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The Historical and Current Distribution of the Eastern Indigo Snake (*Drymarchon couperi*)

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***Abstract.*—The Eastern Indigo Snake (*Drymarchon couperi*) historically occurred in southern Mississippi and Alabama, Georgia, and Florida. Old reports from South Carolina are not thought to be credible. Naturally occurring populations likely no longer occur in Mississippi and Alabama, and populations elsewhere are of conservation concern. However, there have been no large-scale efforts to determine the historical and current distributions of the Eastern Indigo Snake across its entire range. Toward this end, we obtained records of Eastern Indigo Snakes by: (1) searching databases, the literature, and U.S. museum collections; (2) soliciting sightings from qualified individuals via e-mail and questionnaires; and (3) conducting visual-encounter surveys in Georgia. In southeastern and south-central Georgia, we documented 379 recent (2001−2012) records from 29 counties and from 26 public or conservation lands (≥ 100 ha in area) in 18 counties. In Florida, we documented 595 recent (2001−2012) records from 46 counties and from 154 public or conservation lands ≥ 100 ha in area in 44 counties. The species still occurs throughout most of peninsular Florida except in urban areas and some agricultural regions, but recent records are scarce or absent in the panhandle and Florida Keys. Habitat loss, degradation, and fragmentation probably have impacted Eastern Indigo Snake populations over much of their range, and a severe decline of Gopher Tortoise (*Gopherus polyphemus*) populations in the Florida panhandle may account for the scarcity of Eastern Indigo Snakes in this region because tortoise burrows are important overwintering refugia.**

Key Words.—distribution; *Drymarchon couperi*; Eastern Indigo Snake; Florida; Georgia; status

Introduction

Members of the genus *Drymarchon* (Indigo Snakes) are among the largest and most impressive of colubrid snakes, with adults reaching 1.60–2.95 m total length (TL). Ranges of the four recognized *Drymarchon* species (Wüster et al. 2001) extend from the southeastern United States to northern Argentina, including much of Mexico and Central America. The Eastern Indigo Snake (*Drymarchon couperi*) is moderately heavy bodied, bluish-black, and the longest native snake in North America, reaching 2.63 m TL (Conant and Collins 1991). The Eastern Indigo Snake was federally listed as threatened in 1978 because of population declines caused by habitat loss, over-collecting for the pet trade, and mortality from gassing Gopher Tortoise (*Gopherus polyphemus*) burrows to collect Eastern Diamond-backed Rattlesnakes (*Crotalus adamanteus*; U.S. Fish and Wildlife Service [USFWS] 1978). A recent review by the U.S. Fish and Wildlife Service determined that continued listing as threatened was warranted because the rate of habitat destruction and degradation is increasing, and large continuous blocks of habitat must be protected and managed soon before the opportunity to do so is lost (USFWS 2008).

Declines in Eastern Indigo Snake populations are likely due primarily to habitat loss, degradation, and fragmentation (Breininger et al. 2004; Hyslop 2007; Breininger et al. 2012). In the northern one-third of its range (north of approximately Gainesville, Florida), including all of its historical distribution in Georgia, Alabama, and Mississippi, the Eastern Indigo Snake is strongly associated with xeric Longleaf Pine (*Pinus palustris*) sandhills (Diemer and Speake 1983), where Gopher Tortoise populations are present. Longleaf Pine habitats have declined because of large-scale industrial logging of original forests from the 1880s through the 1930s, fire suppression or interruption of natural fire cycles, subsistence and industrial agriculture, urbanization, and

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silviculture (Van Lear et al. 2005; Means 2006). The paucity of recent sightings from many areas in the Florida panhandle may be due to extremely low densities of Gopher Tortoises, whose populations have been impacted by past human harvest for food (Mushinsky et al. 2006) and by habitat degradation resulting from fire exclusion and planting of dense stands of Sand Pine (*Pinus clausa*; Auffenberg and Franz 1982; Diemer 1986). In the southern two-thirds of peninsular Florida and coastal areas of northern Florida, the Eastern Indigo Snake makes nonobligative use of tortoise burrows or xeric upland habitats (Lawler 1977; Steiner 1981; Steiner et al. 1983; Moler 1985b; Layne and Steiner 1996).

Collection of Eastern Indigo Snakes for exhibition purposes and the pet trade probably contributed to population declines in some areas in the past (Whitecar 1973; Lawler 1977), and although illegal collecting still occurs, its impacts on populations are probably minimal compared to those of habitat destruction and fragmentation. Although it is now illegal to gas Gopher Tortoise burrows, which is lethal to resident Eastern Indigo Snakes (Speake and Mount 1973; Speake and McGlincy 1981), some participants in rattlesnake roundups may still use this method. Sport hunters, other recreationists, homeowners, and domestic dogs occasionally kill Eastern Indigo Snakes (e.g., Breininger et al. 2012), and this threat may increase in severity with increasing human development, particularly in rural areas of Florida.

In an effort to re-establish the species, the Alabama Cooperative Fish and Wildlife Unit, under the direction of Dan Speake of Auburn University, experimentally released 538 Eastern Indigo Snakes at nine sites in Alabama, five or six sites in Georgia, two sites in Florida, two sites in Mississippi, and one site in South Carolina from 1976 through 1987 (Speake et al. 1987). Marked snakes were recaptured 10 y or more after their release at some sites, but apparently none of these releases resulted in a sustaining population (Hart 2002; Stevenson 2006; Clay 2008). Despite the imperiled status of the Eastern Indigo Snake and ongoing population declines (USFWS 2008), there have been no recent efforts to summarize in detail the historical and current distributions of the species. However, various reports have suggested the distribution of the species is shrinking. For example, only one unconfirmed recent (i.e., 2001–2012) record of an Eastern Indigo Snake exists from Alabama (Hart 2002), and no recent records exist from Mississippi or South Carolina (USFWS 2008). Additionally, little information exists on population trends for the species anywhere in its range. Our objectives in this paper were to compare the current and historical distributions of the Eastern Indigo Snake and to document its occurrence on conservation lands in Florida and Georgia.

Materials and Methods

We searched scientific and "gray" literature, all U.S. museum collections, and databases of the Alabama Natural Heritage Program, Georgia Natural Heritage Program, Florida Natural Areas Inventory, Florida Fish and Wildlife Conservation Commission, Mississippi Museum of Natural Science, and South Carolina Department of Natural Resources to obtain a comprehensive database of Eastern Indigo Snake records from throughout the perceived historical range of the species (USFWS 1978, 1982). We also contacted various federal, state, and county agencies, non-governmental agencies (NGOs), private landowners, government and institutional biologists, environmental consultants, wildlife officers, amateur herpetologists, and snake enthusiasts in an effort to locate recent records. When soliciting records via e-mail, we attached a series of images (Fig. 1) of Eastern Indigo Snakes to minimize reporting of misidentified species. Since 2000, we have conducted intensive visual-encounter surveys for Eastern Indigo Snakes throughout Georgia, including follow-ups on credible reports obtained from questionnaires and interviews that came from persons with some training in snake identification, an avid interest in native snakes, or a history that included considerable field time in the southeastern Coastal Plain observing snakes (Stevenson 2006; Stevenson et al. 2010a). Some surveys conducted in 2008–2011 used a specially trained wildlife detector dog (Stevenson et al. 2010b). For each record, we

Figure 1. Montage of Eastern Indigo Snake (*Drymarchon couperi*) images used when soliciting observations to help minimize reporting of misidentified species. (Photographed by Jim Blush, Kevin Enge, Natalie Hyslop, Sam Murray, Daniel Parker, Dirk Stevenson, and Robert Zappalorti).

tried to obtain precise location data. In cases where we had only the name of the conservation land on which the snake was observed, we used the centroid of the area to represent the occurrence location.

