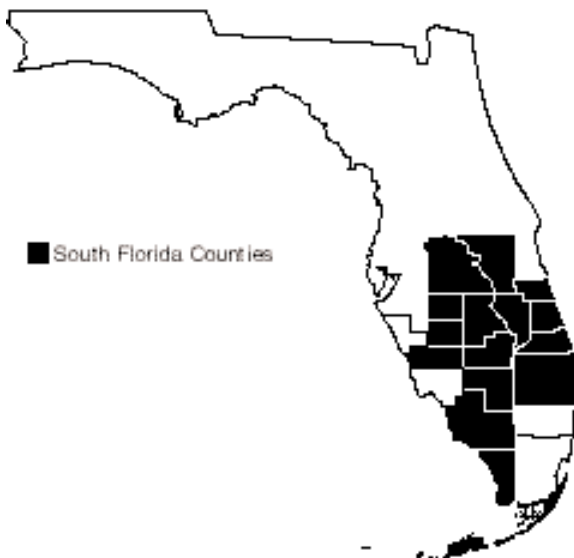

Audubon's Crested Caracara

Polyborus plancus audubonii

Federal Status:	Threatened (July 6, 1987)
Critical Habitat:	None Designated
Florida Status:	Threatened
Recovery Plan Status:	Revision (May 18, 1999)
Geographic Coverage:	Rangewide

Figure 1. County distribution of Audubon's crested caracara.



Audubon's crested caracara is a large, boldly patterned raptor, with a crest and unusually long legs. It is a resident, diurnal, and non-migratory species that occurs in Florida as well as the southwestern U.S. and Central America. In Florida, this species is found in the prairie area of the south-central region of the state. The subspecies is no longer present at its type locality, which is near St. Augustine, St. Johns County, Florida.

Only the Florida population, which is isolated from the remainder of the subspecies in the southwestern U.S. and Central America, is listed under the Endangered Species Act. Although no management activities have been undertaken for the U.S. population of this species, draft habitat management guidelines are being developed that should aid in the caracara's recovery.

This account represents a revision of the existing recovery plan for the Audubon's crested caracara (FWS 1989).

Description

Audubon's crested caracara is a large raptor with a crest, naked face, heavy bill, elongate neck, and unusually long legs. It is about 50 to 64 cm long and has a wingspan of 120 cm. The adult is dark brownish black on the crown, wings, back, and lower abdomen. The lower part of the head, throat, upper abdomen, and under tail coverts are white, sometimes tinged with yellow; the breast and upper back are whitish, heavily barred with black. The tail is white with narrow, dark crossbars and a broad, dark terminal band. Prominent white patches are visible near the tips of the wings in flight. The large, white patches in the primaries and the white tail, broadly tipped with black, are both very conspicuous in flight and can be recognized at a long distance (Bent 1961). Juveniles have a similar color pattern but are brownish and buffy with the breast and upper back streaked instead of barred. Subadults resemble adults but are more brownish in color. Adults have yellow-

orange facial skin and yellow legs. Facial skin of juveniles is pinkish in color, and the legs are gray (Layne 1978). Full adult plumage is obtained sometime after 2 years of age (J. Morrison, University of Florida, personal communication 1997).

There is no evidence of sexual dimorphism, the sexes being similar in color and size (J. Morrison, University of Florida, personal communication 1996a); however, gender can be determined surgically or through blood analysis (Humphrey and Morrison 1996).

The bare skin on the face of this bird is an interesting and distinctive feature. When the bird is at rest, preening or being preened, or engaged in other non-aggressive behaviors, the facial skin is bright orange-red. When threatened, the color of the facial skin changes to a pumpkin color and finally to pale yellow (Lyons 1984). Apparently, threat or fear causes blood to bypass the subepidermal blood vessels, resulting in a change in facial skin color. The caracara's crest provides another method for communication. When a caracara is comfortable and not threatened, the crest lies flat. The crest is raised when they feel threatened, frightened, or are on alert (Lyons 1984).

A caracara's feet and flight behavior are also notable. Their feet are clearly those of a raptor; however, their talons are flatter, enabling caracaras to run and walk more easily than other raptors. Bent (1938) and Layne (1985) noted that the caracara's flight pattern resembles that of a northern harrier (*Circus cyaneus*), but caracaras fly faster and more gracefully. Caracaras are strong fliers and may reach speeds of 40 mph. They have also been observed soaring in large circles at great heights (Howell 1932).

