates that approximately 20 percent of the indigo snakes present at the time of the action could be adversely affected by JIFE. Thus, the Service anticipates incidental take of approximately 14.6 indigo snakes for each JIFE or approximately 29.2 snakes per year. The incidental take is expected to be primarily in the form of harm and harassment, though there is a potential for direct mortality. The Service estimates that 5 percent (0.73 snakes) of the 14.6 snakes potentially affected by each JIFE may be killed, or approximately 1.46 snakes per year.

Snakes may be injured or killed during the action by explosions and ordnance-ignited fires. The JIFE may cause individuals to leave the area, abandon den sites, and possibly miss foraging and mating opportunities. Above ground refugia may be lost during the training exercises. Individual snakes fleeing the area may be more vulnerable to predation. Some snakes may seek underground refugia, if available.

Loss and Degradation of Habitat: Legare and Breininger (2002) estimated that approximately 50,000 acres of upland habitat at APAFR provide potential habitat for the indigo snake. Approximately 6,300 and 3,477 acres, respectively, of potential indigo snake habitat exist within Echo and Bravo Ranges. The proposed HE ordnance delivery action and ordnance-ignited wildfires could affect some percentage of that habitat.

During November weather conditions are cool, moist, and less amenable to fire (Florida Department of Agriculture and Consumer Services 2004). Weather conditions in May however, are highly variable and likely to result in a wide range of effects. This is illustrated by the two most recent May JIFEs conducted 1 year apart.

During the May 2005 JIFE near normal weather conditions prevailed. Approximately 9.6 inches of rainfall occurred in the four month period (January, 2005 through April, 2005) prior to the start of JIFE (Paul Ebersbach, APAFB, electronic mail, 2006). As a result wildfire activity was very limited: 103.8 acres in Echo and 67.5 acres in Bravo were burned by ordnance-ignited fires for a total of 171.3 acres.

In May 2006 weather conditions at APAFR were extremely dry, wind speeds were relatively high, and fuel moisture was low. Approximately 3.7 inches of rain fell in the 4-month period (January 2006 through April, 2006) prior to the start of JIFE (Paul Ebersbach, APAFB, electronic mail, 2006). As a result, four ordnance-related wildfires burned a total of 8,910 acres. One wildfire burned 1,848 acres in Echo range and one wildfire burned 552 acres in Foxtrot range. Two wildfires originated inside Bravo Range. One fire burned 1,251 acres within Bravo Range. A second fire burned approximately 1,050 acres within Bravo range then crossed the southern boundary of Bravo and continued to burn approximately 4,200 acres before crews brought the fire under control. These wildfires are shown on Figure 6.

Future May JIFEs which occur under near-normal weather conditions will result in a small amount of habitat burned. The Service estimates, based on limited local rainfall data, that three out of four future May JIFEs will take place under such circumstances. The Service estimates

that between 150 and 200 acres of indigo snake habitat will be temporarily altered by wildfire, under normal weather conditions. Assuming that all habitats within the impact areas are suitable for indigo snakes, this affected area represents approximately 1.5 to 2.0 percent of the estimated available indigo snake habitat within those two ranges and approximately 0.3 percent of the estimated total potential habitat at APAFR.

The Service estimates, based on limited local rainfall data, that approximately one out of four future May JIFEs will take place under dry weather conditions. Such conditions are most likely to be present during the May JIFEs when wildfire occurrence is greatest in central Florida (Platt et al. 2006). The Service estimates that up to 9,000 acres of indigo snake habitat may be temporarily altered by wildfire under dry weather conditions similar to those described above. Assuming that all burned habitats are suitable for indigo snakes, ordnance-related wildfires will affect up to 18 percent of the estimated total potential indigo snake habitat under dry weather conditions.

The wildfires will result in a temporary loss of habitat available to eastern indigo snake; however, the habitats should recover within a few months depending on the intensity of the burn and amount of rainfall received in the post-burn growing period. Prescribed fire is the tool preferred by resource managers at APAFR for habitat management. However ordnance-caused wildfires occurring in May tend to approximate the natural fire regime and may help maintain suitable conditions for eastern indigo snake.

Indirect Effects

Indirect effects are those that are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. The indirect effects evaluated by the Service include: (1) HE ordnance target maintenance; (2) effects of additional infrastructure; and, (3) reduction in the value of snake habitat adjacent to the impact areas due to habitat fragmentation. The indirect effects that the proposed action may have on indigo snakes within the action area are discussed below.

Disturbance: Routine target maintenance and other ground-based support activities may result in disturbance to snakes, but the disturbance is anticipated to be temporary and discountable. Mechanical preparation and vehicle activity can crush or injure individual snakes and eggs, or destroy or degrade potential habitat. However, given the large home ranges of snakes and the relative low density (estimated to be 2.6 snakes per 100 ha), the Service considers the risk to snakes from maintenance and vehicles to be low and lethal take of indigo snakes or their eggs is not expected. Disturbance to habitat is expected to be temporary and is not expected to pose a risk to indigo snakes.

Infrastructure: The infrastructure created by the proposed action may allow for increased levels of training at APAFR. For example, the infrastructure provided by the proposed action may allow the Florida Army National Guard (FLARNG) to switch from using tracked vehicles to HIMARS for launching RRPRs. They would then be able to use roads instead of tank trails, which would minimize future effects to snakes. The JIFE will expand the firing points and create new mortar firing areas, which would become available for other training units throughout

the year. Increased training scenarios at APAFR could increase the potential for adverse effects to indigo snakes.

Habitat Fragmentation: Mac et al. (1998) define habitat fragmentation as, "The breaking up of a habitat into unconnected patches interspersed with other habitat which may not be inhabitable by species occupying the habitat that was broken up. The breaking up is usually by human action, as, for example, the clearing of forest or grassland for agriculture, residential development, or overland electrical lines." The reference to "unconnected patches" is a central underpinning of the definition. The proposed action is expected to result in short-term habitat fragmentation. Since indigo snakes use a wide variety of habitats and they have large home ranges, the Service does not anticipate that the habitat fragmentation will affect the value of adjacent habitats.

Interrelated and Interdependent Actions

An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. No interrelated or interdependent actions are expected to result from the project.

Species response to the Proposed Action

Mechanical preparation and vehicular activity can crush or injure individual indigo snakes and eggs, and destroy or degrade occupied and potential habitat, and foraging areas. Due to their large home ranges and relative low density, however, risk of direct mortality of snakes is discountable. Any clearing activities, ordnance-ignited wildfires, and ordnance delivery actions may adversely affect indigo snakes by causing them to leave the area, and possibly miss foraging and mating opportunities. Individual indigo snakes fleeing the area may be more vulnerable to predation.

Under normal weather conditions 150 to 200 acres of potential indigo snake habitat within the action area, representing 0.3 to 0.4 percent of the estimated available indigo snake habitat of APAFR, may be affected by the proposed action. Under dry weather conditions up to 9000 acres of potential indigo snake habitat, representing up to 18 percent of the estimated available indigo snake habitat of APAFR, may be affected by the proposed action. The number of individuals present at the time of JIFE is not known. However, the Service estimates that as many as 82.3 adult male and 20.6 adult female snakes may be present within Echo and Bravo/Foxtrot Ranges. These estimates are based on population density estimates at ABS (Layne and Steiner 1996). It is not known how many juvenile snakes may be present at the time of the JIFE. The number of snakes expected to be present on the roads and trails is not known and would vary over time and space.

The indigo snake is sensitive to habitat fragmentation. The proposed action likely will result in short-term habitat fragmentation. The snake's sensitivity to this type of activity is expected to be high, though disruption of normal behavior and activity is anticipated to be brief. This disruption will have the greatest effect on the indigo snake during dry weather conditions, which is the

expected condition for one out of four future May JIFEs. The Service anticipates that the indigo snake population at APAFR will recover from the effects of the proposed action within 1 year of a JIFE held during dry weather conditions.

CUMULATIVE EFFECTS – Eastern indigo snake

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Since the proposed action is located on a Federal military installation, there are no actions that may occur within the action area that would not be subject to consultation.

SUMMARY OF EFFECTS – Eastern indigo snake

Injury and Mortality: The Service anticipates approximately 14.6 indigo snakes will be taken incidental to each JIFE, or about 29.2 snakes annually. The incidental take is expected to be primarily in the form of harm and harassment. However, the Service estimates that 5 percent (0.73 snakes) of the 14.6 snakes potentially affected by each JIFE may be killed, or approximately 1.46 snakes per year.

Loss and Degradation of Habitat: The Service estimates that, during normal weather conditions, between 150 and 200 acres of indigo snake habitat may be affected, which represents approximately 1.5 to 2.0 percent of the estimated available indigo snake habitat within Echo and Bravo/Foxtrot Ranges. Normal weather is expected to prevail during three out of four future May JIFEs. During dry conditions (expected to occur in one out of four future May JIFEs) the Service estimates that up to 9,000 acres of indigo snake habitat may be affected, representing up to 18 percent of the estimated indigo snake habitat present on APAFR. Weather and fuel moisture conditions amenable to wildfire ignition and spread are most likely to occur in May.

Disturbance: Routine target maintenance and other ground-based support activities may result in disturbance to snakes, but the disturbance is anticipated to be temporary and discountable.

Infrastructure: The infrastructure created by the JIFE may allow for increased levels of training at APAFR. Increased training scenarios at APAFR could increase the potential for adverse effects to indigo snakes.

Habitat Fragmentation: The proposed action is expected to result in short-term habitat fragmentation. Since indigo snakes use a wide variety of habitats and they have large home ranges, the Service does not anticipate that the habitat fragmentation will affect the value of adjacent habitats.

Cumulative Analysis: Since the proposed action is located on a Federal military installation, there are no actions that may occur within the action area that would not be subject to consultation.

CONCLUSION – Eastern indigo snake

After reviewing the status of the eastern indigo snake and the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the species. No critical habitat has been designated for the eastern indigo snake; therefore, none will be affected.

ENVIRONMENTAL BASELINE – Florida scrub-jay

The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions, which occur simultaneously with the consultation in progress.

Status of the Species within the Action Area

Populations of FSJs at APAFR are divided into four different groups. These four groups include the north and south bombing range ridges, a group occupying a ridge along the Kissimmee River, and a small group scattered throughout APAFR. From 1991 to 1999, the FSJ population at APAFR declined by 36.4 percent from 99 groups to 63 groups (USAF, 2000). The population continued to decline to 51 groups between 1999 and 2001. A small increase to 54 groups was observed during 2003, which was attributed to high survival of adults and juveniles, successful reproduction in 2002, and a large number of immigrants in 2003 (Bowman 2005). The same number of groups were documented in 2004 (Bowman 2005) and 2005 (John Bridges, email communication). In 2006, 53 breeding groups were present (Bowman et al. 2006).

HMUs for FSJs at APAFR are managed for breeding habitat and matrix habitats for the dispersal of FSJs. These HMUs are managed using prescribed fires and mechanical methods. Monitoring the FSJ populations according to the ESMP consists of an annual survey of all FSJ habitats on APAFR, which is conducted in late June and early July. In addition, all nests are located and nestlings banded. Ninety-nine percent of the known FSJ population at APAFR is currently color-banded.

FSJ's HMUs overlap portions of Bravo, Foxtrot, and Echo target impact areas (Figure 7), with FSJ territories having been documented near some targets in each of the target impact areas except for Echo. Although the impact area in Charlie Range is not within any HMU, FSJs have been documented in the general area of some targets. As indicated in Figure 8, a total of eight FSJ territories overlapped Bravo Range, three were completely within Charlie Range, and four were present along the south western border of Echo Range.

Factors Affecting Species Environment within the Action Area

In a letter dated November 5, 2004, the Service recommended that the USAF request consultation on the existing level of military activity currently taking place at APAFR (*e.g.*, cattle grazing, other military training, timber management, hunting, fishing, camping, controlled burns, prison operations), as our records do not show that such a consultation has taken place. In addition, the Service indicated that it would be to the USAF's advantage, as it would automatically require separate consultation for other armed services activities that would be distinct from USAF actions. APAFR is currently in informal consultation under section 7 of the Act with the Service on the draft update to the 2001 INRMP 2004 to 2009. In addition, the USAF is in informal consultation on their ESMP to address all listed species present on APAFR. The Service has recommended the USAF request formal consultation and submit complete initiation packages for these two plans.

The mission of APAFR is to provide a training infrastructure that allows air and ground forces to practice the latest combat training techniques and procedures safely, efficiently, and realistically, and to design training facilities that meet training needs. The 23rd Wing, at Moody Air Force Base, Georgia, is responsible for operating APAFR. This unit is an element of the Air Combat Command. The range is used for bombing practice by Air Force units throughout the southeast. The Air Force currently uses APAFR for inert/practice and HE ordnance delivery. The purpose of the JIFE is to combine and coordinate the delivery of ordnance from aircraft and artillery by on-the-ground air controllers and FOs for a combined arms effect. The duration of each JIFE will be up to 16 consecutive days in November and again in May. Although many aspects of the JIFE occur at APAFR, the JIFE is the first exercise to combine them in a joint exercise. The proposed action will result in a substantial increase in the use of HE ordnance at APAFR (Table 3). In addition, the JIFE introduces specific types of HE and inert ordnance to a particular range not previously used.

EFFECTS OF THE ACTION – Florida scrub-jay

This section includes an analysis of the direct and indirect effects of the proposed action on FSJ, including beneficial effects, interrelated and interdependent actions, and species response to the proposed action.

Factors to be Considered

Potential effects to FSJs due to the proposed action include a number of direct and indirect effects on the FSJ and FSJ habitat. Potential direct effects to the FSJ or its habitat include: (1) injury and mortality of birds, destruction of nests from ordnance impact, and mortality or loss of nestlings or eggs due to ordnance-ignited fires; (2) effects of ordnance detonation and related wildfires on scrub habitat; (3) disturbance from ground support activities during the training exercise; and (4) lethal and non-lethal noise effects. Potential indirect effects include: (1) temporary reduction in food resources due to habitat alteration and ordnance-ignited fires; (2) reduction in cover and available nest sites due to habitat alteration and ordnance-ignited fires; and, (3) habitat degradation resulting from maintenance activities performed in support of the JIFE.