We divided observations into Type I and Type II records. Type I records were supported by museum voucher specimens (including shed skins) or photographs, were published records from the literature, or had been verified by one of the authors. Type II records were not substantiated with a specimen or photograph but were reported by biologists, landowners, amateur herpetologists, or other qualified individuals whom we deemed credible. We omitted observations that we considered questionable or that represented released snakes (see Appendix A for a list of select observations). We divided Type I and II records into three groups based on their date: (1) pre-1981 (Fig. 4); (2) 1981–2000 (Fig. 5); and (3) 2001–October 2012 (Fig. 6). We considered post-2000 records to be "recent." We mapped all Type I and II records from both public and private lands to show the historical and current distributions of the Eastern Indigo Snake (Figs. 2 and 3). Some Alabama and Mississippi records only had the county identified as the location; these were mapped as a question mark in the middle of the county or the half of the county identified. If no recent record existed for a county where the species occurred historically, we considered this to be suggestive of a possible decline in abundance or population extirpation in that county.

We considered "conservation lands" to include all public lands, including lands not specifically earmarked for conservation purposes, and private lands that are devoted to conservation (i.e., owned by conservation organizations or in conservation easements). We recorded the latest Eastern Indigo Snake record from each conservation land in Georgia and Florida, counting disjunct tracts separately. When reporting the size of conservation lands in coastal areas, we excluded marine habitats unsuitable for

the species. We also considered observations in relation to physiographic areas, because terrain and geology may affect the distribution of the Eastern Indigo Snake, particularly in the northern part of its range. The physiographic divisions used for Georgia follow Wharton (1978), and those for Florida follow Brooks (1981).

Results

Georgia.—We compiled 535 Eastern Indigo Snake records from Georgia, 379 (71%) of which were recent (Fig. 6). Post 2000, Eastern Indigo Snakes have been observed in 29 counties in southeastern and south-central Georgia (Fig. 2). Five counties have 1981–2000 records and eight counties have pre-1981 records. Three counties (Chatham, Montgomery, and Truetlen) have no records despite being located within the perceived range of the species (Fig. 2). Due to a lack of historical and recent records and the presence of clay soils in the Tallahassee Hills physiographic province, we suggest Grady and Thomas counties in extreme southern Georgia should not be considered part of the native range of the Eastern Indigo Snake. Recent records exist from 26 conservation lands in 18 counties, all of which are ≥ 100 ha in size and presumably have some conservation value for Eastern Indigo Snakes (see Appendix B). Recent records exist from the following physiographic provinces in Georgia: Coastal Marine Flatlands, Okefenokee Basin, Tidal Marine Area, Tifton Upland, Trail Ridge, and Vidalia Upland. In Georgia, there are recent records from the Alapaha, Altamaha, Ogeechee, Satilla, St. Mary's, and Suwannee River basins but not from the Chattahoochee, Flint, Ochlockonee, Oconee, and Savannah River basins.

At the northern extent of its Georgia range, pre-1981 records exist north of Interstate 16 (Fig. 4), but Eastern Indigo Snakes apparently no longer occur there despite the existence of suitable habitat in the form of xeric sandhills in the Ohoopee and Canoochee river drainages. At

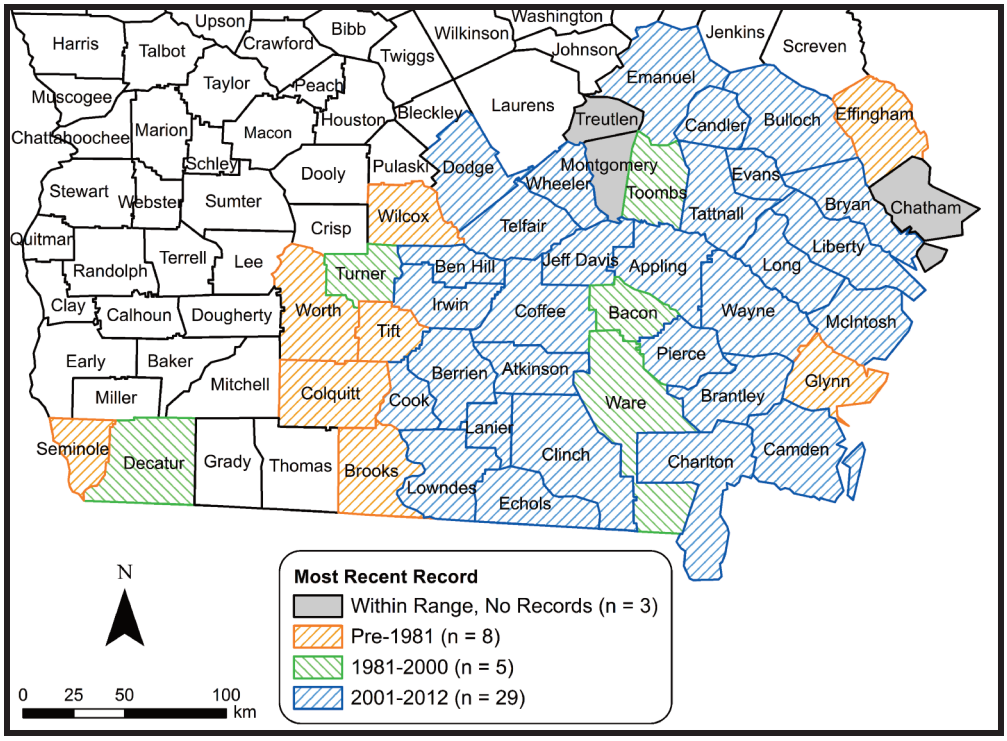

Figure 2. Map of southern Georgia showing the most recent record of the Eastern Indigo Snake (*Drymarchon couperi*) for each county by time period: pre-1981, 1981–2000, and post-2000.

the southwestern edge of its Georgia range, a recent Type II record exists west of Interstate 75, in Reed Bingham State Park, Cook County (Fig. 6). Long-term monitoring of sandhill fauna in this park suggests that the Eastern Indigo Snake population is small, if it is extant (Chet Powell, pers. comm.). The only Type I record (FSM 2318) for the Dougherty Plain of southwestern Georgia came from Seminole County in 1955. Historical and recent records are lacking from coastal or barrier islands in Georgia. A putative specimen from St. Catherine's Island (Couper et al. 1996) was a misidentified North American Racer (*Coluber constrictor*; Behler et al. 1997). From Glynn County northward, Type I records are lacking along the Georgia coast except for a pre-1981 record from Brunswick, Glynn County (USNM 4504).

Florida.—We compiled 1,413 records from Florida, 595 (42%) of which were recent (Fig. 6). Post 2000, Eastern Indigo Snakes have been observed in 46 counties in Florida, including 44 of 51 counties in peninsular Florida (east of Jefferson County; Fig. 3). Ten counties have 1981–2000 records, 10 counties have pre-1981 records, and Union County has no record (Fig. 3). Records exist from 271 public lands or privately owned conservation lands or easements (Appendix B). Recent records exist from 167 public or conservation lands, with 154 conservation lands in 44 counties being ≥ 100 ha in size (Appendix B). The species is known from all physiographic districts in Florida, but few or no recent records exist from physiographic districts in the panhandle (Apalachicola Delta, Dougherty Karst, Southern Pine Hills, and Tifton Upland) or the Sea Island District in the northeastern peninsula.