Little information is available on vocalizations of this species; however, in the morning or evening, the caracara may throw its head back until it almost touches its shoulders and emit a high, cackling cry that resembles its Brazilian name (Bent 1961). Observations of caracaras in Costa Rica and Mexico indicate that this call may be a part of pair formation or courtship. The only other vocalizations heard in Costa Rica were a one-syllable greeting and an alarm call (Palmer 1988).

Taxonomy

Audubon's crested caracara is a member of the Class Aves, Order Falconiformes, Family Falconidae. It was originally described by John James Audubon (1834), who discovered the caracara on November 21, 1831, and published an account under the name *Polyborus vulgaris*. It was renamed in 1865 by John Cassin to *Polyborus audubonii* and has had several other scientific names since that time. Most recently it was renamed *Caracara plancus* (Banks and Dove 1992). Banks (1985) provided a historical review of the taxonomy of the caracara prior to its listing.

The only other species of *Polyborus* known from recent times is the Guadalupe caracara (*Polyborus lutosus*). This species was extirpated from Guadalupe Island, Mexico in the early part of the 20th century (Abbott 1933).

Audubon's crested caracara.
Original photograph by Joan Morrison.



Distribution

The overall range of the crested caracara is from Florida, southern Texas, southwestern Arizona, and northern Baja California, through Mexico and Central America to Panama, including Cuba and the Isle of Pines. It is accidental in Jamaica. Other subspecies range into South America as far as Tierra del Fuego and the Falkland Islands (Stevenson 1976, Layne 1978).

Historically, this subspecies was a common resident in Florida from northern Brevard County, south to Fort Pierce, Lake Okeechobee, and Hendry County. It has been reported as far north as Nassau County, and as far south as Collier County and the lower Florida Keys in Monroe County. Some of the birds sighted in the Florida Keys most likely escaped or were released from captivity. Available evidence indicates that the range of this subspecies in Florida has experienced a long-term continuing contraction, with birds now rarely found as far north as Orlando in Orange County or on the east side of the St. Johns River. Presently, Audubon's crested caracara may be found in Charlotte, Collier, DeSoto, Glades, Hardee, Hendry, Highlands, Martin, Monroe, Okeechobee, Osceola, Palm Beach, Polk, and St. Lucie counties (Figure 1). However, there is little evidence of breeding in Palm Beach, Indian River, Martin and Monroe counties (Layne 1978, Stevenson 1976, Sprunt 1954, FWS 1989, J. Morrison, University of Florida, personal communication 1996a). The region of greatest abundance for this subspecies is a five-county area north and west of Lake Okeechobee, including Glades, Desoto, Highlands, Okeechobee, and Osceola counties.

Habitat

The Florida population commonly occurs in dry or wet prairie areas with scattered cabbage palms (*Sabal palmetto*). It may also be found in lightly wooded areas. Scattered saw palmetto (*Serenoa repens*), scrub oaks (*Quercus geminata*, *Q. minima*, *Q. pumila*), and cypress (*Taxodium* spp.) may also be present. Widespread changes in land use may have forced a change in the type of habitat this subspecies will use. The caracara now uses improved or semi-improved pasture (Layne 1996b, J. Morrison, University of Florida, personal communication 1996a). The presence of seasonal wetlands may be an important factor in the attractiveness of these pastures to caracaras (K. Dryden, GFC, personal communication 1996).

Humphrey and Morrison (1997) characterized habitat features and land use patterns at active caracara nest sites in south-central Florida. They found that caracaras prefer to nest in cabbage palms (*Sabal palmetto*) surrounded by open habitats with low ground cover and low density of tall or shrubby vegetation. The study also indicated that there was a strong association of caracara home ranges with improved pasture. In addition, occupancy rate, breeding rates, and nesting success were consistently higher on private lands during the 3-year study. One of the variables that may contribute to the difference in success is vegetation height. This may be related to lower predation rates in areas with less cover, or it may simply be easier for caracaras to walk around and forage in shorter vegetation. Other factors contributing to nest success may be nest tree height, and distance to major roads or human activity.

Routine observation and radiotelemetry monitoring suggest that there are three congregation areas in south-central Florida which may be important to caracaras during the first year after leaving their natal territory (Humphrey and Morrison 1996). One is along the Kissimmee River, north of State Route 98, one is north of U.S. Highway 27 in Glades County, and one is in the vicinity of Eagle Island Road in northern Okeechobee County. These congregation areas consist of large expanses of improved pasture; however, the particular habitat values of these areas have not yet been evaluated.