Analyses for Effects of the Action

Direct Effects

Direct effects are those effects that are caused by the proposed action. The direct effects evaluated by the Service include: (1) injury and mortality of birds, destruction of nests from ordnance impact, and mortality or loss of nestlings or eggs due to ordnance-ignited fires; (2) effects of ordnance detonation and related wildfires on scrub habitat; (3) disturbance from ground support activities during the training exercise; (4) lethal and non-lethal noise effects.

Injury and Mortality: FSJ habitat exists within the Bravo/Foxtrot Range where an increase in Hellfire missiles and routine ordnance drops would be conducted. FSJ habitat also exists within and adjacent to the Echo Range where mortars and howitzers would fire and routine ordnance would be dropped. Three territories for the FSJ have been recorded near existing targets in Bravo Range. Under the proposed action, four JIFEs will be conducted in May during the peak of the FSJ breeding season. Birds within the immediate vicinity of the ordnance impact areas have the potential to be harmed or killed by the inert/practice and HE ordnance delivery actions; however, the Service believes that the risk of direct mortality of FSJs due to explosion of ordnance is low.

Ordnance-ignited wildfires present the greatest risk for direct mortality of FSJs. If a wildfire were to reach an occupied FSJ territory during the nesting season, the potential would exist for the loss of eggs and nestlings. Risk of wildfire will be greater when humidity and fuel moisture are low and wind speeds and temperatures are high. These conditions typically occur in Florida in May (Platt et al. 2006). Risk of fire will be relatively low in November.

Four incidents of losses of FSJs as a result of training activities were documented from 1994 to 2000 (USAF 2000). These incidents resulted in the destruction of 7 nests and 5 fledglings. Additionally, one nest with 3 nestlings likely failed as a result of nearby activities (USAF 2000). Fire was the primary cause for the losses, although 1 nest with 4 fledglings was destroyed by a FLARNG tracked vehicle (USAF 2000). Ordnance-related wildfires, in May 2006 resulted in the loss of two FSJ nests containing a total of seven eggs (Bowman et al. 2006).

Based on 2006 monitoring data, 53 FSJ groups occurred at APAFR, one less than 2005 (Bowman et al. 2006). The mean group size in 2004 averaged 2.3 birds per group, which was a 0.7 reduction from the previous year's census (Bowman 2005). The mean group size in 2006 averaged 2.6 birds per group, identical to the 2005 census (Bowman et al. 2006). A family group consists of a monogamous breeding pair and often one or more pre-breeding offspring (USAF 2000), and each group inhabits and defends a territory.

Three FSJ territories are completely contained within Bravo Range, and an additional five territories are located along the southeastern and southwestern borders of the range (Figure 8). The Service believes that the territories closest to the HE targets and the Hellfire missile impact area in Bravo Range are the most at risk for fire-related effects. Four FSJ territories are located along the southwestern border of Echo range (Figure 8). Though not

proximal to the HE impact area, the Service believes these territories may be affected by ordnance-related wildfires that reach these areas during dry weather conditions.

The effects of wildfire on FSJs are highly variable and weather dependent. This is best illustrated by two JIFEs conducted one year apart in May 2005 and May 2006. Prior to the May 2005, JIFE, approximately 9.6 inches of rainfall occurred in January 2005 through April 2005 (Paul Ebersbach, APAFB, electronic mail, 2006). During the May 2005 JIFE, 103.8 acres burned as a result of ordnance-ignited wildfires in the Echo Range and 67.5 acres burned in the Bravo Range. No fires occurred in the vicinity of nesting FSJs. Prior to May 2006 JIFE approximately 3.7 inches of rainfall occurred in the months of January 2006 through April 2006 (Paul Ebersbach, APAFB, electronic mail, 2006). During the May 2006 JIFE ordnance ignited four wildfires burning 8,910 acres. FSJ habitat in Bravo, Echo, and south and east of Bravo range were affected by wildfire (Dent 2006). Two FSJ nests containing a total of seven eggs were lost.

Three territories directly overlap targets within the HE impact area of Bravo Range. One territory is also within approximately 650 m of the Hellfire missile target area. Several territories occur near Bravo and Echo Ranges, and these may be affected by ordnance-related wildfires which spread outside the HE areas. Based on the effects of the May 2006, JIFE wildfire may spread into FSJ habitat outside Bravo and Echo Ranges during future exercises. The Service anticipates that some FSJ territories, or portions of territories, may be affected outside Bravo and Echo Ranges during future JIFEs. The number of territories affected by ordnance-related wildfire will vary greatly based on fuel, weather, and effectiveness of fire management measures. Thus, loss of nests or nestlings, as a result of fire, may occur during JIFEs conducted in May.

The Service anticipates that up to two nests per year may be taken incidental to the proposed action as a result of ordnance-ignited fire. Take will most likely occur in May during years when rainfall and fuel moisture conditions are low. The mean fledgling production in 2004 was 2.02 young per breeding pair. Thus, loss of productivity of two nests is anticipated to result in incidental take of up to 4.04 fledglings per year.

Habitat Changes: FSJ habitat exists in all three impact area ranges. The continuous use of inert/practice and HE ordnance has the potential to adversely affect FSJ habitat by destroying vegetation and altering the landscape. Repeated and increased detonation of HE ordnance could change the characteristics of the scrub habitat within these ranges. Craters formed from ordnance explosions would create new depressions in the landscape. These depressions would recover to some extent, but would likely remain for several years and could change the vegetation and hydrology of the area.

HE ordnance delivery may result in high intensity fires in scrub habitat, especially habitat that has had a relatively lengthy period of fuel accumulation. Scrub habitat is pyrogenic, *i.e.*, maintained by periodic fire events, though the return period between fires is highly variable (Myers 1990). Most scrub species [scrub oak (*Quercus inopina*), myrtle oak (*Q. myrtifolia*), sand live oak (*Q. geminate*), Chapman oak (*Q. chapmanii*), saw palmetto (*Serenoa repens*), Lyonia (*Lyonia* sp.)] are killed to ground level but rapidly resprout. In the post-fire interval (3 to 4 years), acorn production increases and scrub vegetation grows in stature. The overall forage,

cover, and nesting conditions for FSJ improve. Habitat conditions become optimal approximately 5 years after the fire event and remain so for about fifteen years, post fire (Woolfenden and Fitzpatrick 1996b).

Ordnance-ignited wildfires, particularly those that occur during May JIFEs, may approximate the natural fire regime for native scrub habitat. These fires can result in the temporary reduction of cover and acorn production within FSJ habitat. Wildfire also may maintain low vegetation structure for nesting, maintain open sandy areas for foraging and acorn caching, and reduce tree density. Adverse effects to FSJ habitat due to ordnance-ignited wildfire are expected to be temporary. Prescribed fire is the tool preferred by resource managers at APAFR for FSJ habitat management; however, ordnance-caused wildfires may achieve similar, though unplanned, results and may provide benefits to FSJ in the long term. Risk of wildfire during November JIFEs will be low.

Disturbance: Disturbance associated ground unit training, occurring during JIFE, has the potential to adversely affect FSJs. This disturbance can disrupt normal behavior, causing birds to leave the area and possibly miss foraging and mating opportunities. These effects are similar to those that already occur, or have occurred on APAFR in the past, but the proposed action represents an increase in disturbance. The disturbance is anticipated to be temporary and discountable.

An anecdotal example of disturbance occurred during the May 2006 JIFE. A rocket launcher fired salvos of inert rockets (RRPR, aka "Smokey Sams"), within, approximately, 30 meters of an FSJ nest on Bravo Range. The noise and explosive flashes of the rockets caused a pair of FSJs to, temporarily, abandon incubation. Both adults resumed normal behavior and nesting activities the following day (Dent 2006).

Lethal and Non-lethal Noise: High-explosive ordnance noise is categorized as impulse noise and is accompanied by abrupt increases in pressure and powerful, low frequency sound that rapidly spreads from the point of detonation (Navy 2005). The USAF's BA did not specifically analyze the potential effects of noise disturbance on FSJ within the JIFE action area. The Service, however, believes that noise effects from the proposed action may pose a risk to the FSJ and the marked increase in HE ordnance and RRPRs used for the JIFE will likely result in take of FSJs in the form of harm and harassment.

Several studies have been conducted on the effects of aircraft noise and sonic booms on wildlife, but empirical information is lacking on impulse noise thresholds and the physiological and behavioral effects of HE detonation on birds. Lethal noise can result in the death of individual birds within the immediate vicinity of the blast. It is likely, though, that birds subjected to lethal noise levels would also be exposed to other potentially lethal HE detonation effects such as intense heat and blast fragments. Thus, the territories and individuals potentially subjected to lethal noise levels are the same individuals that would be affected by HE detonation. These effects were discussed in the previous section (Injury and Mortality).

Non-lethal noise may result in temporary or permanent hearing loss after repeated exposure. The noise disturbance may also cause behavioral changes or alter habitat use. FSJ populations at

Ocala National Forest exposed to noise levels resulting from use of ordnance and aircraft similar to that being proposed for the JIFE at APAFR appear conditioned to tolerate mission-associated noise (Navy 2005). The training activities proposed for the JIFE are very similar to individual training activities that already take place at APAFR. Though the FSJ populations at APAFR are likely habituated to the current baseline level of noise, the JIFE will result in an increase in noise levels over the existing condition. During the 2005 JIFE, RRPRs broke the sound barrier, which caused birds in the area to flush. The sharp increase in use of RRPRs from a baseline of 0 to total of 300 is likely to adversely affect the FSJ population. Similarly, the proposed action will result in a substantial increase over the baseline condition in the use of some HE ordnance at APAFR (Table 3).

Non-lethal noise disturbance may cause birds to abandon active nests or possibly miss foraging opportunities. Given the lack of empirical information on the effects of HE ordnance detonation or sonic booms on birds, it is difficult to predict the effect threshold for FSJs at APAFR. Three territories directly overlap targets within the HE impact area of Bravo Range. Four additional territories are directly adjacent to the HE area in Bravo Range and within approximately 600 m of targets. The Service estimates that these seven families (16.1 birds) could be adversely affected by non-lethal noise. The effect is anticipated to be in the form of harm and harassment.

Indirect Effects

Indirect effects are those that are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. The indirect effects evaluated by the Service include: (1) disturbance from HE ordnance target maintenance; (2) effects of additional infrastructure; (3) reduction in food resources; and (4) reduction in the value of FSJ habitat adjacent to the impact areas due to habitat fragmentation. The indirect effects that the proposed action may have on FSJs within the action area are discussed below.

Disturbance: Routine target maintenance and other ground-based support activities, indirectly related to JIFE, may result in temporary disturbance to FSJs, but the disturbance is anticipated to be temporary and discountable.

Infrastructure: The infrastructure created by the JIFE may allow increases in future training at APAFR. The JIFE will expand the firing points and create new mortar firing areas, which would become available for other training units throughout the year. Increased training scenarios at APAFR could increase the potential for adverse effects to FSJs.

Food Resources: Ordnance-ignited wildfires that burn scrub habitat may result in a temporary reduction in food resources available to FSJs. Depending on the intensity of the burn and the extent of scrub habitat affected, acorn production may be diminished for several years following the burn. Although wildfires may temporarily reduce the foraging value of scrub habitats, these fires can also improve the habitat value by maintaining lower tree densities. Fire also maintains low vegetation structure for nesting and open sandy areas for foraging. Risk of ordnance-caused

fire is greater for JIFEs conducted in May but will be low for JIFEs conducted in November. FSJs will usually forage in the unburned patched of scrub while the burned patches recover.

Habitat Fragmentation: The proposed action is expected to result in short-term habitat fragmentation. However, this fragmentation is not expected to present an impediment to movement to other habitats. Stith et al. (1996) found that habitat gaps larger than 7.5 miles represent barriers to natural dispersal and recolonization by FSJs. Habitat gaps of this size are not expected to result from the proposed action. Thus, the Service does not anticipate that the habitat fragmentation will affect the value of adjacent habitats.

Interrelated and Interdependent Actions: An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. No interrelated or interdependent actions are expected to result from the project.

Species Response to the Proposed Action

Implementation of the proposed action including any clearing activities, ordnance delivery and detonation, and ordnance-ignited wildfires may adversely affect FSJs. The adverse effects range from mortality to non-lethal disturbance. Ordnance-ignited wildfires have the potential to destroy eggs and kill nestlings. Risk of ordnance-caused fire and associated negative effects is relatively high in May but low in November. Birds within the immediate vicinity of the HE ordnance impact areas have the potential to be harmed by the inert/practice and HE ordnance delivery actions. Disturbance resulting from the proposed action may disrupt normal behavior, causing birds to leave the area and possibly abandon active nests or miss foraging and mating opportunities. Ordnance-ignited wildfires that burn scrub habitat may result in reduced foraging opportunities; however, FSJs will usually forage in the unburned patched of scrub while the burned patches recover. FSJ may respond positively to the post fire alterations in scrub habitat including lower scrub height, increased bare ground, decreased tree density.

Lethal noise effects to FSJs are not anticipated. Non-lethal noise disturbance may cause birds to abandon active nests or possibly miss foraging opportunities.

The FSJs at APAFR potentially adversely affected by the proposed action are expected to recover within one breeding season.

CUMULATIVE EFFECTS – Florida scrub-jay

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Since the proposed action is located on a Federal military installation, there are no actions that may occur within the action area that would not be subject to consultation.

SUMMARY OF EFFECTS – Florida scrub-jay

Injury and Mortality: The Service anticipates two nests per year may be taken incidental to the proposed action as a result of ordnance-ignited fire during May JIFEs. The mean fledgling production in 2004 was 2.02 young per breeding pair. Thus, loss of productivity of two nests per year is anticipated to result in incidental take of 4.04 fledglings per year.

Habitat Changes: Repeated and increased detonation of HE ordnance could change the characteristics of the scrub habitat within the impact areas. Craters formed from ordnance explosions would recover to some extent but would likely remain for several years and could change the vegetation and hydrology of the area. HE craters could result in small depressions, barren of vegetation. These depressions may accumulate over time and contribute to fragmentation of FSJ habitat. Adverse effects to FSJ habitat due to ordnance-ignited wildfire are expected to be temporary. Wildfires may burn overgrown scrub and result in long-term improvement in FSJ habitat.