Recent records exist from most of peninsular Florida, and Eastern Indigo Snakes are documented relatively frequently in upland areas along the Suwannee River and along the Brooksville Ridge from Gilchrist to Pasco counties (Fig. 6). Extensive public lands, such as Goethe State Forest, Chassahowitzka Wildlife Management Area, and Withlacoochee State Forest, provide strongholds for the species along

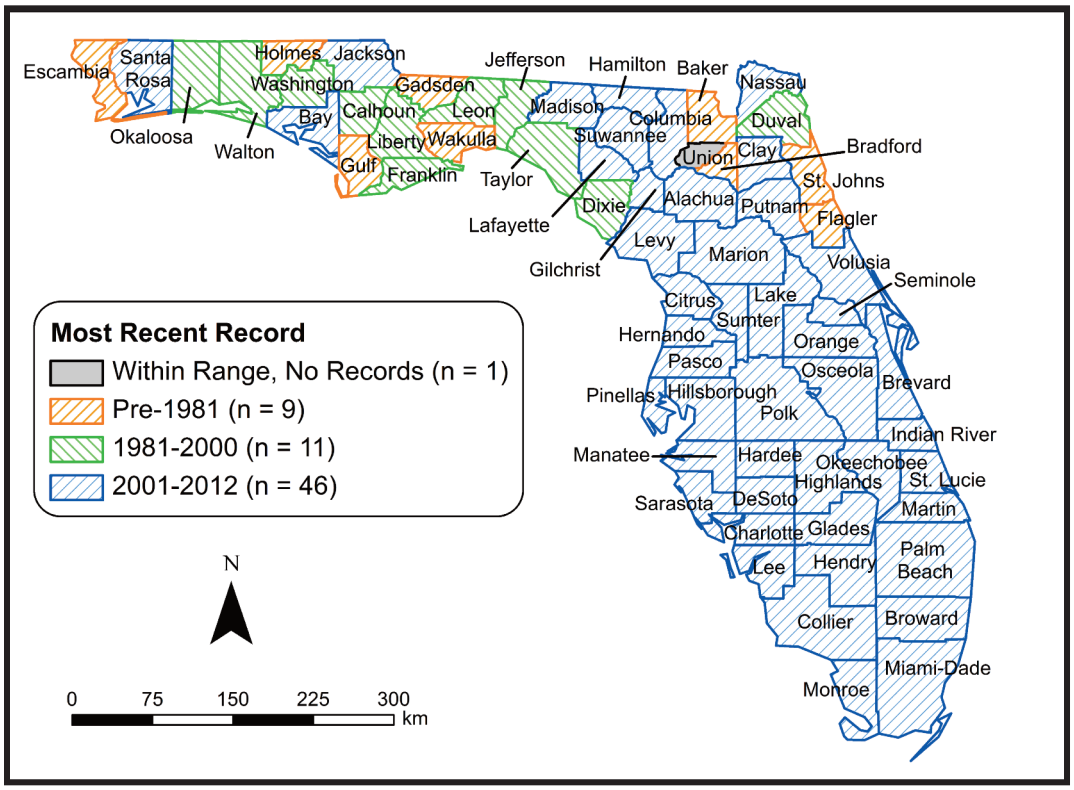

Figure 3. Map of Florida showing the most recent record of the Eastern Indigo Snake (*Drymarchon couperi*) for each county by time period: pre-1981, 1981–2000, and post-2000.

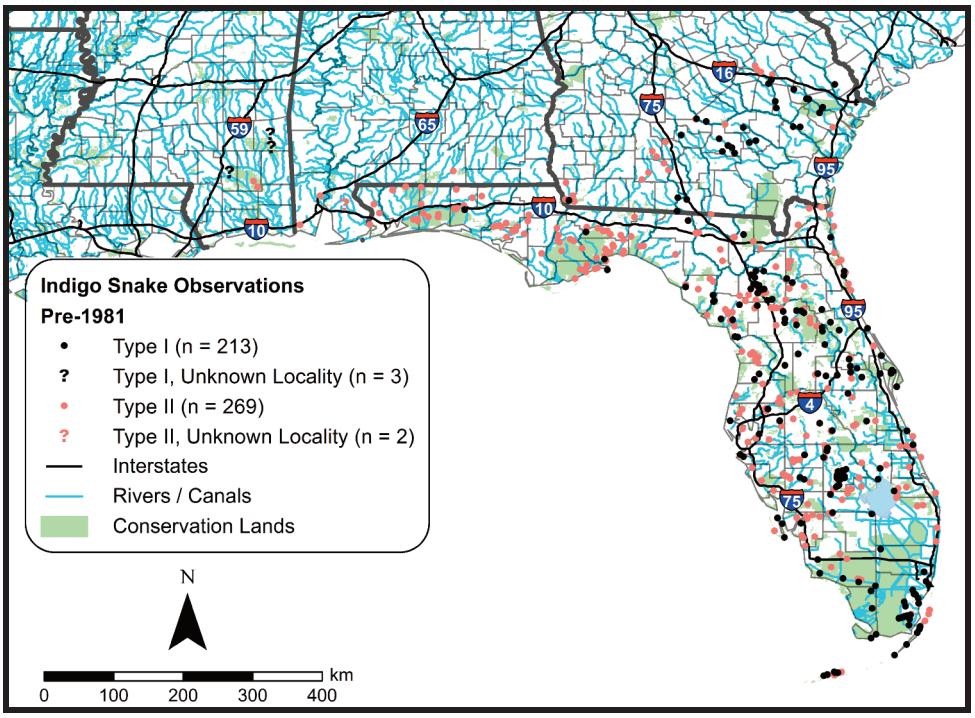

Figure 4. Pre-1981 records of the Eastern Indigo Snake (*Drymarchon couperi*), excluding released animals.

the Brooksville Ridge. Populations also occur in more poorly drained areas along the Gulf Coast in Levy and Citrus counties, but no recent records exist from farther north in the Big Bend region in Dixie and Taylor counties (Fig. 6). Populations apparently persist throughout much of the southern half of the peninsula, except for parts of the urbanized southeastern coast in Palm Beach and Broward counties (Fig. 6). Eastern Indigo Snakes are observed frequently in areas of the southern peninsula with relatively unfragmented habitats (including large ranchlands) and along the fragmented Lake Wales Ridge, especially in Highlands County (Fig. 6).

Unlike in Georgia, Eastern Indigo Snakes occur on some islands in Florida. Along the Atlantic Coast, populations occur on Merritt Island in Brevard and Volusia counties. Along the Gulf Coast in Lee County, the species still occurs on Cayo Costa, North Captiva, Big Pine, and Little Pine islands, but the population on the more developed Sanibel Island may have been extirpated (Fig. 6). The last specimen seen on Sanibel Island had been run over by a bicycle on Indigo Trail in 1999 (Christopher Lechowicz, pers. comm.). An Eastern Indigo Snake was killed in 2012 at a resort on the highly developed Captiva Island, Lee County, where the previous record was from 1988 (Christopher Lechowicz, pers. comm.). Eastern Indigo Snakes were also observed on two coastal islands in Citrus County in 2012 (Bill Kellner, pers. comm.). Historically, Eastern Indigo Snakes occurred in the Florida Keys from Key Largo to Sugarloaf Key; as well as, on at least three small keys farther north in Biscayne National Park (Steiner et al. 1983; Lazell 1989; Fig. 4). We received a photograph (UF 157357; Fig.7) in 2009 of a snake drinking from a water dish set out for birds on Little Knockemdown Key in the Lower Keys between Summerland and Cudjoe keys (Fig. 6). The species has been present on this key since at least 1981, with the most recent observation in 2011 (Peter Braisted, pers. comm). Prior to this record, the last Type I or Type II record from the Florida Keys came from Key Largo in 1998 (UF 117765).