Behavior

Reproduction

Caracaras are relatively long-lived. A caracara was kept in captivity for at least 30 years, suggesting that this falconid may have a high reproductive potential (Brown and Amadon 1968). Layne (1996b) describes a 20 year-old female brought into captivity as a nestling as still being in good health. The age at first breeding is unknown (Palmer 1988).

Breeding behavior in Audubon's crested caracara is relatively unknown. Based on the limited amount of information available, courtship behavior may involve the pair perching next to each other, almost touching, uttering the cackling call with their heads thrown back (Batten 1969). Brown and Amadon (1968) stated that males may occasionally fight in the air. Caracaras in Costa Rica have been observed in a ritual involving the rattle call where one of the birds had a lizard that was later broken apart so that both individuals could eat.

It is not known if this is a true courtship ritual or pair bond maintenance (Palmer 1988). The pair bond is relatively strong, lasting until one mate dies (FWS 1989).

Caracaras are one of the first of Florida's raptors to begin nesting. Egg laying has been estimated to begin as early as late September based upon evidence of chicks fledging in December (Humphrey and Morrison 1997). The height of the nesting season is in January and February. Nests with eggs have also been found as late as April (Nicholson 1929). In their study, Humphrey and Morrison (1997) suggest that most reproductive activity occurs during the winter dry season, although nesting attempts may occur throughout the year.

Caracaras construct new nests each nesting season, often in the same tree as the previous year. Nests are well-concealed and most often found in the tops of cabbage palms (J. Morrison, University of Florida, personal communication 1996a) although nests have been found in live oaks (*Q. virginiana*), cypress (first record, 1996), Australian pine (*Casuarina* spp.), saw palmetto, and black gum (*Nyssa sylvatica*). Caracaras usually construct their nests 4 to 18 m above the ground; their nests primarily consist of haphazardly woven vines trampled to form a depression (Bent 1938, Sprunt 1954, Humphrey and Morrison 1996, Layne, Archbold Biological Station, personal communication 1996a). Both adults participate in nest construction. Caracaras do not vigorously defend their nest site although they are aggressive toward other adult caracaras intruding near the nest itself (J. Morrison, University of Florida, personal communication 1996a). Sprunt (1954) wrote, "One female remained on the nest until approached to within four feet, when she flew to a stub about 12 feet away and watched. The male soon joined her and they together uttered rasping, cackling noises with their heads bent back upon their backs." A.C. Bent (1961) wrote, "Almost any small bird would probably drive one away from the vicinity of its nest, or at least attempt to do so."

Clutch size is two or three eggs, but most often two. Incubation lasts for about 28 days and is shared by both sexes. Ordinarily only one brood is raised in a season. If the eggs are taken, a second or even third set may be laid (Bent 1961). The young fledge at about 8 weeks of age (Layne 1978). Double brooding (two clutches successfully reared in one breeding season) has been documented in the Florida population, particularly for pairs that initiate nesting early in December or January (Humphrey and Morrison 1996; J. Morrison, University of Florida, personal communication 1996a).

Foraging

Caracaras are highly opportunistic in their feeding habits, eating carrion and capturing live prey. Their diets include insects and other invertebrates, fish, snakes, turtles, birds, and mammals (Layne 1978). Live prey also include rabbits, skunks, prairie dogs, opossums (*Didelphis marsupialis*), rats (*Rattus* spp.), mice, squirrels, frogs, lizards, young alligators (*Alligator mississippiensis*), crabs, crayfish, fish, young birds, cattle egrets (*Bubulcus ibis*), beetles, grasshoppers, maggots, and worms (Bent 1961, Layne *et al.* 1977). Several authors have noted that caracaras may consume unusual items, including turtle and other eggs (Terres 1980, Grossman and Hamlet 1964) as well as coconut meat (Haverschmidt 1947). This last food item may have been taken while foraging for insects on the coconut.

These raptors hunt on the wing, from perches, and on the ground (FWS 1989). They will also regularly patrol sections of highway in search of carrion (Palmer 1988). They may be seen feeding on road kills with vultures. However, caracaras are dominant over vultures and may occasionally chase the larger raptor from the road kill (Howell 1932).