Disturbance: Disturbance-associated ground unit training, routine target maintenance, and other ground-based support activities have the potential to adversely affect FSJs. These effects are similar to those that already occur, or have occurred on APAFR in the past, but the proposed action represents an increase in disturbance. The disturbance is anticipated to be temporary and discountable.

Lethal and Non-lethal Noise: Lethal noise effects to FSJs are not anticipated. The Service estimates that seven families (16.1 birds) could be adversely affected by non-lethal noise. The effect is anticipated to be in the form of harm and harassment.

Infrastructure: The infrastructure created by the JIFE may allow for increase levels of training at APAFR. Increased training scenarios at APAFR could increase the potential for adverse effects to FSJs.

Food Resources: Wildfires may temporarily reduce the foraging value of scrub habitats; however, these fires can also improve the habitat value by keeping the scrub open by maintaining lower tree densities.

Habitat Fragmentation: The proposed action may result in short-term habitat fragmentation; however, the Service does not anticipate that the habitat fragmentation will affect the value of adjacent habitats.

Cumulative Analysis: Since the proposed action is located on a Federal military installation, there are no actions that may occur within the action area that would not be subject to consultation.

CONCLUSION – Florida scrub-jay

After reviewing the status of the FSJ and the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion

that the action, as proposed, is not likely to jeopardize the continued existence of the species. No critical habitat has been designated for the FSJ; therefore, none will be affected.

ENVIRONMENTAL BASELINE – Red-cockaded woodpecker

The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions, which occur simultaneously with the consultation in progress.

Status of the Species within the Action Area

A total of 25 active RCW clusters were documented on APAFR in 2006 (Gilson 2006). This represents an increase over 2005 when 21 clusters were active (Bowman et al. 2006). Typically one RCW fledgling is produced per nesting pair (USAF 2000; Gilson 2006). Clusters are dispersed over the entire range with concentrated areas in the north-central/northwest, northeastern, and eastern portions of APAFR. RCW's HMUs overlap portions of Bravo, Foxtrox, and Charlie Ranges (Figure 9). RCWs are not present in Echo Range, including the HE area. Based on 2006 survey data, one active RCW cluster was present in the north to central portion of Bravo Range (Figure 10).

The RCW population is managed in accordance with the APAFR ESMP, and the APAFR RCW management strategy is consistent with the Service's RCW Recovery Plan. Management activities within the RCW HMUs include prescribed burning and mechanized vegetation treatments (logging, mowing, and planting of longleaf pine). Prescribed burning is the primary tool in managing RCW habitat. Because RCW habitat is limited, cavity augmentation is used to supplement natural cavities. Cavity augmentation is conducted in accordance with the Service's Recovery Plan. RCW translocation has been conducted on APAFR since 1998 (Gilson 2006). Nineteen RCWs (7 females and 12 males) mostly from Apalachicola National Forest have been introduced into APAFR. Thirteen individuals (12 females and 1 male) have been relocated from one cluster to another within APAFR.

Factors Affecting Species Environment within the Action Area

In a letter dated November 5, 2004, the Service recommended that the USAF request consultation on the existing level of military activity currently taking place at APAFR (*e.g.*, cattle grazing, other military training, timber management, hunting, fishing, camping, controlled burns, prison operations), as our records do not show that such a consultation has taken place. In addition, the Service indicated that it would be to the USAF's advantage, as it would automatically require separate consultation for other armed services activities that would be distinct from USAF actions. APAFR is currently in informal consultation under section 7 of the Act with the Service on the draft update to the 2001 INRMP 2004 to 2009. In addition, the USAF is in informal consultation on their ESMP to address all listed species present on APAFR. The Service has recommended the USAF request formal consultation and submit complete initiation packages for these two plans.

The mission of APAFR is to provide a training infrastructure that allows air and ground forces to practice the latest combat training techniques and procedures safely, efficiently, and realistically, and to design training facilities that meet training needs. The 23rd Wing, at Moody Air Force Base, Georgia, is responsible for operating APAFR. This unit is an element of the Air Combat Command. The range is used for bombing practice by USAF units throughout the southeast. The USAF currently uses APAFR for inert/practice and HE ordnance delivery. The purpose of the JIFE is to combine and coordinate the delivery of ordnance from aircraft and artillery by TACPs and FOs for a combined arms effect. Although many aspects of the JIFE occur at APAFR, the JIFE is the first exercise to combine them in a joint exercise. In addition, the JIFE introduces specific types of HE and inert ordnance to a particular range not previously used.

EFFECTS OF THE ACTION – Red-cockaded woodpecker

This section includes an analysis of the direct and indirect effects of the proposed action on RCWs, including beneficial effects, interrelated and interdependent actions, and species response to the proposed action.

Factors to be Considered

Potential effects to RCWs due to the proposed action include a number of direct and indirect effects on the RCW and RCW habitat. The duration of each JIFE will be up to 16 consecutive days in November and again in May. The May JIFEs will coincide with the breeding season of RCWs. Although no RCW clusters occur within the target areas several clusters in Bravo/Foxtrot Range could be affected by ordnance-related fires. Potential direct effects to the RCW or its habitat include: (1) mortality or loss of nestlings or eggs and loss or damage of cavity and forage trees due to ordnance-ignited fires; (2) disturbance from ground support activities during the training exercise; and (3) non-lethal noise effects. Potential indirect effects include: (1) habitat degradation resulting from maintenance activities performed in support of the JIFE; and (2) effects of additional infrastructure.

Analyses for Effects of the Action

Direct Effects

Direct effects are those effects that are caused by the proposed action. The direct effects evaluated by the Service include: (1) mortality or loss of nestlings or eggs and loss or damage of cavity and forage trees due to ordnance-ignited fires; (2) disturbance from ground support activities during the training exercise; and (3) non-lethal noise effects.

Injury and Mortality: RCW's HMUs overlap portions of Bravo, Foxtrot, and Charlie Ranges. No RCW clusters have been documented in Echo Range. Most of the active RCW clusters are not within close proximity to any targets used for the proposed action. Potential effects to RCWs from the JIFE are primarily related to ordnance-ignited fires that could spread into the HMUs damage cavity trees and harm eggs or nestlings during nesting season.

JIFE related fire effects are most likely to occur in May following an extended dry period. Such weather conditions prevailed during the May 2006 JIFE. JIFE-related wildfires burned vegetation in RCW cluster AP5 (Bowman et al. 2006). The fire scorched the nest tree containing four eggs in a natural cavity. Although the tree survived the fire effects all eggs were lost to the intense heat. Wildfire also has the potential to damage artificial nest inserts. Heat and flame could, potentially, melt the plastic openings, rendering the cavity unsuitable for use. During May 2006 JIFE-related wildfires damaged two nest inserts in this manner (Lauren Gilson, Research Assistant, ABS, personal communication 2006). Risk of wildfire will be greater when the fire index is high and in areas not recently burned.

Based on 2006 data, one RCW cluster is present in the north-central portion of Bravo Range, three are present within the north central portion of Foxtrot Range, and five more are present along the northern borders of Foxtrot Range. The potential exists for the cluster nearest the HE impact area to be affected by ordnance-ignited fire. Since the ordnance used in Foxtrot Range is inert, the risk of fire-related effects is much lower for those clusters. The Service estimates that one active cluster in Bravo Range has the potential to be affected by ordnance-ignited fires. The effect is expected to be in the form of damage or loss of forage and/or nesting trees, resulting in the take (harm and harassment) of RCWs associated with those habitat components. The Service anticipates that as many as three cavity trees per year may be subject to fire effects, ranging from minor scorching to tree mortality. The Service also anticipates take of RCWs in the form of the loss of productivity of one nesting RCW pair per year, or one fledgling, due to ordnance-caused wildfires.

Fire may also benefit the RCW by helping to maintain RCW habitat. Historically, fires at APAFR have been more beneficial than adverse. Over a 9-year period, only three active cavity trees have been lost as a result of ordnance-ignited fire. The proposed action, however, will result in a substantial increase in the use of HE ordnance at APAFR (Table 3).

Disturbance: Disturbance associated ground unit training, during JIFE, has the potential to affect RCWs. This disturbance can disrupt normal behavior, causing birds to leave the area and possibly miss foraging and mating opportunities. These effects are similar to those that already occur, or have occurred on APAFR in the past, and the proposed action represents an increase in disturbance. The disturbance is anticipated to be temporary and discountable.

Non-lethal Noise: Non-lethal noise disturbance may cause birds to flush from the area and possibly miss foraging or mating opportunities. Several studies have suggested that RCWs can become acclimated to military noise; however, these studies have primarily focused on noise associated with small arms fire and military maneuvering. Since most of the active clusters are not in close proximity to the target areas, though, effects associated with noise are anticipated to be temporary and discountable.

Indirect Effects

Indirect effects are those that are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. The indirect effects evaluated by the Service include:

(1) habitat degradation resulting from maintenance activities performed in support of the JIFE; and (2) effects of additional infrastructure.

Disturbance: Routine target maintenance and other ground-based support activities, indirectly related to JIFE, may result in temporary disturbance to RCWs, but the disturbance is anticipated to be temporary and discountable.

Infrastructure: The infrastructure created by the JIFE may allow for increased levels of training at APAFR. The JIFE will expand the firing points and create new mortar firing areas, which would become available for other training units throughout the year. Increased training scenarios at APAFR could increase the potential for adverse effects to RCWs.

Interrelated and Interdependent Actions: An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. No interrelated or interdependent actions are expected to result from the project.

Species response to the Proposed Action

Ordnance-ignited wildfires resulting from implementation of the proposed action may adversely affect RCWs. Ordnance-ignited wildfires have the potential to destroy eggs and kill nestlings and damage or kill cavity trees and forage trees. No active clusters are in close proximity to HE targets; however take of nests or nestlings may occur due to ordnance-related wildfires. Cavity trees, forage trees, or artificial nest inserts may be lost or damaged by ordnance fire, which would adversely affect the clusters using those habitat components.

The RCWs at APAFR potentially be affected by the proposed action are expected to recover within one breeding season.

CUMULATIVE EFFECTS – Red-cockaded woodpecker

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Since the proposed action is located on a Federal military installation, there are no actions that may occur within the action area that would not be subject to consultation.

SUMMARY OF EFFECTS – Red-cockaded woodpecker

Injury and Mortality: The Service estimates that one active cluster in Bravo Range has the potential to be affected by ordnance-ignited fires. The effect is expected to be in the form of damage or loss of forage and/or cavity trees. The Service anticipates that as many as three cavity trees per year may be damaged or lost due to fire. The Service also anticipates the loss of

productivity of one nesting RCW pair per year, or one fledgling, due to ordnance-caused wildfires in May. Fire may also benefit the RCW by helping to maintain RCW habitat.

Disturbance: Disturbance associated ground unit training is expected to be temporary and discountable.

Non-lethal Noise: Effects associated with noise are anticipated to be temporary and discountable.

Disturbance: Disturbance associated with routine target maintenance and other ground-based support activities is expected to be temporary and discountable.

Infrastructure: The infrastructure created by the proposed action may allow for increased levels in future training at APAFR. Increased training scenarios at APAFR could increase the potential for adverse effects to RCWs.

Interrelated and Interdependent Actions: No interrelated or interdependent actions are expected to result from the project.
Cumulative Analysis: Since the proposed action is located on a Federal military installation, there are no actions that may occur within the action area that would not be subject to consultation.

CONCLUSION – Red-cockaded woodpecker

After reviewing the status of the RCW and the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the species. No critical habitat has been designated for the RCW; therefore, none will be affected.

ENVIRONMENTAL BASELINE – Florida grasshopper sparrow

The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions, which occur simultaneously with the consultation in progress.

Status of the Species within the Action Area

There are three spatially isolated populations of FGSs on APAFR, within Echo, Bravo, and Delta Trail Area-OQ Ranges (Figure 11). These populations occupy the remaining large patches of native dry prairie or prairie-like habitat at APAFR. The area supporting the Bravo Range population is the smallest of the three, and occurs in an area that was historically forested. The prairie-like conditions that occur at the site today are probably a result of frequent fires and disturbances resulting from the military missions at the site.

The FGS sub-populations have been surveyed at APAFR from 1996 to present. These surveys show a steady decline in the overall population, with the sub-population at the Bravo/Foxtrot impact area having been possibly extirpated (Tucker and Bowman 2004; Bowman et al. 2006). The total population size reported at APAFR during 2002 was 162 sparrows distributed between the 3 populations with the largest population (100 sparrows) reported at Echo Range (Delany 2002). In 2003 the FGS population at APAFR declined significantly with a total of 12 male sparrows and 1 additional bird of unknown sex detected. No sparrows were detected in the smallest population (Bravo Range) and the remaining birds were distributed between the other two populations (Delta Trail Area-OQ and Echo Ranges) (Bowman and Tucker 2003). During the 2004 breeding season, a total of 15 male sparrows were detected with only 1 of those being detected at Bravo Range (Delany et al. 2005). The FGS populations at this site did not appear to increase in 2005, and results from 2006 surveys (7 singing males detected during point counts, 11 in all) suggest that the number of birds may have declined further (USAF 2006). At these low numbers, even small effects to the FGS may increase the likelihood of extirpation of one or more populations.

Dry prairie habitat has been maintained within the three populations primarily through the application of prescribed fire, and the area of suitable dry prairie has not appeared to decline significantly. However, the growth of trees and shrubs in patches within dry prairies and along the perimeter of the prairies may have resulted in a reduction in suitability for FGSs. Prior to the 2005 FGS breeding season and during the remainder of 2005, APAFR staff conducted management actions to improve the suitability of remaining dry prairie habitat for FGSs.