The last Type I record (UF 151471) from the panhandle came from Eglin Air Force Base, Okaloosa County, in 1999 (Fig. 5). We received recent Type II records from Pine Log State

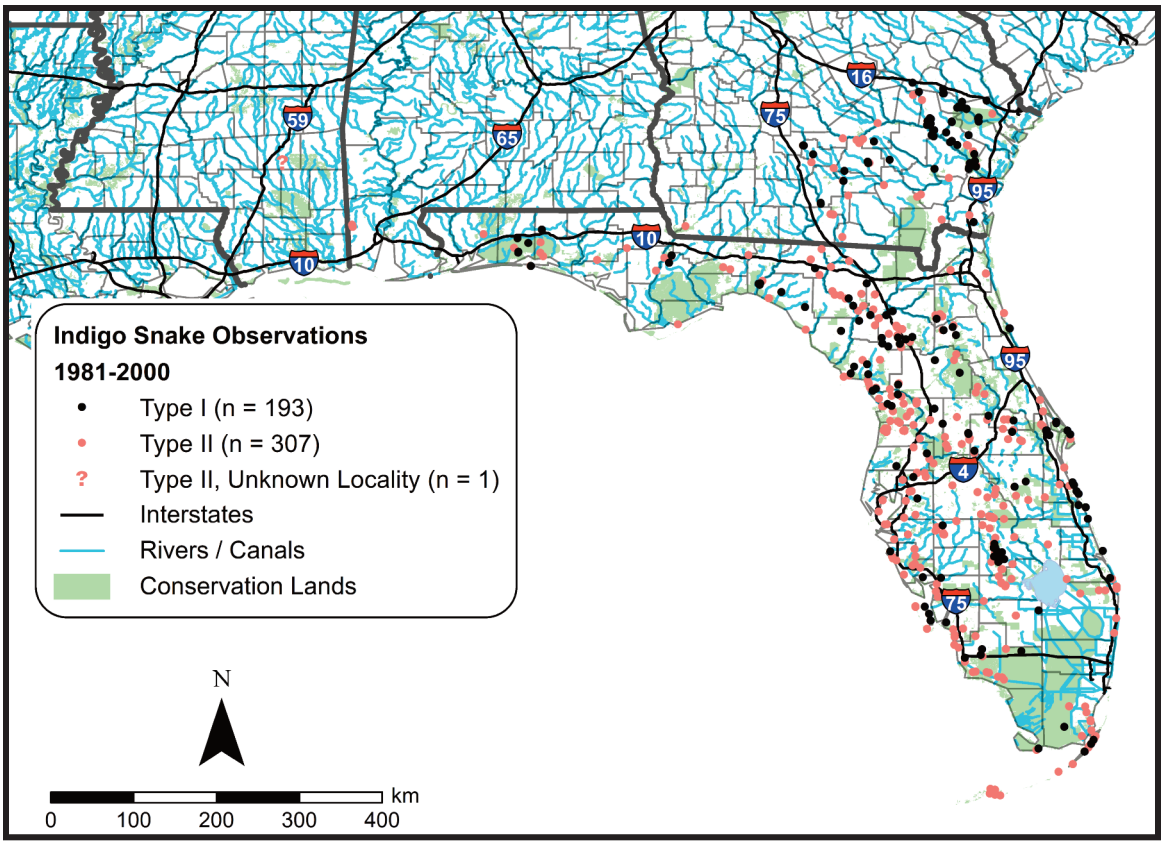

Figure 5. Records from 1981 through 2000 of the Eastern Indigo Snake (*Drymarchon couperi*), excluding released animals.

Forest in Bay County (2008), Florida Caverns State Park in Jackson County (2009), and private land in Santa Rosa County (2011; Fig. 6). The Santa Rosa County record was of a snake of approximately 2.1 m TL crossing a road 0.5 km north of Eglin Air Force Base (Paul Moody, pers. comm.). Before these sightings were made, the most recent Type I or Type II records of Eastern Indigo Snakes from other panhandle counties were Calhoun (1997), Escambia (1975), Franklin (1988), Gadsden (1974), Gulf (pre-1954), Holmes (1980), Jefferson (1988), Leon (1996), Liberty (1986), Wakulla (1980), Walton (1987), and Washington (1981; Fig. 3).

Alabama.—No Type I record exists from Alabama, but Haltom (1931) claimed the Eastern Indigo Snake occurred in Baldwin County, and Neill (1954) reported two specimens were collected from ca. 19 km north of Florala, Covington County (Fig. 4). Löding (1922) reported observations from near Satsuma and Grand Bay in Mobile County (Fig. 4). The most recent Type II records are from Mobile County, where a snake was seen crossing a road near Citronelle in 2001, and two snakes were seen 2.5 km apart near Wilmer in 2000 (Hart 2002). We did not include probable sightings, mostly from the 1990s, in Covington, Escambia, Mobile, and Washington counties that were near introduction sites of Dan Speake (Hart 2002). Pedestrian and burrow-camera surveys conducted since 1990 at these introduction sites failed to locate Eastern Indigo Snakes, suggesting that if the species still occurs in Alabama, its population density is so low that detection is improbable (Hart 2002; Clay 2008). A very small population may persist in Mobile County, and snakes were released starting in 2008 in Conecuh National Forest, Covington County, in an attempt to establish a population (Godwin et al. 2011).

Mississippi.—Cook (1954) reported three specimens from Mississippi (Fig. 4), which are

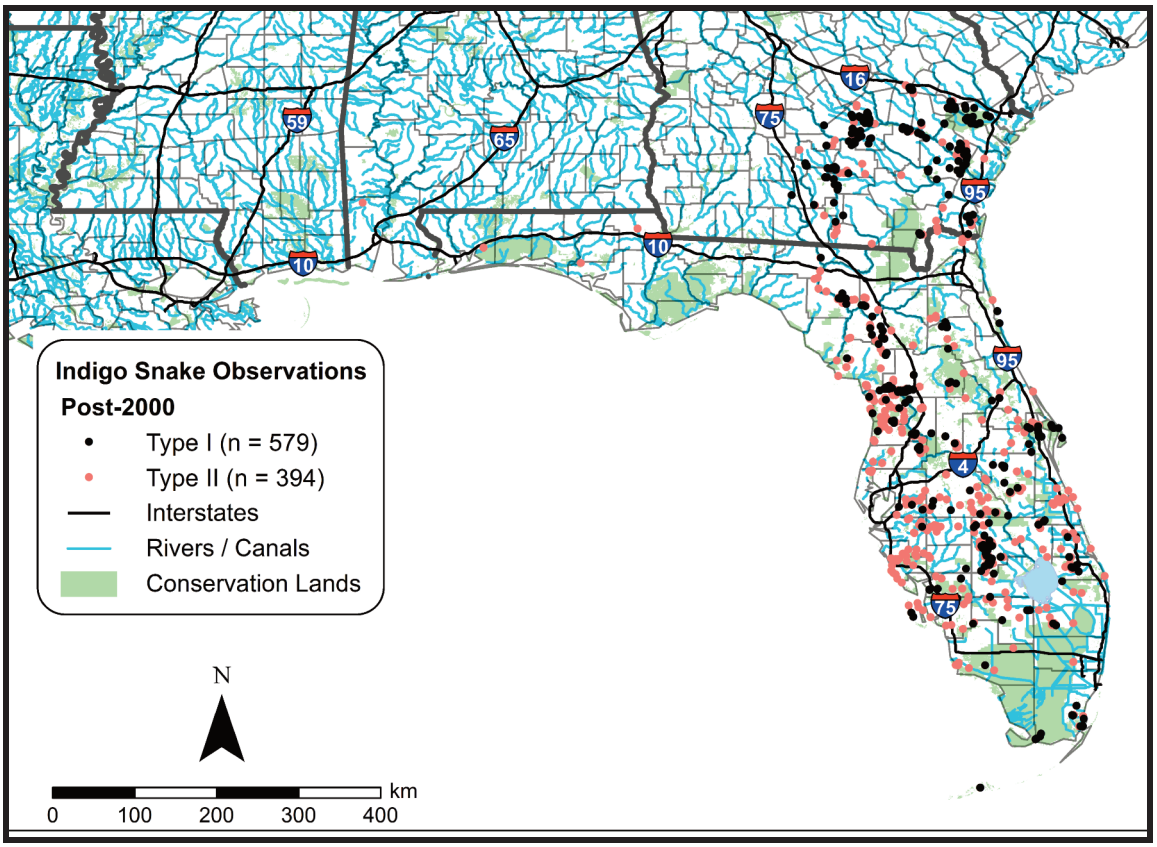

FIGURE 6. Post-2000 records of the Eastern Indigo Snake (*Drymarchon couperi*), excluding released animals.