Caracaras may also attack or harass other avian species in order to steal their food. Bent (1938) observed a caracara attacking a bald eagle (*Haliaeetus leucocephalus*) to steal its food. Caracaras may also attack other caracaras, pelicans (*Pelecanus* spp.), gulls (*Larus* spp.), and other large birds. They jump on the victim's back or strike from above with the talons; the victim usually drops its prey or regurgitates its food. The caracara then dives and snatches the prey before it hits the ground (Lyons 1985).

Localized Movements

Caracaras are resident, diurnal, and nonmigratory. Adult caracaras may be found in their home range year-round. Home ranges may encompass an area of up to 2,389 ha with an average of 1,552 ha. There is no significant difference between male and female home ranges; Humphrey and Morrison (1996) found female home ranges from 3.8 to 24.9 km² and male home ranges ranging from 3.9 km² to 22.5 km².

Occasionally large groups of individuals are encountered (Layne 1978). Oberholser (1974) attributes this to the birds' carrion feeding habit although Morrison (University of Florida, personal communication 1996a) has noted that juvenile caracaras are nomadic. This may account for the number of sightings far outside the core area in Glades, Hendry, Okeechobee, Osceola, and Highlands counties. Occasional sightings have been reported in Polk, Orange, Indian River, St. Lucie, Martin, Palm Beach, Monroe, and Charlotte counties. When subadult birds are associated with one of the aggregation areas, the aggregation areas are comprised of similar habitat to that found in the natal territory.

Relationship to Other Species

There appears to be no migration or genetic exchange between the Florida population and other populations of the subspecies. The only other member of the genus *Polyborus* was the Guadalupe caracara that was extirpated in the early 1900s. Detailed studies on natural predators are lacking; however, fish crows (*Corvus ossifragus*) and raccoons (*Procyon lotor*) have been documented as nest predators (J. Layne, Archbold Biological Station, personal communication 1996a, J. Morrison, University of Florida, personal communication 1996b).

Status and Trends

The caracara has declined throughout its range, from the early 1900s until the 1980s. It was once plentiful in Texas, and was more numerous in Arizona than it is at this time. It was considered uncommon in New Mexico and extremely rare in Oklahoma (Ellis *et al.* 1988). It would appear that the distribution of the bird presently is similar to the historic distribution, however, numbers of

individuals are lower. The status in most areas where the caracara is found is largely unknown, however, it is thought to be severely declining in Mexico. It is relatively unprotected except in Florida and is actively shot in Argentina (J. Morrison, University of Florida, personal communication 1996b).

The size of the Florida caracara population remains in question. Accurate counts become difficult because of limited access to areas of suitable habitat and because of the bird's behavior and detectability (Humphrey and Morrison 1997). In 1970, Heinzmann published the results of a 4-year survey (1967 - 1970) which indicated that fewer than 100 individual caracaras at 58 localities remained in Florida. Stevenson (1976) concurred with this estimate in 1974. Layne (1995), however monitored caracara distribution and population status in Florida from 1972 to 1991. He estimated that the population was stable with a minimum of about 300 adults in 150 territories. The immature population was estimated to be between 100 and 200 individuals, bringing the total statewide population to between 400 and 500 birds.

The caracara's decline, as described in historic literature, is primarily due to habitat loss (Layne 1985); the documentation of this decline eventually resulted in the caracara's listing as threatened in 1987 (52 FR 25232). In particular, the caracara was listed as threatened because its dry prairie habitat had been destroyed or modified for agriculture and residential development. It was also listed because existing regulatory mechanisms did not adequately prevent the destruction or modification of the caracara's habitat, which is mainly located on private land. (The only federal property that supports caracaras is Avon Park AFR in Polk and Highlands counties. In recent years, nesting on the AFR has been limited to only one nesting pair (J. Morrison, University of Florida, personal communication 1996a).

The presence of disease in caracara remains largely unknown. However, Lyons (1985) reported that some cases of avian pox had been diagnosed in the past.

In addition to population declines related to habitat loss, direct human-caused mortality may also be a factor in the slow recovery of the species. Caracaras may still be killed in the false belief that they prey on newborn calves. In the past, large numbers of caracaras were killed in vulture traps (FWS 1989). Individuals may also be caught in leghold traps used to control mammalian predators (Morrison 1996c). Road mortalities may be a significant cause of caracara decline; Morrison (University of Florida, personal communication 1996a) identifies highway mortalities as a major cause of juvenile mortalities with young birds especially vulnerable within the first 6 months of fledging.