Factors Affecting Species Environment within the Action Area

In a letter dated November 5, 2004, the Service recommended that the USAF request consultation on the existing level of military activity currently taking place at APAFR (*e.g.*, cattle grazing, other military training, timber management, hunting, fishing, camping, controlled burns, prison operations), as our records do not show that such a consultation has taken place. In addition, the Service indicated that it would be to the USAF's advantage, as it would automatically require separate consultation for other armed services that would be distinct from USAF actions. APAFR is currently in formal consultation under section 7 of the Act with the Service on the draft update to the 2001 INRMP 2004 to 2009. In addition, the USAF is under formal consultation on their ESMP to address all listed species present on APAFR. Based on current plan review information, the Service is concerned that take may have been exceeded for both the FSJ and FGS.

The mission of APAFR is to provide a training infrastructure that allows air and ground forces to practice the latest combat training techniques and procedures safely, efficiently, and realistically, and to design training facilities that meet training needs. The 23rd Wing, at Moody Air Force Base, Georgia, is responsible for operating APAFR. This unit is an element of the Air Combat Command. The range is used for bombing practice by USAF units throughout the southeast. The USAF currently uses APAFR for inert/practice and HE ordnance delivery. The purpose of the JIFE is to combine and coordinate the delivery of ordnance from aircraft and artillery by on-the-ground air controllers and FOs for a combined arms effect. Although many aspects of

the JIFE occur at APAFR, the JIFE is the first exercise to combine them in a joint exercise. In addition, the JIFE introduces specific types of HE and inert ordnance to a particular range.

EFFECTS OF THE ACTION – Florida grasshopper sparrow

This section includes an analysis of the direct and indirect effects of the proposed action on FGS, including beneficial effects, interrelated and interdependent actions, and species response to the proposed action.

Factors to be Considered

Potential effects to FGSs due to the proposed action include a number of direct and indirect effects on the FGS and FGS habitat. Potential direct effects to the FGS or its habitat include: (1) injury and mortality of birds, destruction of nests from ordnance impact, and mortality or loss of nestlings or eggs due to ordnance-ignited fires; (2) effects of ordnance detonation and related wildfires on prairie habitat; (3) disturbance from ground support activities during the training exercise; (4) lethal and non-lethal noise effects. Potential indirect effects include: (1) temporary reduction in food resources due to habitat alteration and ordnance-ignited fires; (2) reduction in cover and available nest sites due to habitat alteration and ordnance-ignited fires; and (3) habitat degradation resulting from maintenance activities performed in support of the JIFE.

Analyses for Effects of the Action

Direct Effects

Direct effects are those effects that are caused by the proposed action. The direct effects evaluated by the Service include: (1) injury and mortality of birds, destruction of nests from ordnance impact, and mortality or loss of nestlings or eggs due to ordnance-ignited fires; (2) effects of ordnance detonation and related wildfires on prairie habitat; (3) disturbance from ground support activities during the training exercise; and (4) lethal and non-lethal noise effects.

Injury and Mortality: FGS's HMUs overlap portions of the North Bravo, Echo, and Charlie Ranges. The delivery of HE ordnance to Echo and Bravo Ranges has the potential to directly affect FGS through death or injury of individuals resulting from ordnance detonation and associated wildfires. Additionally, about half of the Hellfire missile target area is within FGS habitat in the Bravo Range. The JIFE is proposed to be conducted during the early part of the FGS breeding season. Birds within the immediate vicinity of the ordnance impact areas have the potential to be harmed or killed by the inert/practice and HE ordnance delivery actions. Take may be in the form of direct mortality of adult birds, destruction of nests with eggs or nestlings, and abandonment of active nests due to disturbance. Ordnance-ignited wildfires present the greatest risk for direct mortality of FGSs. A fire has the potential to destroy eggs, nestlings, and possibly adults. Risk of wildfire will be greater when the fire index is high and in areas not recently burned.

During 2004 point counts, only six singing males and one bird of unidentified gender were detected and all were in Echo Range. Outside of point counts, nine additional males were detected: four at Charlie/Echo Range; four at Delta/OQ Range, and one at Bravo Range. Information presented in the BA for the May 2006 JIFE (USAF 2005) shows that 10 birds were counted during 2005 surveys. One FGS was detected in Bravo/Foxtrot Range, six in Charlie/Echo Range, and three in Delta/OQ Range. It is not clear, though, if all were singing males.

Each year one JIFE will be conducted in May during the FGS breeding season. The post-JIFE monitoring report submitted by the USAF; as required by the May 5, 2005, Biological Opinion; states that four FGSs were detected near the HE area in Echo Range prior to the JIFE and three of the four were located immediately following the JIFE. Also, prior to the May 2005 JIFE, one FGS was documented inside the Bravo Range HE area and was relocated within that area after the JIFE. The USAF concluded that there was no incidental take of FGSs; however, the Service believes there likely was taking of at least one sparrow in Echo Range since it was never relocated after the JIFE.

Prior to the May 2006 JIFE, one male FSG was documented within 200 meters of the HE area in Echo Range. It relocated to an unburned portion of Echo Range in the weeks following JIFE (Bowman et al. 2006). A second male was documented; prior to the May 2006 JIFE, approximately 1,200 meters northeast of the Echo HE area. Its territory was burned over by ordnance-related fire however it was relocated approximately 300 meters east of the HE area after JIFE concluded. One female/male pair was observed tending a nest with four nestlings about 300 meters east of the HE area prior to the May 2006 JIFE (Bowman et al. 2006). After the JIFE the same pair with one nestling were relocated. No mortality was confirmed, however, take of three fledglings may have occurred. This take may have been in the form of direct mortality from ordnance delivery or wildfire. Take could also have occurred indirectly, in that the young FGSs could have been exposed to predation after wildfire removed their escape cover and displaced them into unfamiliar territory.

The Service believes there is a risk of direct take of FGSs in Echo Range due to the close proximity (within 400 meters) of documented singing males to the HE impact area. The Service anticipates that FGSs near the HE area in Echo Range will be adversely affected by future May JIFEs. Based Bowman et al. (2006) two singing males are likely to occur within Echo Range during a given breeding season. Assuming that each male is mated to a single female, and that each pair has a nest containing up to four eggs or nestlings, the Service anticipates take, in the form of harm and harassment, of up to four adult FGSs, and up to eight FGS eggs or nestlings, per year.

Based on population levels provided by Bowman et al. (2006) it is likely that one mated pair of FGS per year will establish a territory in an area of Echo Range that is susceptible to fire (*i.e.*, an area that has not burned in 2 years or more). The Service believes that direct mortality of the two adult sparrows and up to four eggs or nestlings associated with that territory may occur, per year. Adult birds or active nests may be lost due to ordnance explosions or ordnance-ignited fires, and birds may abandon nests and miss foraging and mating opportunities due to disturbance. These

effects are most likely to occur in May when fuel moisture is typically low and weather conditions are dry (Florida Department of Agriculture and Consumer Services 2004).

A single singing male was detected in Bravo Range in 2005, before and after JIFE, however no singing males were detected in Bravo Range, either before or after the May 2006 JIFE. Since FGSs are secretive and difficult to detect, FGSs may still be present on Bravo Range. Given this and the fact that the last documented bird was in close proximity to the Hellfire missile target area, the Service believes it is reasonable to expect that one breeding pair and its nest will be adversely affected per year by future May JIFEs. The incidental take is expected to be in the form of harm, harassment, or direct mortality. Take may result from ordnance explosions, ordnance-ignited fires, or disturbance. The Service believes FGSs are at risk of being extirpated from Bravo Range, given the sharp decline in that subpopulation over the last 5 years.

Habitat Changes: FGS's habitat exists in all three impact area ranges. The continuous use of inert/practice and HE ordnance has the potential to adversely affect FGS habitat by destroying vegetation and altering the landscape. Repeated and increased detonation of HE ordnance could change the characteristics of the prairie habitat within these ranges. Craters formed from ordnance explosions would create new depressions in the landscape. These depressions would recover to some extent, but would likely remain for several years and could change the vegetation and hydrology of the area. HE craters could potentially develop into small wetland plant communities. This could fragment the prairie landscape to the detriment of FGS.

Wildfires resulting from HE ordnance delivery may also damage FGS habitat, though effects would likely be temporary. Although ordnance-ignited wildfires can result in the temporary loss of FGS habitat, they also have the potential to improve habitat by maintaining very low tree densities and providing or maintaining open prairie habitat important to FGSs for foraging and nesting. Thus, adverse effects to FGS habitat due to ordnance-ignited wildfire are expected to be temporary.

Disturbance: Disturbance associated ground unit training, directly associated with JIFE, has the potential to adversely affect FGSs. This disturbance can disrupt normal behavior, causing birds to leave the area and possibly miss foraging and mating opportunities. These effects are similar to those that already occur, or have occurred on APAFR in the past, and the proposed action represents an increase in disturbance. The disturbance is anticipated to be temporary and discountable.

Lethal and Non-lethal Noise: The USAF BA did not specifically analyze the potential effects of noise disturbance on FGS within the JIFE action area. The Service, however, believes that noise effects from the proposed action may pose a risk to the FGS and the marked increase in HE ordnance and RRPRs used for the JIFE will likely result in take of FGSs. Take is anticipated to be in the form of mortality and harm and harassment.

Lethal noise can result in the death of individual birds within the immediate vicinity of the blast. It is likely, though, that birds subjected to lethal noise levels would also be exposed to other potentially lethal HE detonation effects such as intense heat and blast fragments. Thus, the individual birds potentially subjected to lethal noise levels are the same individuals that

would be affected by HE detonation. These effects were discussed in the previous section (Injury and Mortality).

Non-lethal noise may result in temporary or permanent hearing loss after repeated exposure. The noise disturbance may also cause behavioral changes or alter habitat use. The training activities proposed for the JIFEs are very similar to individual training activities that already take place at APAFR. Though the FGS populations at APAFR are likely habituated to the current baseline level of noise, the JIFEs will result in a significant increase in noise levels over the existing condition. During the 2005 JIFE, RRPRs broke the sound barrier, which caused birds in the area to flush. The sharp increase in use of RRPRs from a baseline of 0 to a total of 300 is likely to adversely affect the FGS population. Similarly, the proposed action will result in an increase over the baseline condition in the use of some HE ordnance at APAFR (Table 3).

Non-lethal noise disturbance may cause birds to abandon active nests or possibly miss foraging or mating opportunities. Given the lack of empirical information on the effects of HE ordnance detonation or sonic booms on birds, it is difficult to predict the disturbance threshold for FGSs at APAFR. The Service anticipates that four birds in Echo and two birds in Bravo Range could be adversely affected by non-lethal noise. The effect is anticipated to be in the form of harm and harassment.

Indirect Effects

Indirect effects are those that are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. The indirect effects evaluated by the Service include: (1) habitat degradation resulting from maintenance activities performed in support of the JIFE; (2) temporary reduction in food resources due to habitat alteration and ordnance-ignited fires; (3) effects of additional infrastructure; and (4) reduction in the value of FGS habitat adjacent to the impact areas due to habitat fragmentation. The indirect effects that the proposed action may have on FGSs within the action area are discussed below.

Disturbance: Routine target maintenance and other ground-based support activities, indirectly associated with JIFEs, may result in temporary disturbance to FGSs, but the disturbance is anticipated to be temporary and discountable.

Food Resources: Ordnance-ignited wildfires that burn dry prairie habitat may result in a temporary reduction in food resources available to FGSs. FGSs routinely re-occupy burned areas nearly immediately after fires, and the effect of fires probably does not result in long-term reduction in foraging opportunities.

Infrastructure: The infrastructure created by future JIFEs may allow for increases in future training at APAFR. The JIFEs will expand the firing points and create new mortar firing areas, which would become available for other training units throughout the year. Increased training scenarios at APAFR could increase the potential for adverse effects to FGSs.

Habitat Fragmentation: The semi-annual JIFE may result in short-term habitat fragmentation. However, the Service does not anticipate that the habitat fragmentation resulting from the proposed action will affect the value of adjacent habitats.

Interrelated and Interdependent Actions: An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. No interrelated or interdependent actions are expected to result from the project.

Species Response to the Proposed Action

Implementation of the proposed action including any clearing activities, ordnance-ignited wildfires, and ordnance delivery and detonation may adversely affect FGSs. The adverse effects range from mortality to non-lethal disturbance. Birds within the immediate vicinity of the ordnance impact areas have the potential to be harmed or killed by the inert/practice and HE ordnance delivery actions. Disturbance resulting from the proposed action may disrupt normal behavior, causing birds to leave the area and possibly abandon active nests or miss foraging and mating opportunities. Ordnance-ignited wildfires have the potential to destroy eggs and kill nestlings and possibly adults. Ordnance-ignited wildfires that burn prairie habitat may result in reduced foraging opportunities; however, those effects are expected to be short term.

Lethal noise generated by the proposed action can result in the death of individual birds within the immediate vicinity of the blast. Individuals potentially subjected to lethal noise levels are the same individuals that would be affected by HE detonation. Non-lethal noise disturbance may cause birds to abandon active nests or possibly miss foraging opportunities.

The Service believes, due to the FGS population decline between 1997 and 2003, that populations of FGSs at APAFR are in danger of extirpation. The Service anticipates that the FGSs may be extirpated from Bravo/Foxtrot Ranges within the next 3 years and may become extirpated from APAFR entirely within 5 years.

CUMULATIVE EFFECTS – Florida grasshopper sparrow

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Since the proposed action is located on a Federal military installation, there are no actions that may occur within the action area that would not be subject to consultation.

SUMMARY OF EFFECTS – Florida grasshopper sparrow

Injury and Mortality: The Service anticipates take in the form of harm and harassment of up to four adult FGSs, and up to eight FGS eggs or nestlings in Echo Range, per year. The Service believes that direct mortality of two adult sparrows and up to four eggs or nestlings in Echo

Range may occur per year. The Service also anticipates that take of two adults and up to four FGS eggs or nestlings, per year, in Bravo Range may occur. Take is anticipated to be in the form of harm and harassment or direct mortality. Take is most likely to occur in May during nesting season. Weather and fuel moisture conditions are most amenable to wildfire ignition and spread at that time.

Habitat Changes: Repeated and increased detonation of HE ordnance could change the characteristics of the prairie habitat within the impact areas. Craters formed from ordnance explosions would recover to some extent but would likely remain for several years and could change the vegetation and hydrology of the area. HE craters could potentially develop into small wetland plant communities. This could fragment the prairie landscape to the detriment of FGS. Adverse effects to FGS habitat, due to ordnance-ignited wildfire, are expected to be temporary since most dry prairie plant species are fire-adapted and will regrow in a short period of time.