Type I records. An adult (MMNS 1199) was collected in southern Wayne County in 1939 during a statewide biological inventory (Cook 1954), but the other two specimens from Wayne and Forrest counties ca. 1943 have been lost (Bob Jones, pers. comm.). There is a Type II record in 1955 from Forrest County (Bob Jones, pers. comm.) and two Type II records in the mid-1950s from DeSoto National Forest, Perry County (Lohoefener and Altig 1983; USFWS 2008; Fig. 4). The most recent sighting is a Type II record from southern Jones County in 1985, when an area manager for the Mississippi Department of Wildlife Conservation caught and released a docile, 2.13-m snake found in a Gopher Tortoise burrow (Linda LaClaire, pers. comm.). As in southern Alabama, sightings of large, black snakes may be Black Pinesnakes (*Pituophis melanoleucus lodingi*). Because the last Type I record in this state is from the 1940s and there has not been a Type II record in nearly 30 years, we suspect the species no longer occurs in Mississippi.

South Carolina.—There are two unconfirmed records in the 1960s from extreme southern South Carolina (USFWS 1982, 2008), but the species was removed from the state list of native reptiles and amphibians in 2009 because of lack of evidence that it had ever occurred there (Steve Bennett, pers. comm.). The lack of records from sandhills associated with the Savannah River drainage in adjacent Georgia supports this contention.

DISCUSSION

Our efforts to document the current distribution of the Eastern Indigo Snake indicate that it still occurs throughout much of its historical range in Georgia and Florida, but recent records are scarce or lacking from

Figure 7. The Eastern Indigo Snake (*Drymarchon couperi*) observed 30 March 2009 on Little Knockemdown Key, Monroe County, Florida, USA. (Photographed by Peter Braisted).

portions of that range. Based on the lack of recent records, naturally occurring populations are probably no longer extant in Mississippi and Alabama, and the species probably never occurred in South Carolina. We do not feel the decrease in the number of Eastern Indigo Snake records over time can be attributed to a decline in survey effort. In fact, we documented almost as many recent records (n = 973) as pre-2001 records (n = 988); however, these recent records were located within a reduced geographic area. We therefore suggest that recent non-detection of the species in a particular area where it was detected historically might indicate substantial population declines or even extirpation. In addition, our records indicate only the presence of the species, not the status of populations, and some of our records, particularly those from more fragmented or disturbed areas, may represent declining, rather than viable, populations. Eastern Indigo Snakes suffer greater adult mortality in fragmented landscapes than in natural areas, primarily as a result of road mortality and of persecution by humans (Breininger et al. 2012). Although population-modeling data suggest that Eastern Indigo Snake populations in fragmented landscapes may not be viable under certain scenarios (Breininger et al. 2004), information on viability is lacking for the vast majority of populations. Some populations in southern Florida occur primarily in disturbed agricultural landscapes, suggesting that populations can persist in a variety of non-natural habitats.

In Georgia, apparent current strongholds with numerous recent records include the Alapaha, Altamaha, and Ogeechee River basins (Stevenson 2006; Stevenson et al. 2010a). Our results are consistent with those of Diemer and Speake (1981, 1983), who conducted a two-year survey in Georgia by distributing questionnaires to natural-resource personnel and private landowners and following up on reported sightings with interviews and intensive field

surveys. Their work indicated a stronghold for the species consisting of a contiguous block of ca. 41 counties located in southeastern and south-central Georgia. Historically, at least one small population occurred in extreme southwestern Georgia (Decatur and Seminole counties), close to the Florida state line (Fig. 4); this population was apparently a northerly extension of the Florida population inhabiting sandhills along the Apalachicola River (Landers and Speake 1980; Stevenson 2006). Eastern Indigo Snakes observed or captured (as recently as 2000) on the Joseph W. Jones Ecological Research Center (Ichauway) in Baker County represented marked animals released there in the 1980s (Smith et al. 2006). Despite localities mapped by Diemer and Speake (1983) based upon "credible sightings," the occurrence of Eastern Indigo Snakes in the following areas of Georgia has never been substantiated by photographs or specimens: (1) the Fall Line Sandhills region, including the Fort Valley plateau; (2) the Fall Line Red Hills; and (3) the Tallahassee (Red) Hills. Historical and recent records are lacking for the Savannah area, including the well-inventoried Chatham County, despite the presence of historically suitable habitat in the form of xeric sandhills along the lower Ogeechee River.

Moler (1985a) concluded that the Eastern Indigo Snake was "distributed widely, though not necessarily commonly throughout Florida, including the panhandle" (Fig. 4). Our study indicates that the Eastern Indigo Snake still occurs throughout much of peninsular Florida but is now rarely observed and has a restricted distribution in the Florida panhandle (Fig. 6). The last Type I record from the panhandle was in 1999 in Okaloosa County, and there are only three recent Type II records. As in Georgia, records are lacking from the Tallahassee Hills area of Florida despite the presence of Gopher Tortoise populations and suitable-looking habitat (however, heavy clay soils may create unsuitable burrow conditions in winter) on large plantations managed for many decades primarily for the hunting of Northern Bobwhite (*Colinus virginianus*). In the northern part of its range (approximately the latitude of Gainesville, Florida), the Eastern Indigo Snake is apparently dependent on tortoise burrows for overwintering refugia (Diemer and Speake 1983; Hyslop et al. 2009). Krysko et al. (2011) reported 491 vouchered (i.e., Type I) records from 51 counties and unverified (i.e., Type II) records from 15 counties in Florida, but only 12 records were from panhandle counties: Jefferson, Leon, Liberty, Okaloosa, Wakulla, and Walton. The only recent records from the Keys came from roadless Little Knockemdown Key, suggesting that Eastern Indigo Snake populations have declined or been extirpated on some of the keys, many of which are highly fragmented by roads.

The broad distribution and large home range of the Eastern Indigo Snake complicate evaluation of its population status and trends. The species is also difficult to locate in the field, even where populations are large, making it difficult to reliably assess population trends. Loss of native habitats that support Eastern Indigo Snake populations is continuing due to the pressures of human population growth and development within the range of the species. Moler (1992) estimated that at least 1,000 ha of habitat is needed to provide conservation benefits to the species because of its large home range and other behavioral traits. Eighteen conservation lands in Georgia and 100 conservation lands in Florida with recent records of the species meet this criterion of size (see Appendix B), although the snakes may not use all available habitats. The future of the species would appear to be relatively secure in Florida because 27.0% of non-submerged land acreage is in fee simple conservation lands and 1.7% is in conservation easements (Florida Natural Areas Inventory. Available from http://www.fnai.org/PDF/Maacres_201302_FCL_plus_LTF.pdf [Accessed 14 December 2012]). However, despite 29.3% of the panhandle being in fee simple conservation lands (including large, relatively unfragmented parcels) and 1.3% in conservation easements, Eastern Indigo Snake populations have apparently declined there.

Maintaining viable populations of Eastern Indigo Snakes will require appropriate habitat management, including the use of prescribed fire, preservation of Gopher Tortoise populations, minimization of habitat fragmentation due to paved roads, and

educational programs that foster snake-friendly attitudes. Monitoring of Eastern Indigo Snake populations should be initiated at all occupied sites that are large enough for long-term persistence of populations. At a minimum, land managers or biologists should maintain a database of all observations, including date, location (e.g., latitude and longitude), and, when possible, photographs of snakes observed. Development and implementation of habitat management plans at sites with Eastern Indigo Snake populations would provide a meaningful step toward ensuring the long-term perpetuation of this species.

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Dirk Stevenson attended Southern Illinois University where he received a B.S. degree in Zoology. He has more than 20 years of professional experience working as a field zoologist, primarily conducting herpetofaunal field studies and surveys in the Coastal Plain of the southeastern United States. Since 1996, Dirk has conducted intensive mark-recapture studies and distributional surveys of the Eastern Indigo Snake throughout southern Georgia, USA. He is a herpetologist with The Orianne Society. Dirk has published a number of technical and popular articles relating to Indigo Snakes, Flatwoods Salamanders (*Ambystoma cingulatum*), rare odonates, Bark Scorpions (*Centruroides* spp.), and other animals. Many of his photographs appeared in *Amphibians and Reptiles of Georgia*. (Photographed by Joshua Parker).

Matt Elliott is a graduate of the University of the South – Sewanee (B.A.) and Yale University (Master of Environmental Studies). Matt also holds a certificate in Geographic Information Science from the University of Georgia. Since 2004, he has been the Program Manager of Georgia's Natural Heritage Program, housed within the Nongame Conservation of the Wildlife Resources Division, Department of Natural Resources. Over the years, Matt has been the coordinator of the Georgia Gap Analysis Program and conducted fieldwork on amphibians, reptiles, and Spotted Owls (*Strix occidentalis*). He is a co-author of *Amphibians and Reptiles of Georgia* and is interested in the biogeography of nearly everything. (Photographed by Stacy Smith).

Javan Bauder is a graduate of the University of Idaho (B.S.) and Idaho State University (M.S.). Javan studied the spatial ecology of the Prairie Rattlesnake (*Crotalus viridis*) in central Idaho for his graduate research. He has worked for The Orianne Society since 2009 and is an Assistant Conservation Scientist with its Indigo Snake Initiative. Javan has worked on multiple projects relating to Indigo Snake ecology and conservation in Georgia and Florida, focusing on physiological ecology, population monitoring, and elucidating how landscape composition and configuration influence population viability. (Photographed by Joshua Parker).

Appendix A. Select Type II records of purported Eastern Indigo Snakes (*Drymarchon couperi*) from the literature or other sources that we did not map in the current survey. We also did not map records from near release sites of Dan Speake.

Location	Year	Source	Reasons not mapped
Cuthbert, Randolph Co., Georgia	2006	George Folkerts, pers. comm.	Waif or escaped pet observed outside of species' perceived range; 85 km from nearest record in Seminole Co.
Sunny Hills, Washington Co., Florida	2010	Rebekah Dean, pers. comm.	Seen in suitable sandhill habitat, but the observer was not a biologist (she had seen a confirmed Eastern Indigo Snake in Georgia, however).
Enterprise, Coffee Co., Alabama	2000	USFWS (2008); Hart (2002)	Photograph (Auburn University Herpetological Lab) of a juvenile snake in a privet hedge; determined by authors to be a North American Racer (*Coluber constrictor*).
Deer Park, Washington Co., Alabama	1998	Hart (2002)	Adult observed by landowner, but qualifications of observer unknown
Mobile Co., Alabama	1990s	Photograph	Determined by authors to be a Texas Eastern Indigo Snake (*Drymarchon erebennus*) based upon coloration and pattern
John C. Stennis Space Center, Hancock Co., Mississippi	1975	Mississippi Natural Heritage Program	Observed by two zoologists conducting an Environmental Impact Study, but the record should be considered suspect (Linda LaClaire, pers. comm.)
Northeastern Stone Co., Mississippi	1977	Letter signed by Cliff Finch, Governor	Identification was unconfirmed, and the record should be considered suspect (Linda LaClaire, pers. comm.)

Appendix B. The most recent Type I or Type II record of an Eastern Indigo Snake (*Drymarchon couperi*) from conservation lands (public lands or private conservation lands) in Georgia, Florida, Alabama, and Mississippi.

Public or conservation land	County	Year	Size (ha)
Georgia			
Big Hammock Natural Area	Tattnall	2000	324
Bowens Mill Fish Hatchery	Ben Hill	1947	70
Broxton Rocks Preserve	Coffee	2012	668
Crooked River State Park	Camden	2003	202
Dixon Memorial State Forest	Ware	1999	12,748
Flat Tub Wildlife Management Area	Coffee	2009	2542
Fort Stewart Military Reservation	Bryan	2012	113,000
General Coffee State Park	Coffee	2012	611
Georgia Forestry Commission Conservation Easement	Berrien	2011	2,040
Georgia Dept. of Nat. Resources Conservation Easement	Bryan	2012	368
Grand Bay Wildlife Management Area	Lowndes	2002	3,520
Griffin Ridge Wildlife Management Area	Long	2012	2,266
Horse Creek Wildlife Management Area	Telfair	2010	3,278
*Joseph W. Jones Ecological Research Center	Baker	2000	11,300
Lewis-Penholoway Flatwoods Preserve	Brantley	1990s	138
Little Satilla Wildlife Management Area	Wayne	2012	7,957
Long Co. Georgia Dept. of Transport. Mitigation Tract	Long	2009	2,920
Moody Air Force Base	Lanier	2002	4,614
Moody Forest Natural Area Preserve	Appling	2012	2,546
Ohoopee Dunes Natural Area	Emanuel	1990s	1,276
Okefenokee National Wildlife Refuge	Charlton	2012	162,680
Orianne Eastern Indigo Snake Preserve	Telfair	2012	1,012
Penholoway Swamp Wildlife Management Area	Wayne	2012	1,728
Reed Bingham State Park	Cook	2007	653
Sansavilla Wildlife Management Area	Wayne	2012	6,781
Silver Lake Wildlife Management Area	Decatur	1980s	3,723
Townsend Bombing Range – Buffer Easement	Long	2008	4,504
Townsend Wildlife Management Area	McIntosh	2010	10,158
Florida			
Alafia River Corridor	Hillsborough	2002	1,599
Allapattah Flats	Martin	2007	8,476
Allen Mill Pond Conservation Area	Lafayette	2007	188
Alligator Harbor Aquatic Preserve	Franklin	1975	5,828
Anastasia State Park	St. Johns	2006	688
Andrew Dodge Memorial Pineland	Miami-Dade	1999	2
Annutelliga Hammock	Hernando	2007	482
Apalachicola Bluffs and Ravines Preserve	Liberty	1983	2,528
Apalachicola National Forest	Leon	1996	230,591
Archbold Biological Station	Highlands	2012	2,120
Archbold Reserve	Highlands	2011	1,476
Archie Carr National Wildlife Refuge	Brevard	1994	100
Arthur R. Marshall Loxahatchee National Wildlife Refuge	Palm Beach	2009	59,647
Aucilla Wildlife Management Area	Jefferson	1988	19,272
Avon Park Air Force Range	Polk	2009	42,937
Babcock Ranch Preserve	Charlotte	2007	29,947
Balm-Boyette Scrub Preserve	Hillsborough	2012	2,347
Barley Barber Swamp	Martin	1980	176
Beker State Park	Manatee	2002	230