Disturbance: Disturbance associated ground unit training, routine target maintenance, and other ground-based support activities have the potential to adversely affect FGSs. These effects are similar to those that already occur, or have occurred on APAFR in the past, and the proposed action represents an increase in disturbance. The disturbance is anticipated to be temporary and discountable.

Lethal and Non-lethal Noise: Lethal noise generated by the proposed action may result in the death of individual birds within the immediate vicinity of the blast. It is likely, though, that birds subjected to lethal noise levels would also be exposed to other potentially lethal HE detonation effects such as intense heat and blast fragments. Thus, the territories and individuals potentially subjected to lethal noise levels are the same individuals that would be affected by HE detonation and associated wildfires. Non-lethal noise disturbance may cause birds to abandon active nests or possibly miss foraging opportunities.

Infrastructure: The infrastructure created by the JIFE may allow for increase levels of future training at APAFR. Increased training scenarios at APAFR could increase the potential for adverse effects to FGSs.

Food Resources: Wildfires may temporarily reduce the foraging value of prairie habitats; however, these fires can also improve the habitat value by preventing encroachment of trees and shrubs and increasing seed production and food available for wintering sparrows.

Habitat Fragmentation: The proposed action is expected to result in short-term habitat fragmentation; however, the Service does not anticipate that the habitat fragmentation will affect the value of adjacent habitats.

Cumulative Analysis: Since the proposed action is located on a Federal military installation, there are no actions that may occur within the action area that would not be subject to consultation.

CONCLUSION – Florida grasshopper sparrow

After reviewing the status of the FGS and the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the species. No critical habitat has been designated for the FGS; therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Sections 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns such as breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are nondiscretionary, and must be undertaken by the USAF so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in action 7(o)(2) to apply. The USAF Air Force has a continuing duty to regulate the activity covered by this incidental take statement. If the USAF fails to assume and implement the terms and conditions the protective coverage of section 7(o)(2) may lapse. To monitor the effect of incidental take, the USAF must report the progress of the action and its effect on the species to the Service as specified in the incidental take statement.

Section 7(b)(4) and 7(o)(2) of the Act generally do not apply to listed plants species. However, limited protection of listed plants from take is provided to the extent that the Act prohibits the removal and reduction to possession of federally listed endangered plants or the malicious damage of such plants on areas under Federal jurisdiction, or the destruction of endangered plants on non-Federal areas in violation of State law or regulations or in the course of any violation of a State criminal trespass law.

AMOUNT OR EXTENT OF TAKE

The Service anticipates that the proposed action will incidentally take federally listed species, though the level of incidental take will be difficult to detect because finding a dead or impaired specimen is unlikely following ordnance delivery and/or ordnance-ignited wildfires. It is possible that the FSJ, FGS, RCW, and the eastern indigo snake could be temporarily extirpated from any given burn or HE ordnance impact. The incidental take is expected to be in the form of

harass, harm, wound, or kill. The Service expects, however, that listed species populations will rebound from temporary fire effects.

Eastern indigo snake

Take of the eastern indigo snakes will be difficult to detect for the following reasons: (1) indigo snakes have a wide-ranging distribution; (2) indigo snakes have a patchy distribution within suitable habitat; (3) apparently suitable habitat may not be occupied; and (4) indigo snakes are difficult to detect with surveys. Incidental take is expected to be in the form of harassment, injury, and direct mortality due to the impact of HE ordnance delivery, increased road usage by vehicles, inability to escape ordnance-ignited wildfires, or due to harm from the fragmentation of habitat from construction, maintenance, and especially the use of the targets. Due to the lack of surveys, in conjunction with the wide-ranging activity and use of a variety of habitat types by the eastern indigo snake, it is difficult to determine the exact number of snakes that will be taken.

Indigo snakes have been documented in the northwest corner of the Alpha impact area, north of Foxtrot Range, northwest of Brave Range, and west and north of Echo Range. Because indigo snakes use a variety of habitats, and have very large home ranges, indigo snakes may occur throughout APAFR. Consequently, HE ordnance delivery actions would potentially affect the indigo snake including injury or direct mortality.

The Service anticipates approximately 14.6 indigo snakes will be taken incidental to each JIFE or about 29.2 snakes annually. The incidental take is expected to be primarily in the form of harm and harassment. However, the Service estimates that 5 percent (0.73 snakes) of the 14.6 snakes potentially affected by each JIFE may be killed or about 1.46 snakes annually.

Florida scrub-jay

The following level of take of this species can be anticipated by loss of suitable habitat as a result of ordnance-ignited fires that occur during the breeding season because fires will destroy any FSJ nests and their contents that occur within a burned area.

Based on 2006 survey data, there are a total of three FSJ territories that overlap targets in Bravo Range/Foxtrot that have the potential of being affected. Based on the effects of the May 2006 JIFE, the Service believes that wildfire may spread into FSJ habitat outside Bravo and Echo Ranges during future exercises. The Service anticipates that some FSJ territories, or portions of territories, may be affected outside Bravo and Echo Ranges. The number of territories affected by ordnance-related wildfire will vary greatly based on fuel, weather, and effectiveness of fire management measures. The Service anticipates two nests per year may be taken incidental to the proposed action as a result of ordnance-ignited fire. The mean fledgling production in 2004 was 2.02 young per breeding pair. Thus, loss of productivity of two nests is anticipated to result in incidental take of 4.04 fledglings per year. Additionally, the Service estimates that 7 families (16.1 FSJs) could be adversely affected by non-lethal noise. The effect is anticipated to be in the form of harm and harassment.

Red-cockaded woodpecker

The following level of take of this species can be anticipated by loss of suitable habitat as a result of ordnance-ignited fires that occur during the breeding season.

Based on 2006 data, one RCW cluster was present in the north central portion of Bravo Range, three were present within the north central portion of Foxtrot Range, and five more were present along the northern borders of Foxtrot Range. The potential exists for cluster nearest the HE impact area to be affected by ordnance-ignited fire. The effect is expected to be in the form of damage or loss of forage and/or nesting trees, resulting in the take (harm and harassment) of RCWs associated with those habitat components. The Service anticipates that as many as three cavity trees may be adversely affected, which would adversely affect the birds in the cluster using those habitat components. The Service also anticipates the loss of productivity of one nesting RCW pair per year, or one fledgling, due to ordnance caused wildfires.

Florida grasshopper sparrow

The Service anticipates incidental take of FGSs will be difficult to detect because FGS are very secretive. In addition, determining the presence or absence of all individuals; especially females and fledglings, and/or nests can not be reliably achieved, and finding a dead or impaired specimen or a disturbed or destroyed nest is unlikely. However, the following level of take of this species can be anticipated by loss of suitable habitat as a result of ordnance-ignited fires that occur during the breeding season because fires will destroy any FGS nests and their contents that occur within a burned area.

The delivery of HE ordnance to Echo and Bravo Ranges has the potential to directly affect FGSs through death or injury of individuals resulting from ordnance. These actions may also indirectly affect FGSs through ordnance-ignited wildfires within the portions of the ranges where FGSs occur. The delivery of this type of ordnance currently occurs within both ranges, and the proposed action consequently represents an incremental increase in risk to FGSs from these actions. Lethal noise generated by the proposed action also can result in the death of individual birds within the immediate vicinity of the blast. Individuals potentially subjected to lethal noise levels are the same individuals that would be affected by HE detonation. Non-lethal noise disturbance may cause birds to abandon active nests or possibly miss foraging opportunities.

The Service anticipates take in the form of harm and harassment of up to four adult FGSs, and up to eight FGS eggs or nestlings in Echo Range. The Service believes that direct mortality of two adult sparrows and up to four eggs or nestlings in Echo Range may occur. The Service also anticipates that take of two adults and up to four FGS eggs or nestlings in Bravo Range may occur. Take is anticipated to be in the form of harm and harassment or direct mortality. The Service believes the loss of this number of nests and the productivity associated with these nests, coupled with the level of incidental take currently authorized for other Federal actions at APAFR may result in the extirpation of the FGS from APAFR.

The Service will not refer the incidental take of any migratory bird for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703-712). If such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize effects of incidental take of the eastern indigo snake, FSJ, RCW, and FGS.

The USAF will coordinate their operational training schedules and unexploded ordnance clean-up to the greatest extent practical to minimize potential adverse effects on natural resource compliance, management, and monitoring requirements.

The USAF will continue conservation efforts to maintain and restore local populations of eastern indigo snake, FSJ, RCW, and FGS; and reduce threats from exotic/invasive species.

The USAF will educate personnel regarding the presence and value of sensitive, threatened, and endangered species on APAFR

The USAF will monitor eastern indigo snake, FSJs, RCWs, and FGSs in order to determine the effectiveness of terms and conditions and conservation measures.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the USAF must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. The USAF will provide for removal of ordnance that falls outside the delineated HE areas within 30 days of completion of each JIFE. This will provide for continued monitoring in areas which might otherwise be restricted.

2. The USAF will continue to their invasive/exotic plant monitoring and control program throughout APAFR. This effort will minimize the potential for an increase in invasive/exotic plant species due to an increase in ground disturbance.

3. The USAF will continue to work with the Service to identify and manage potentially suitable, restorable, dry prairie habitat that could support sustainable FGS populations. The USAF will continue habitat restoration efforts, inside and outside existing target ranges, in

accordance with the terms and conditions outlined in the May 5, 2005, Biological Opinion for the JIFE at APAFR.

4. All personnel participating in the ground portion of JIFE will be briefed on the presence of sensitive, threatened, and endangered species on APAFR. Personnel will be educated to recognize the eastern indigo snake, FSJs, RCWs, FGSs and other sensitive, threatened, or endangered species which might be encountered. Personnel will be briefed as to how to best avoid disturbing individual animals, burrows, nests, cavities, etc. If any sensitive, threatened, or endangered species, is encountered, it will be observed at a distance, not deliberately harmed or harassed, and allowed to leave the area on its own.

5. If the results of studies undertaken in April and May 2006 by Maiken Winter indicate that automated recording units (ARUs) are a viable method of monitoring the effects of JIFE disturbances on FGS, the USAF shall deploy 2 to 5 ARUs in close proximity to known FGS territories closest to the HE impact area in Echo range. These ARUs will be installed to record FGS vocalizations for >2 days prior to commencing JIFE in May 2007 and throughout the duration of the exercise. Sensitive equipment will be buried in waterproof containers to protect the equipment against potential damage from ordnance and fires. The USAF shall provide access to the site to retrieve ARUs as soon as logistically feasible and no longer than 1 month from the end of JIFE exercises. The USAF shall provide for analysis of the recordings from ARUs, and shall provide the Service with copies of the final analysis which shall include descriptions of FGS vocalizations and patterns of activity prior to, during, and after the JIFE. The report shall also include analysis of data on the intensity and duration of mission-related noise at the site.

6. Pending the availability of EOD escort, the USAF shall conduct at least one traditional point count FGS survey of target areas on Bravo and Echo Ranges prior to Spring JIFEs, and shall conduct at least two surveys in these areas following the completion of each Spring JIFE, and prior to June 1, each year. Results of all surveys on these areas shall be provided to the Service.

7. The USAF shall continue to maintain areas of dry prairie that were restored through mechanical control of woody vegetation through the use of frequent, high-intensity growing season prescribed fires until the areas are occupied by FGS. Once occupied by FGS, these areas shall be managed in accordance with FGS habitat management plans.

8. The USAF will submit a report after completion of each JIFE. The report shall be submitted 45 days after completion of each JIFE. This report will summarize efforts to monitor the effects to listed species and their habitats due to ground activities, ordnance delivery, and ordnance-ignited wildfires associated with JIFE, and shall document the date, number, and location of acres burned or otherwise altered due to JIFE, and the response of federally listed species and their habitats. The report shall also summarize monitoring of the post-action response of species and document any species sightings, locations of sightings, and response to, as well as observations of changes in population levels. A summary report shall be submitted 60 days after completion of the May 2010 JIFE. This report shall summarize

effects of JIFEs, conducted between November 2006 and May 2010 on threatened and endangered species within APAFR. This report will include observed changes in habitat and population levels of threatened and endangered species affected by JIFEs.

9. Upon locating a dead, injured, or sick federally listed species, initial notification must be made to the nearest Service Law Enforcement Office (Fish and Wildlife Service; 9549 Koger Boulevard, Suite 111; St. Petersburg, Florida 33702; 727-570-5398). Secondary notification should be made to the FWC; South Region; 3900 Drane Field Road; Lakeland, Florida; 33811-1299; 1-800-282-8002. Care should be taken in handling sick or injured specimens to ensure effective treatment and care or in the handling of dead specimens to preserve biological material in the best possible state for later analysis as to the cause of death. In conjunction with the care of sick or injured specimens or preservation of biological materials from a dead animal, the finder has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the effect of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take would represent new information requiring reinitiation of consultation and review of the reasonable and prudent measure provided. The USAF must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. We recommend the following:

1. Conduct water surveys to examine the levels of toxic soil-bound compounds (*i.e.*, lead, arsenic).

2. Conduct blood analyses for ordnance-related compounds, and soil-bound compounds in Bachman' sparrow.

3. Participate in land or easement acquisitions in the vicinity of the range (*i.e.*, River Ranch Acres) for conservation purposes and/or for the prevention of incompatible land use.

4. Provide long-term ecological monitoring and plant demographics in affected and non-affected areas.

5. Develop and participate in a re-vegetation program (*i.e.*, collecting, germinating, and planting seeds) of threatened and endangered plants.

6. Consider building another target in the future where no listed species are located, or in a less sensitive area.

7. Consider delaying bombing/strafing activities on Echo Range during FGS nesting season until after one FGS nesting cycle has been completed.

8. Rotate target areas seasonally to avoid cumulative effects of HE in a small area.

9. Maintain connectivity of habitat for each species (*i.e.*, the ridge is a corridor down the middle of the range), to an extent practical.