Public or conservation land	County	Year	Size (ha)
Bayonne Site	Sarasota	1992	4
Bell Creek Preserve	Hillsborough	2012	193
Bell Ridge Longleaf Wildlife and Environmental Area	Gilchrist	2009	291
Bettie & Crawford Rainwater Perdido Nature Preserve	Escambia	1972	943
Big Bend Wildlife Management Area	Taylor	1982	27,967
Big Cypress National Preserve	Collier	2005	295,015
Biscayne National Park	Miami-Dade	2005	69,980
Black Sink Prairie	Marion	1975	150
Blackwater Creek Preserve	Hillsborough	1997	800
Blackwater River State Forest	Okaloosa	1977	76,726
Blue Spring State Park	Volusia	2008	1,070
Bok Tower Gardens	Polk	2007	64
Boyd Hill Nature Park	Pinellas	1995	99
Branford Bend Tract	Suwannee	1992	415
Bright Hour Watershed	DeSoto	1970s	12,945
Brooker Creek Preserve	Hillsborough	2007	3,180
Buck Lake Conservation Area	Brevard	2005	3,919
Bull Creek Wildlife Management Area	Osceola	2012	9,569
Bullfrog Creek Mitigation Park Wildl. & Environ. Area	Hillsborough	2003	337
C-44 Stormwater Treatment Area	Martin	2011	4,856
Camp Blanding Military Reservation	Clay	2009	29,573
Cape Canaveral Air Station	Brevard	2004	6,266
Caravelle Ranch Wildlife Management Area	Putnam	2008	10,693
Casperson Beach County Park	Sarasota	2003	64
Cayo Costa State Park	Lee	2011	976
Cedar Key Scrub State Reserve	Levy	1996	1,989
Charlotte Harbor Preserve State Park	Lee	2007	17,206
Chassahowitzka National Wildlife Refuge	Citrus	2005	12,482
Chassahowitzka Wildlife Management Area	Hernando	2009	13,726
Chinquapin Farm Conservation Easement	Suwannee	2003	2,568
Chinsegut Wildl. & Environ. Area – Big Pine Tract	Hernando	1991	165
Chuluota Wilderness Area	Seminole	2006	255
Circle B Bar Reserve	Polk	1989	513
Cockroach Bay Preserve State Park	Hillsborough	1996	416
Collier-Seminole State Park	Collier	2002	2,942
Cone Ranch	Hillsborough	1997	5,759
Corkscrew Regional Ecosystem Watershed (CREW)	Collier	2008	11,550
Corkscrew Swamp Sanctuary	Collier	1992	4,409
Cottage Hill State Forest	Escambia	1972	13
Crocodile Lake National Wildlife Refuge	Monroe	1984	2,711
Crooked Lake Prairie	Polk	2006	212
Cross Bar Ranch Wellfield	Hillsborough	2012	5,059
Crowley Museum and Nature Center	Sarasota	1992	77
Crystal River Preserve State Park	Citrus	2010	15,378
Curry Creek Preserve	Sarasota	2003	33
Cypress Creek Flood Detention Area	Pasco	1998	3,311
Cypress Lakes Preserve	Hernando	1995	130
Dagny Johnson Key Largo Hammock Botan. State Park	Monroe	1994	932
Daniel's Preserve at Spanish Creek	Lee	2005	40
Deep Creek Conservation Area	Columbia	1969	743
Delnor-Wiggins Pass State Park	Collier	1995	67
Dinner Island Ranch Wildlife Management Area	Hendry	2005	12,966
Disney Wilderness Preserve	Polk	2008	4,659

Public or conservation land	County	Year	Size (ha)
Dudley Farm Historic State Park	Alachua	1983	132
Duette Park	Manatee	2007	8,903
Dupuis Reserve	Palm Beach	2007	8,852
Econfina Creek Water Management Area	Bay	1972	16,656
Edward Ball Wakulla Springs State Park	Wakulla	1968	1,919
Eglin Air Force Base	Okaloosa	1998	187,551
Ekker Preserve	Hillsborough	1989	34
English Creek	Hillsborough	2002	154
Estero Bay Preserve State Park	Lee	2004	3,415
Etoniah Creek State Forest	Putnam	2012	3,512
Everglades Agricultural Area – A-1 Reservoir	Palm Beach	2011	6,313
Everglades National Park	Miami-Dade	2010	307,119
Fakahatchee Strand Preserve State Park	Collier	2006	28,480
Fellsmere Water Management Area	Indian River	2011	4,047
Fish Hawk Nature Preserve	Hillsborough	2001	1,133
Fisheating Creek Lykes Bros. Conservation Easement	Glades	2000	16,804
Fisheating Creek Wildlife Management Area	Glades	2006	7,394
Flat Island Preserve	Lake	1996	887
Florida Atlantic University Ecological Site	Palm Beach	1970	37
Florida Caverns State Park	Jackson	2009	534
Florida Gulf Coast University	Lee	2008	308
Florida Keys Wildlife and Environmental Area	Monroe	2011	732
Fort Cooper State Park	Citrus	2006	303
Fort Drum Marsh Conservation Area	Indian River	2009	8,441
Fort Matanzas National Monument	St. Johns	1999	121
Fort Pierce Inlet State Park	St. Lucie	1980	462
Fred C. Babcock – Cecil M. Webb Wildl. Manage. Area	Charlotte	2002	26,616
Georgia Pacific–Lochloosa Conservation Easement	Alachua	2004	11,059
Goethe State Forest	Levy	2008	19,604
Green Swamp Wildlife Management Area	Lake	1994	20,514
Green Swamp Wildlife Management Area – West Unit	Pasco	2009	15,115
GTMNERR - Guana River Site	St. Johns	2005	1,052
Guana Tolomato Matanzas National Estuarine Research Reserve (GTMNERR)	St. Johns	1975	29,583
Hal Scott Regional Preserve and Park	Orange	2004	3,410
Half Moon Wildlife Management Area	Sumter	2011	3,836
Halpata Tastanaki Preserve	Marion	2004	3,282
Henderson Beach State Park	Okaloosa	1986	89
Hickey Creek Mitigation Park Wildl. & Environ. Area	Lee	2005	379
Hickory Lake Scrub County Park	Polk	2005	23
High Ridge Scrub Natural Area	Palm Beach	1982	16
Highlands Hammock State Park	Highlands	2002	3,294
Hillsborough River State Park	Hillsborough	1994	1,382
Hilochee Wildlife Management Area	Lake	2002	1,951
Hungryland Slough Natural Area	Palm Beach	1999	824
Ichetucknee Springs State Park	Columbia	2004	921
Ichetucknee Trace	Columbia	2009	267
Indian Lake State Forest	Marion	1976	1,809
Indian River Lagoon Preserve State Park	Brevard	2001	163
J.N. Ding Darling National Wildlife Refuge	Lee	1999	2,556
J.W. Corbett Wildlife Management Area	Palm Beach	2002	24,373
Janet Butterfield Brooks Preserve	Hernando	2006	136
John Pennekamp Coral Reef State Park	Monroe	1984	1,282
Jonathan Dickinson State Park	Martin	2007	4,646

Public or conservation land	County	Year	Size (ha)
Juno Dunes Natural Area	Palm Beach	1991	234
Jupiter Ridge Natural Area	Palm Beach	1991	108
Kanapaha Prairie	Alachua	1981	277
Kicco Wildlife Management Area	Polk	2003	3,005
Kissimmee Prairie Preserve State Park	Okeechobee	2007	18,798
Kissimmee River	Okeechobee	2008	21,052
Koreshan State Historic Site	Lee	1974	78
Lafayette Blue Springs State Park	Lafayette	2005	81
Lake George Conservation Area	Putnam	1965	4,845
Lake Jesup Conservation Area	Seminole	1981	2,133
Lake Jesup Wilderness Area	Seminole	2000	199
Lake June in Winter Scrub State Park	Highlands	2011	342
Lake Kissimmee State Park	Polk	1999	2,401
Lake Louisa State Park	Polk	2011	1,784
Lake Lizzie Conservation Area	Osceola	1970	
Lake Manatee State Park	Manatee	1983	222
Lake Monroe Conservation Area	Volusia	2003	2,991
Lake Okeechobee Ridge	Martin	1970	82
Lake Panasoffkee	Sumter	2004	3,511
Lake Talquin State Forest	Gadsden	1974	6,607
Lake Wales Ridge State Forest – Arbuckle Tract	Polk	2002	5,463
Lake Wales Ridge State Forest – Walk–in-the-Water Tract	Polk	2005	3,486
Lake Wales Ridge WEA – Carter Creek Unit	Highlands	2008	1,418
Lake Wales Ridge WEA – Gould Road Unit	Highlands	2009	69
Lake Wales Ridge WEA – Henscratch Unit	Highlands	2007	519
Lake Wales Ridge WEA – Highlands Park Estates	Highlands	2007	880
Lake Wales Ridge WEA – Highlands Ridge/Leisure Lakes Unit	Highlands	2008	1,358
Lake Wales Ridge WEA – Lake Placid Scrub	Highlands	2008	1,275
Lake Wales Ridge WEA – McJunkin Unit	Highlands	2007	296
Lake Wales Ridge WEA – Royce Unit	Highlands	2009	1,093
Lake Wales Ridge WEA – Silver Lake Unit	Highlands	2009	368
Lake Wales Ridge WEA – Sun N Lakes Unit	Highlands	2011	172
Lake Wales Ridge WEA – Tubbs Unit	Highlands	2006	23
Lakeland Highlands Scrub	Polk	2002	223
Lemon Bay Park and Environmental Center	Sarasota	2003	83
Lignum Vitae Key Botanical State Park	Monroe	1983	4,362
Lithia Springs Park	Hillsborough	1981	65
Little Big Econ State Forest – Kilbee Unit	Seminole	2006	666
Little Manatee River Corridor	Hillsborough	1960s	1,996
Little Manatee River State Park	Hillsborough	2009	978
Little River Conservation Area	Suwannee	2007	894
Lower Steinhatchee Conservation Area	Levy	2003	20,651
Loxahatchee Slough Natural Area	Palm Beach	1993	5,195
Martinez Pineland	Miami-Dade	2000	57
MacArthur Agro-ecology Res. Cent. (Buck Island Ranch)	Highlands	2007	4,249
Malabar Scrub Sanctuary	Brevard	1994	160
Malabar Transmitter Annex	Brevard	1997	259
Manasota Scrub Preserve	Sarasota	2003	63
Manatee Springs State Park	Levy	1980	960
Marjorie Harris Carr Cross Florida Greenway	Marion	2009	32,897
Merritt Island National Wildlife Refuge	Brevard	2011	53,061
Middle Aucilla Conservation	Taylor	1992	3,711
Mike Roess Gold Head Branch State Park	Clay	2009	957

Public or conservation land	County	Year	Size (ha)
Moody Branch Mitigation Park Wildl. & Environ. Area	Manatee	2007	388
Mullock Creek Preserve	Lee	1975	2
Myakka River State Park	Manatee	2008	14,951
Myakkahatchee Creek Environmental Park	Sarasota	2003	65
Nassau Wildlife Management Area	Nassau	2009	5,664
National Key Deer Refuge	Monroe	1991	3,723
Natural Bridge Battlefield Historic State Park	Leon	1970	4
Nubbin Slough Stormwater Treatment Area	Okeechobee	2005	327
Ocala National Forest	Marion	2009	155,226
Ordway-Swisher Biological Station	Putnam	1995	2,487
Oscar Scherer State Park	Sarasota	2009	559
Osceola National Forest	Columbia	1977	80,324
Oyster Creek Regional Park	Charlotte	2003	110
Paynes Creek Historic State Park	Hardee	1994	160
Paynes Prairie State Preserve	Alachua	1970	8,476
Peacock Springs Conservation Area	Suwannee	2005	243
Perry Oldenburg Mitigation Park Wildl. & Environ. Area	Hernando	2006	149
Picayune Strand State Forest	Collier	1982	26,481
Pine Island Flatwoods Preserve	Lee	2009	295
Pine Log State Forest	Bay	2008	2,797
Pinecastle Bombing Range	Marion	2011	2,331
Pinelands Reserve	Sarasota	2003	2,489
Pioneer Park	Hardee	1981	46
Platt Branch Mitigation Park Wildl. & Environ. Area	Highlands	2007	798
Poe Springs Park	Alachua	1981	82
Potts Preserve	Citrus	2008	3,440
Rainbow Springs State Park	Marion	2009	439
Ralph E. Simmons State Forest	Nassau	2007	1,472
Rocky Ford Preserve	Sarasota	2003	563
Rookery Bay National Estuarine Research Reserve	Collier	2011	44,742
Ross Prairie State Forest	Marion	2008	1,435
Salt Lake Wildlife Management Area	Brevard	2007	3,159
San Felasco Hammock Preserve State Park	Alachua	1993	2,803
Savannas Preserve State Park	St. Lucie	2005	2,070
Scrub Point Preserve	Lake	1991	36
Sebastian Inlet State Park	Brevard	2004	352
Seminole Ranch Conservation Area	Brevard	2006	11,765
Seminole State Forest	Lake	1991	10,952
Shamrock Park and Nature Center	Sarasota	2003	40
South Venice Lemon Bay Preserve	Sarasota	2003	90
Southern Glades	Miami-Dade	1990	12,173
Space Coast Regional Airport	Brevard	2001	667
Split Oak Forest Mitigation Park Wildl. & Environ. Area	Orange	2005	683
Spring Hammock Preserve	Seminole	1995	564
St. Marks National Wildlife Refuge	Wakulla	1970s	27,341
St. Sebastian River Preserve State Park	Brevard	2009	8,880
*St. Vincent National Wildlife Refuge	Franklin	1994	5,054
Starkey Wilderness Park	Pasco	2008	7,694
Steinhatchee Conservation Area	Dixie	1974	21,560
SUMICA	Polk	2005	1,686
Suwannee River State Park	Suwannee	1982	779
T. Mabry Carlton Jr. Memorial Reserve	Sarasota	2003	9,941
Tate's Hell State Forest	Franklin	1970s	58,480

Public or conservation land	County	Year	Size (ha)
Ten Mile Creek	St. Lucie	2002	373
Tenroc Fish Management Area	Polk	2009	2,583
Terra Ceia Preserve State Park	Manatee	1990	804
Three Lakes Wildlife Management Area	Osceola	2005	21,439
Three Lakes Wildl. Manag. Area – Prairie Lakes Unit	Osceola	2009	3,585
Tiger Creek Preserve	Polk	2010	1,944
Torreya State Park	Liberty	1982	1,057
Tosohatchee Wildlife Management Area	Orange	2008	12,424
Triple N Ranch Wildlife Management Area	Osceola	2003	6,228
Troy Springs Conservation Area	Lafayette	2007	732
Turnbull Hammock Conservation Area	Volusia	1967	479
Twin Rivers State Forest – Black Tract	Madison	2006	272
Twin Rivers State Forest – Blue Springs Longleaf Tract	Hamilton	2012	798
Twin Rivers State Forest – Ellaville Tract	Madison	1970	1,734
Twin Rivers State Forest – Mill Creek South	Madison	2012	566
Twin Rivers State Forest – Westwood West Tract	Madison	1992	335
University of Central Florida Research Park	Orange	1990	416
University of Florida	Alachua	1960	809
University of South Florida Ecological Research Area	Hillsborough	1984	202
Upper Hillsborough	Pasco	1988	4,422
Waccasassa Bay Preserve State Park	Levy	1999	12,458
Washington Oaks Gardens State Park	Flagler	1980	172
Water Conservation Area 3B	Broward	2011	33,184
Watermelon Pond Wildlife and Environmental Area	Alachua	2012	1,712
Weedon Island Preserve	Pinellas	1993	1,093
Weekiwachee Riverine System	Hernando	2008	3,862
Wekiwa Springs State Park	Seminole	2004	3,127
Whispering Pines City Park	Citrus	2006	117
Whitehouse Naval Outlying Field	Duval	2005	769
Withlacoochee River Park	Pasco	2009	245
Withlacoochee State Forest – Citrus Tract	Citrus	2009	19,958
Withlacoochee State Forest – Croom Tract	Hernando	2009	8,334
Withlacoochee State Forest – Lecanto Sandhills	Citrus	2008	769
Withlacoochee State Forest – Richloam Tract	Hernando	2008	23,531
Withlacoochee State Forest – Sugarmill Woods Tract	Citrus	2008	2,266
Withlacoochee State Forest – Two Mile Prairie	Citrus	2005	1,174
Withlacoochee State Trail	Hernando	2005	308
Wolf Creek Ranch Conservation Easement	Brevard	1995	1,543
Yamato Scrub Natural Area	Palm Beach	1984	88
Yucca Pens Unit	Charlotte	2005	5,359
Alabama			
*Conecuh National Forest	Covington	2012	33,590
Mississippi			
DeSoto National Forest	Perry	1950s	209,955

*Represents released individuals.