10. Remove tree plantations and/or do not replant after pine plantations have been harvested, to benefit FGSs where possible. A common recommendation from all Population Variability Analysis models for reserve design show that removing trees on Echo Range would benefit FGSs.

11. Replant some tree plantations with mixed-age longleaf pine to benefit RCWs.

12. Assess herbaceous and shrub vegetation near RCW cavity trees in and around Bravo/Foxtrot Ranges once per year for susceptibility to wildfire damage. Treat vegetation around cavity trees, which are determined to be at risk. Use the applicable guidelines for cavity tree protection on pages 203 and 204 of the RCW recovery plan (Service 2003a).

13. Collect any large snake sheds for future eastern indigo snake genetic analysis.

REINITIATION NOTICE

This concludes formal consultation on the proposed action. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded, as defined by the action area measures provided in this project description; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this biological opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Thank you for your cooperation and effort in protecting wildlife resources. If you have any questions regarding this project, please contact Allen Webb at 772-562-3909, extension 246.

Sincerely yours,

Paul Souza
Field Supervisor
South Florida Ecological Services Office

cc:
APAFR, Avon Park, Florida (Paul Ebersbach)
FWC, Lakeland, Florida (Jeff McGrady)
Service, Atlanta, Georgia (Noreen Walsh) (electronic copy only)
Service, Jacksonville, Florida (FSJ Species Lead)
Service, Jackson, Mississippi (Eastern Indigo Snake Species Lead)
Service, Clemson, South Carolina (RCW Species Lead)
Service, Vero Beach, Florida (Tylan Dean) (electronic copy only)

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Table 1. Acronyms and abbreviations.

Acronym/Abbreviation	Definition
ABS	Archbold Biological Station
Act	Endangered Species Act of 1973, as amended
APAFR	Avon Park Air Force Range
ARU	Automated Recording Units
BA	Biological Assessment
DUC	Deployment Unit Complex
DZ	Drop Zone
EA	Environmental Assessment
EOD	Explosive Ordnance Disposal
ESMP	Endangered Species Management Plan
FDNR	Florida Department of Natural Resources
FGS	Florida Grasshopper Sparrow
FLARNG	Florida Army National Guard
FMO	Fire Management Officer
FNAI	Florida Natural Areas Inventory
FO	Forward Observers
FP	Firing Point
FSJ	Florida Scrub-jay
FWC	Florida Fish and Wildlife Conservation Commission
HE	High Explosive
HIMARS	High Mobility Artillery Rocket System
HMU	Habitat Management Unit
INRMP	Integrated Natural Resources Management Plan
JIFE	Joint Integrated Fires Exercise
KPPSP	Prairie Preserve State Park
MFA	Mortar Firing Areas
MLRS	Multiple Launch Rocket Systems
MSRP	Multi-Species Recovery Plan
RCW	Red-cockaded Woodpecker
RRPR	Reduced Range Practice Rocket
SDZ	Surface Danger Zone
Service	United States Fish and Wildlife Service
TACP	Tactical Air Control Party
TLWMA	Three Lakes Wildlife Management Area
UAV	Unmanned Aerial Vehicles
USAF	United States Air Force

Table 2. List of assets, maximum number of weapon platforms, vehicles, and personnel participating in the JIFE at Avon Park Air Force Range .

Weapon Asset Platforms	Number of Platforms, Support Vehicles, and Personnel
Fixed Wing Fighter/Attack Aircraft	24 aircraft, 28 vehicles, 200 personnel
Fixed Wing Bomber Aircraft	2 aircraft, 8 personnel
Fixed Wing Gunship Aircraft	3 aircraft, 8 vehicles, 70 personnel
Rotary Wing Attack Aircraft	12 aircraft, 10 vehicles, 75 personnel
UAVs	6 aircraft, 12 vehicles, 25 personnel
Howitzers	8 guns, 20 vehicles, 40 personnel
HIMARS	6 launchers, 20 vehicles, 60 personnel
Mortars	8 mortars, 8 vehicles, 50 personnel
TACPs and FOs	10 vehicles, 35 personnel
Command Center	5 vehicles, 10 personnel

Table 3. The amount of ordnance approved and expended by the JIFE over baseline at Avon Park Air Force Range.

Ordnance	Baseline	Number Approved	JIFE
5.56 mm bullet	7,200	Unlimited	5,000
7.62 mm bullet	186,072	Unlimited	5,000
.50 caliber bullet	54,00	Unlimited	5,000
20 mm bullet	9,295	Unlimited	5,000
25 mm bullet	736	Unlimited	1,000
30 mm bullet	54,242	Unlimited	2,000
40 mm HE	630	Unlimited	125
81 mm HE	120	Unlimited	600
81 mm Illum	60	Unlimited	60
81 mm WP	15	Unlimited	30
105 mm HE	977	Unlimited	50
120 mm HE	None	Unlimited	600
120 mm Illum	None	Unlimited	60
120 mm WP	None	Unlimited	30
155 mm HE	None	Unlimited	50
155 mm Illum	None	Unlimited	10
RRPR	None	81	300
BUD and MK	8,394	Unlimited	250
ATGM (HE)	None	48	100
2.75 inch rocket (inert)	830	Unlimited	1,200

Table 4. The quantity and type of ordnance delivered by assets for the Advanced Operations.

Target Area	Ordnance	Asset	Total Ordnance
Bravo and Foxtrot	7.62 mm ball and tracer	Rotary-wing	5,000
Bravo and Foxtrot	20 mm bullet	Fixed-wing	5,000
Foxtrot	25 mm bullet	Fixed-wing	1,000
Foxtrot	20 mm HE	Fixed-wing	Not available
Foxtrot	30 mm bullet	Fixed-wing	2,000
Bravo	40 mm bullet	Fixed-wing	125
Bravo	81 mm HE, Illum, WP	Mortar	690
Bravo	120 mm HE, Illum, WP	Mortar	690
Bravo	105 mm HE	Fixed-wing	50
Bravo	155 mm HE and Illum	Howitzer	60
Bravo and Foxtrot	RRPR	HIMARS	300
Foxtrot	BDU and MK series bombs (inert)	Fixed-wing	250
Foxtrot	ATGM-114 Hellfire rocket (inert)	Rotary-wing	Not available
Bravo	ATGM-114 Hellfire rocket HE	Rotary-wing	100
Foxtrot	2.75 inch rocket (inert)	Fixed- and Rotary-wing	1,200
Bravo	2.75 inch rocket HE	Rotary-wing	Not available

Table 5. The quantity and type of ordnance delivered by assets for the Mid-level Operations.

Target Area	Ordnance	Asset	Total Ordnance
Echo	7.62 ball and tracer	Rotary-wing	5,000
Echo	20 mm bullet	Rotary-wing	5,000
Echo	20 mm HE	Gunship	Not available
Echo	40 mm HE	Gunship	125
Echo	81 mm HE, Illum, WP	Mortars	690
Echo	120 mm HE, Illum, WP	Mortars	690
Echo	105 mm and 155 mm HE	Howitzer	100
Echo	105 mm training round s/40 mm HE	Gunship	50
Echo	RRPR	Gunship	300
Echo	BDU and MK series bombs (inert)	Fixed-wing	250

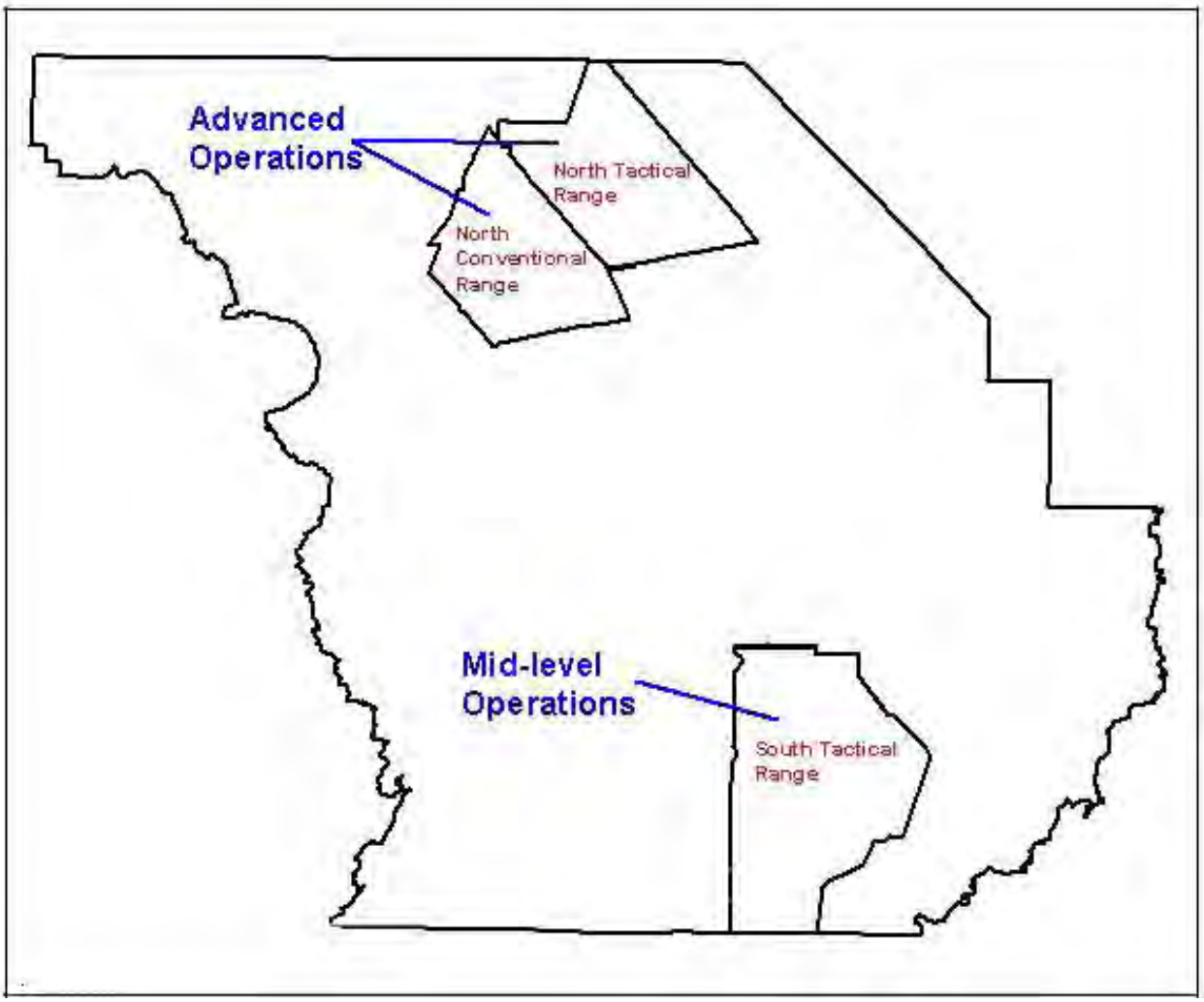

Figure 1. Location of target ranges used for the Joint Integrated Fires Exercise at Avon Park Air Force Range.

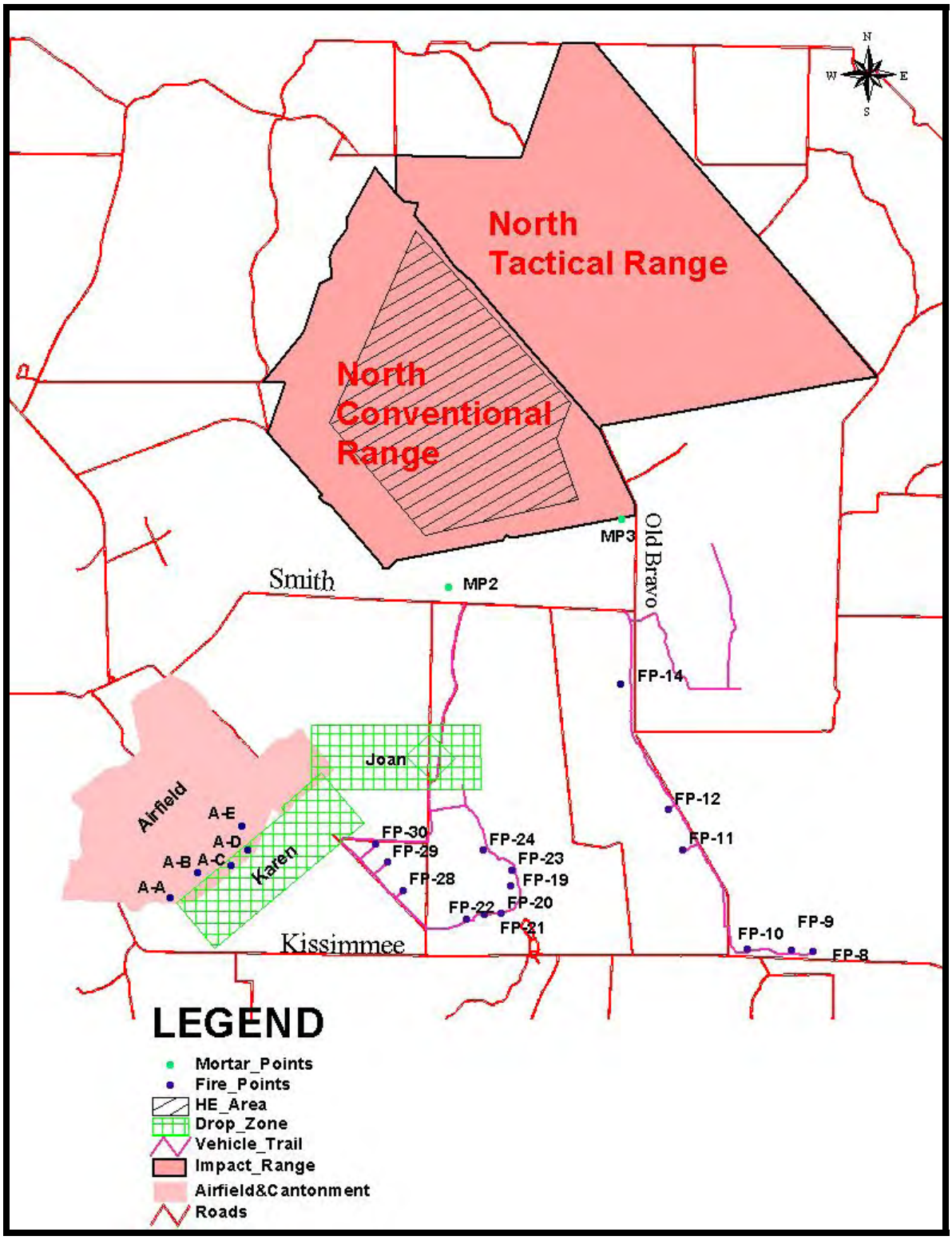

Figure 2. High explosive impact area in the North Conventional (Bravo) Range and the location of ground assets.

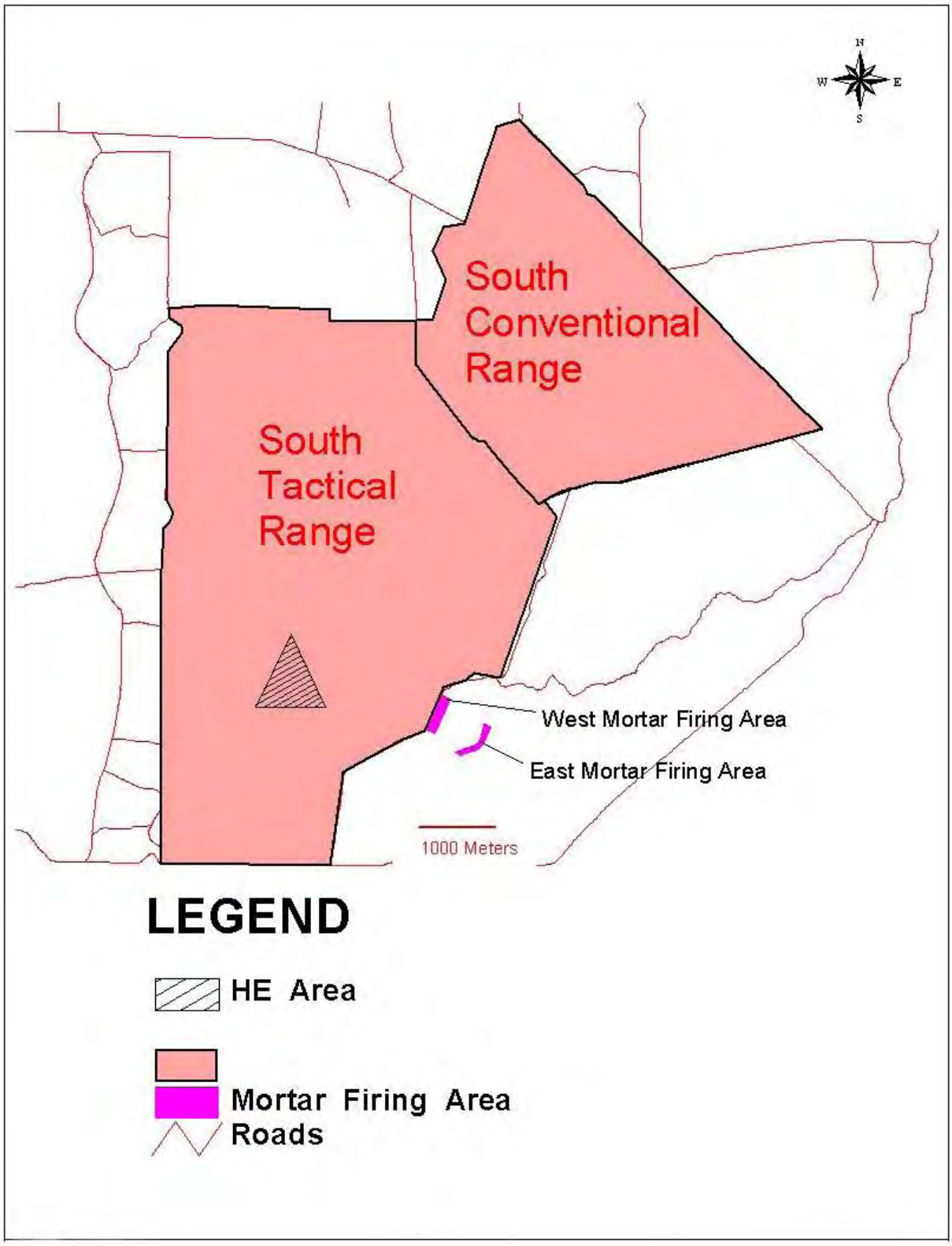

Figure 3. High explosive impact area in the South Tactical (Echo) Range.

Figure 4. Surface Danger Zone impact area in the South Tactical (Echo) Range.

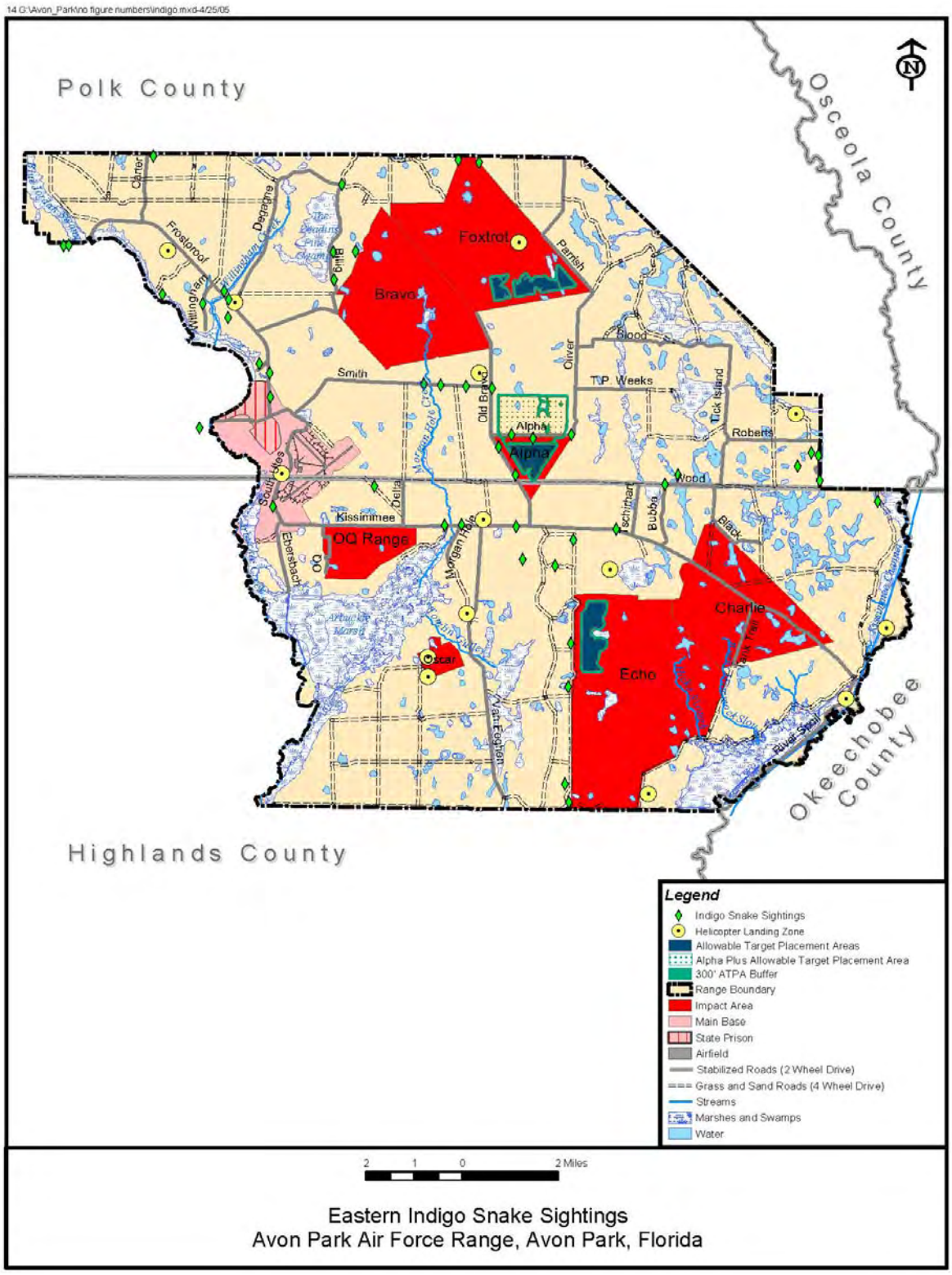

Figure 5. Sightings of eastern indigo snakes on Avon Park Air Force Range.

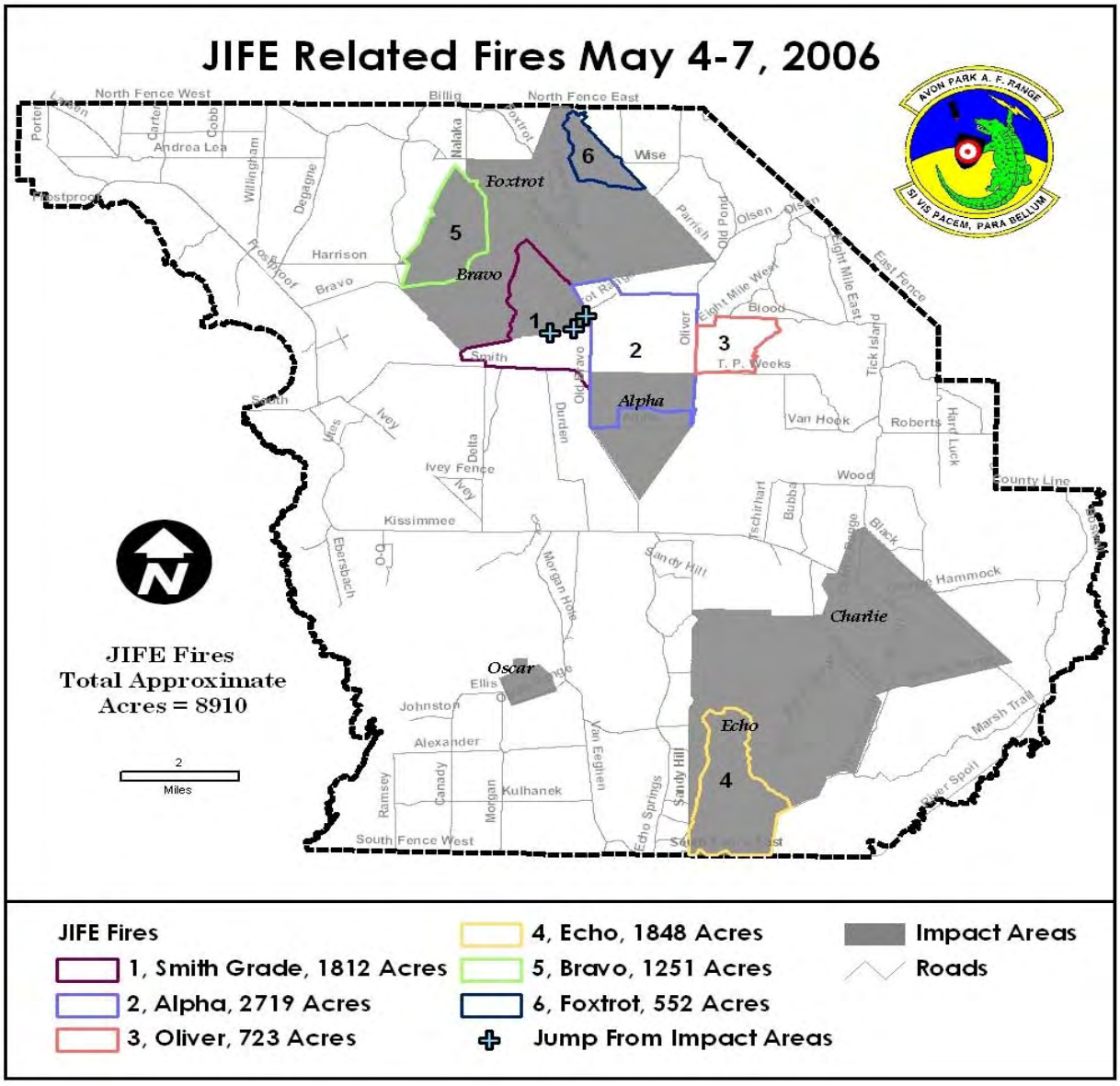

Figure 6. JIFE related wildfires. May 2006.

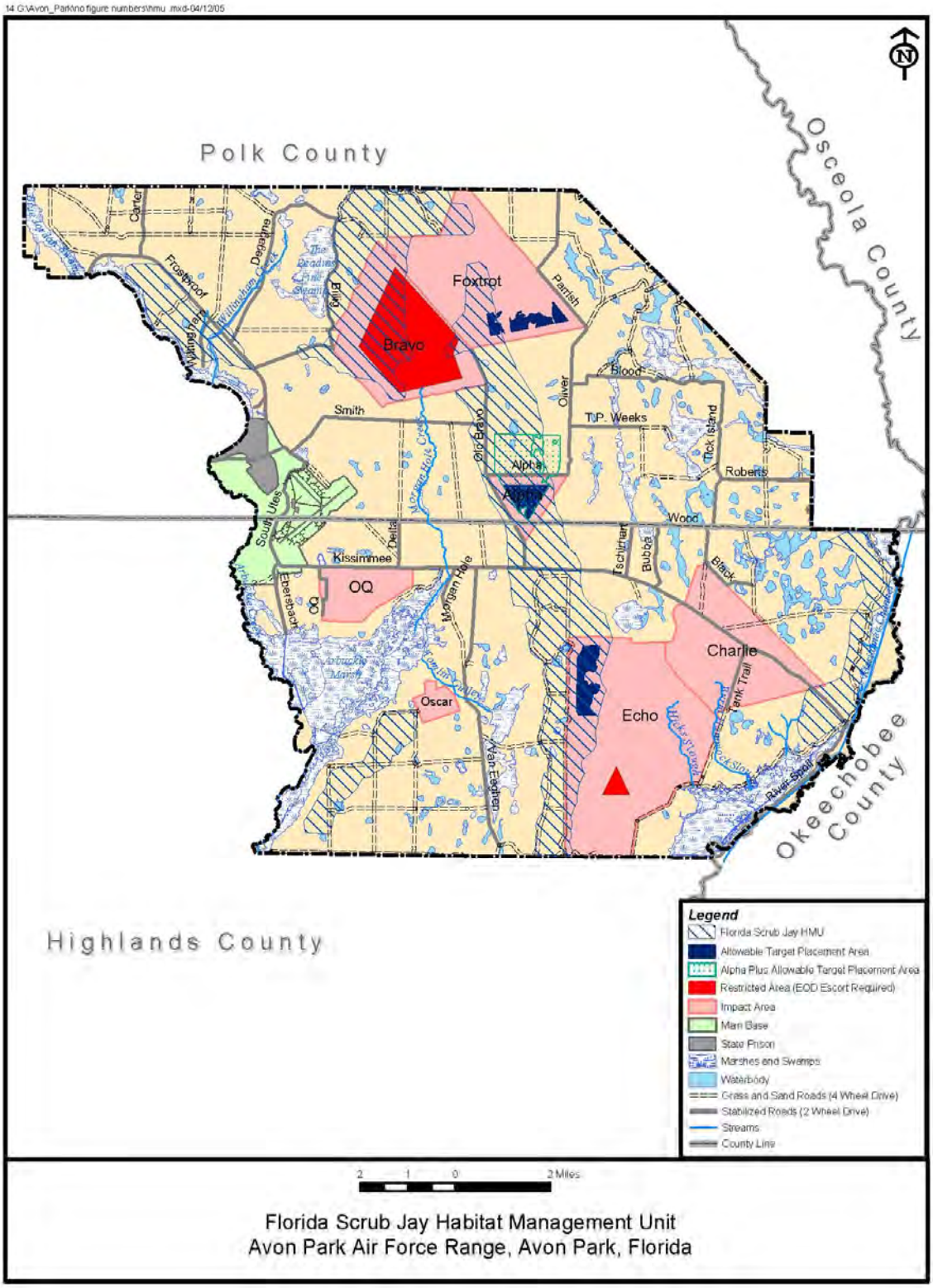

Figure 7. Florida scrub-jay Habitat Management Units located on Avon Park Air Force Range.

Figure 8. Florida scrub-jay territories (2006) located on Avon Park Air Force Range (Archbold Research Station).

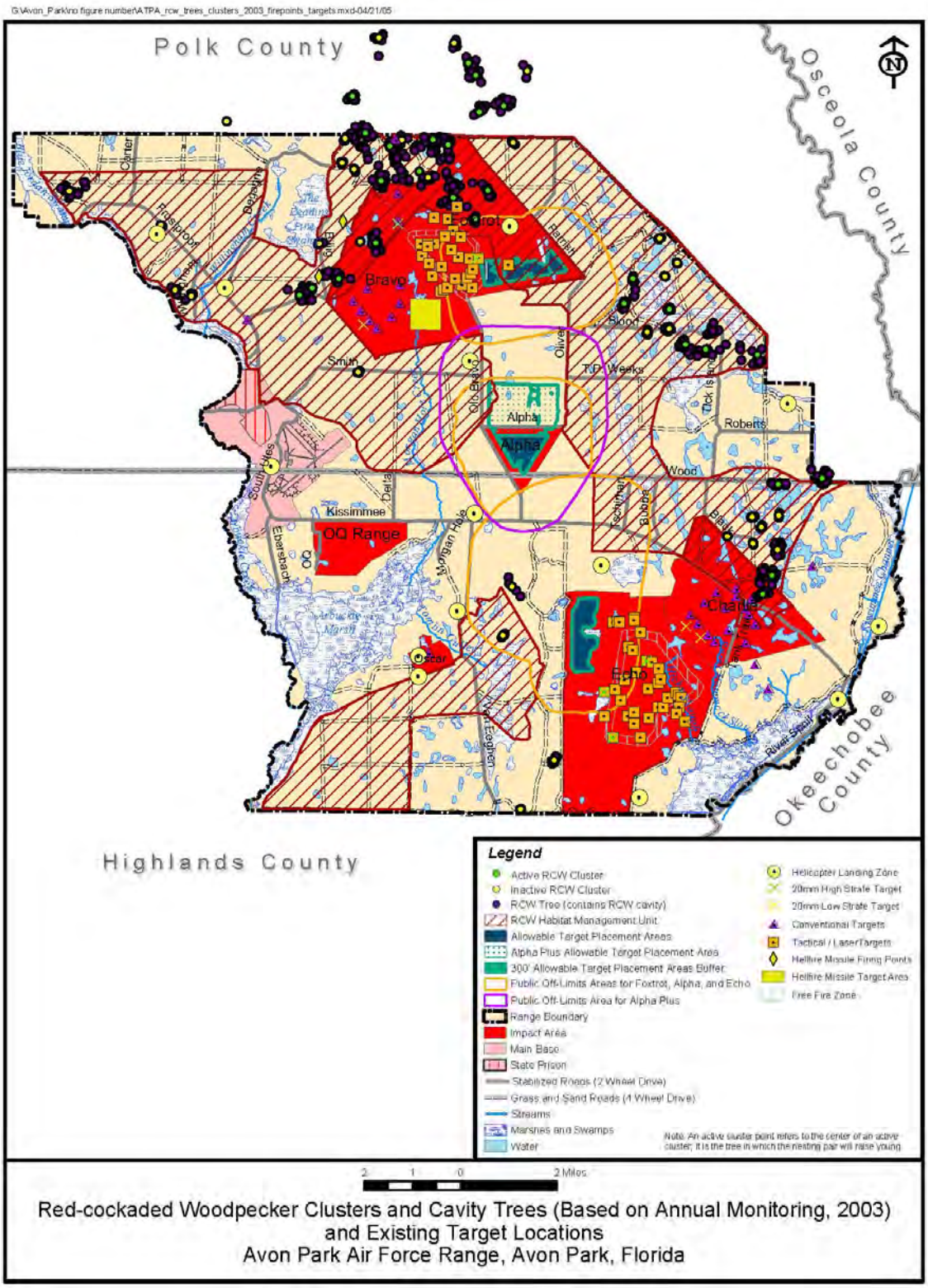

Figure 9. Red-cockaded woodpecker Habitat Management Units located on Avon Park Air Force Range.

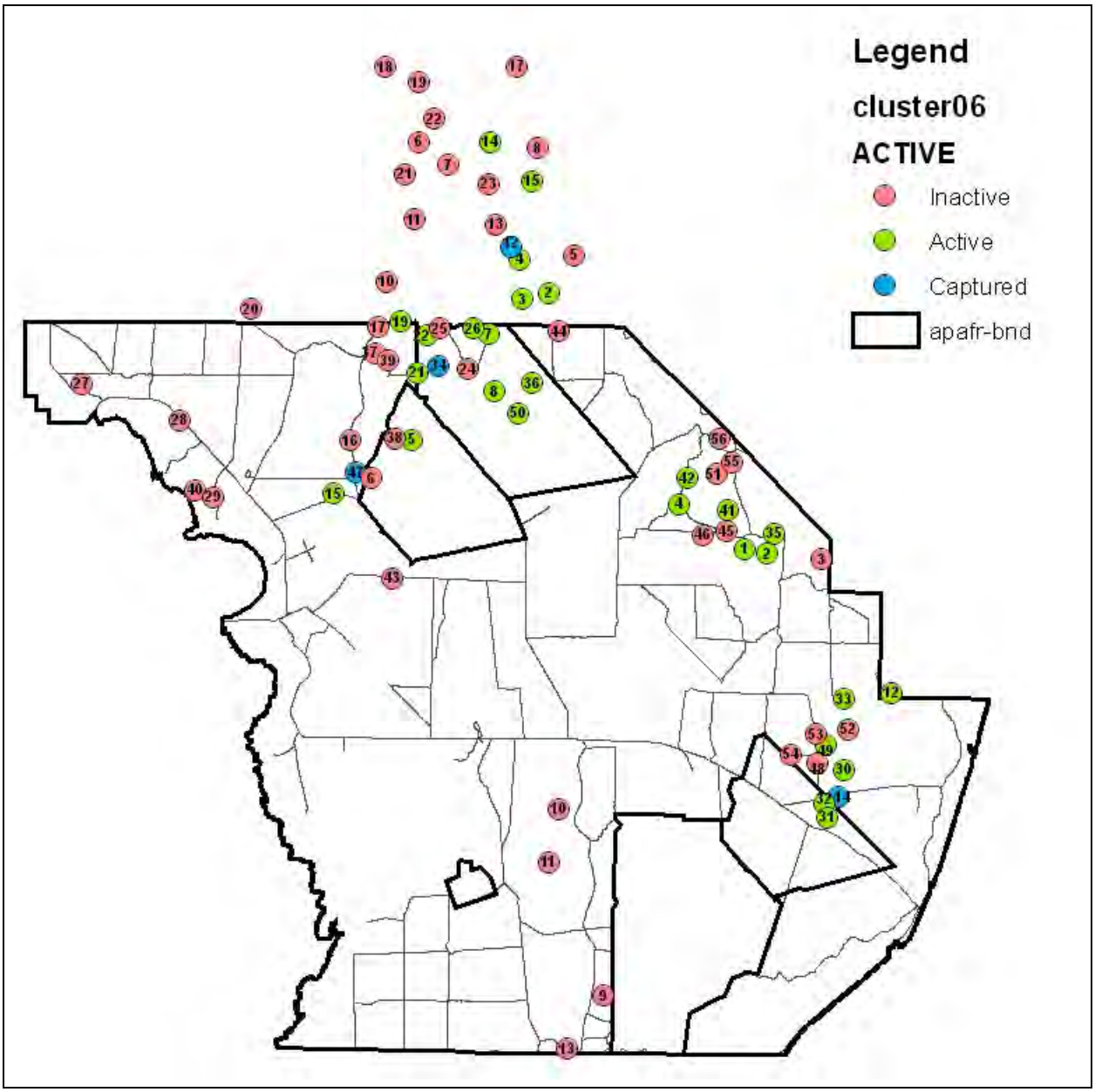

Figure 10. Red-cockaded woodpecker active clusters (2006) located on Avon Park Air Force Range.

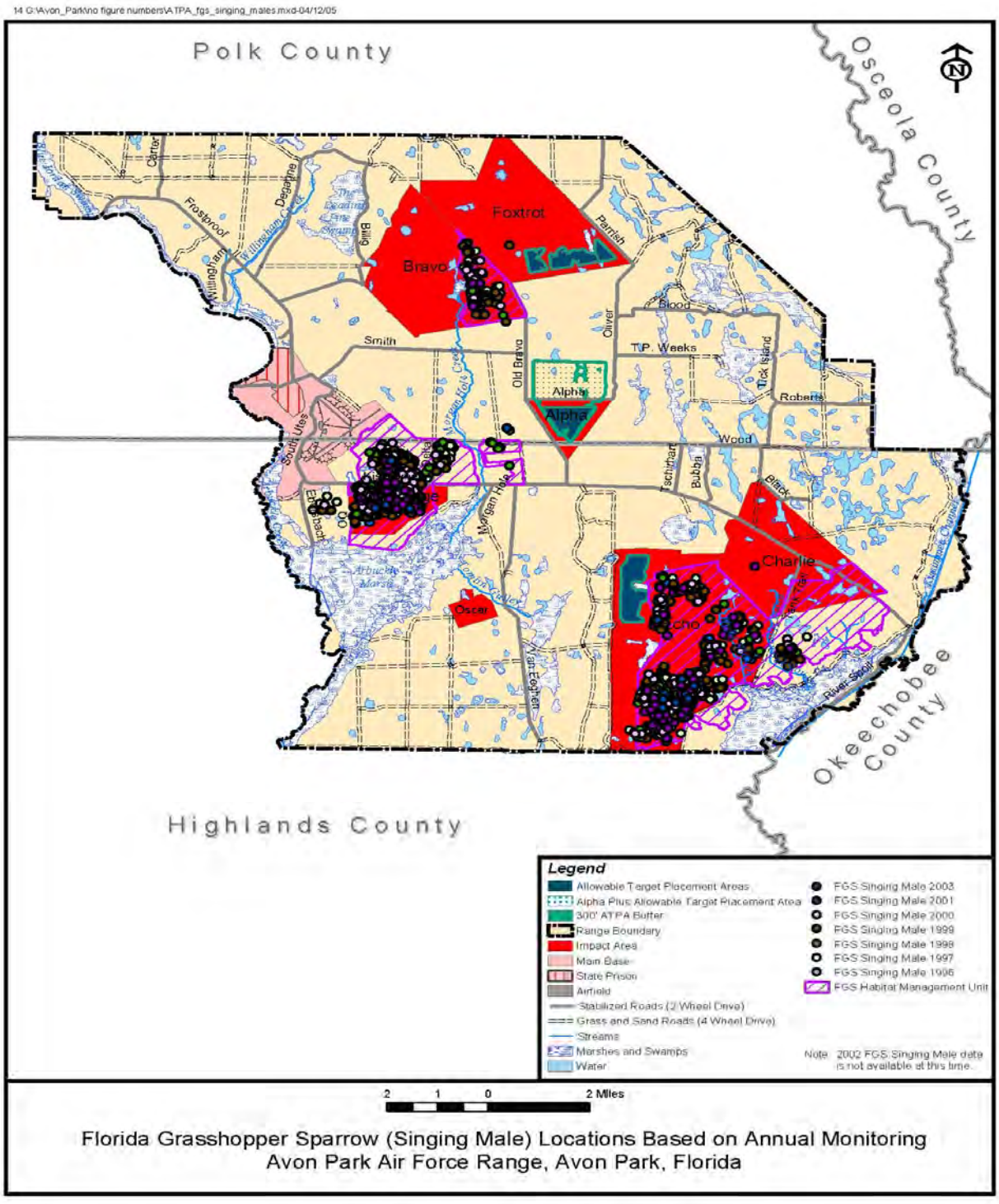

Figure 11. Florida grasshopper sparrow territories between 1996 and 2003 and Habitat Management Units located on Avon Park Air Force Range.