The Florida population of caracaras is isolated and habitat-specific. Therefore, it may be susceptible to environmental catastrophes and potentially reduced reproductive rates because of demographic accidents such as skewed sex ratios or disproportionate age-related mortality. Because of its scavenging habits, the caracara may be susceptible to mass poisonings. Low numbers may also reduce the genetic viability through loss of heterozygosity, thereby increasing vulnerability to environmental stresses. The location of many of the occupied territories on private land, and the inaccessibility of these territories to surveyors, makes it difficult to census the caracara and detect changes in its population size

and distribution. This difficulty increases the possibility of not detecting a population decline that could result in extinction.

Large areas of native prairie have been lost in south-central Florida to citrus operations, tree farms, improved pasture, other forms of agriculture, and real estate development (Layne 1978, Layne 1985). The threat of habitat loss persists as these changes in land use continue. Florida's burgeoning population has also increased the number of motor vehicles and the need for roads. The increase in traffic as well as the caracara's predisposition for feeding on road-killed animals has probably increased this type of mortality.

Cattle ranching on large tracts of land seems to be compatible with caracara survival. The number of territories occurring in improved or unimproved pasture is expected to increase as juvenile caracaras establish their territories in similar, adjacent settings (J. Morrison, University of Florida, personal communication 1996a). The conversion of pasture to citrus (Cox *et al.* 1994), sugarcane and residential development is reason for concern. Humphrey and Morrison (1996) found that pasture constitutes the highest percentage of habitat cover type found within the home ranges of breeding caracaras.

Management

To date, no active conservation measures have been undertaken for this species in Florida. Management activities are also lacking throughout its range. Avon Park AFR has conducted caracara surveys in the past. This contract allowed a biologist to perform research activities both on the AFR and in the surrounding region. In recent biological opinions and informal consultations, the FWS has endeavored to better address effects to the caracara through recommendations to: set aside home ranges, allow research and monitoring, perform surveys, avoid work during the nesting season, and formulate a management plan for protection of the resident pair. Proposed development projects evaluated by the FWS for their effect on the caracara have included the conversion of pasture to citrus, a DOT road improvement project, and the construction of a juvenile detention center.

Caracaras appear to benefit from prescribed burning, plowing, and mowing (Morrison 1996c). These activities reduce available cover and may facilitate the observation and capture of prey. In addition, regular mowing, burning, and high-density grazing maintain low vegetative structure, an important habitat characteristic of the caracara's nest stand area (Humphrey and Morrison 1996).

Draft habitat management guidelines similar to those in place for the bald eagle (*Haliaeetus leucocephalus*) are being developed (J. Morrison, University of Florida, personal communication 1996a). The bald eagle guidelines (FWS 1987) have been useful in preserving bald eagle nest sites in areas subject to development pressure.

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Recovery for the Audubon's Crested Caracara

Polyborus plancus audubonii

Recovery Objective: DELIST the species once recovery criteria are met.

Recovery Criteria

This objective will be achieved when any further loss, fragmentation, and degradation of habitat in south-central Florida has been prevented; when the number of Audubon's crested caracara territories in the historic range increases from 200 to 300; when Audubon's crested caracara have maintained or exceeded this number of territories for at least 10 years; when these territories are well-distributed throughout the core counties of Glades, DeSoto, Highlands, Okeechobee, and Osceola; when additional breeding pairs have established territories on unoccupied or restored habitat; when those lands have been protected through land acquisition, conservation easements, or cooperative agreements; and when the Audubon's crested caracara population in Florida exhibits an intrinsic rate of increase (r) equal to or greater than 0.0, sustained as a 3-year running average over at least 10 years.

Species-level Recovery Actions

- S1. **Determine the distribution, status, and abundance of Audubon's crested caracaras.** Dry prairie habitats throughout the Kissimmee River valley should be targeted for surveys. Other areas that might support populations of the Audubon's crested caracara should be determined through the use of satellite imagery to locate search areas and other aggregation areas important to juvenile caracaras.
 - S1.1. **Locate active caracara territories in Glades, DeSoto, Highlands, Okeechobee, and Osceola counties.** Active territories in these counties should be mapped using digital, spatial information; this information should be maintained as part of a database to facilitate land protection and monitoring efforts for the caracara.
 - S1.2. **Locate and map potential habitat within the former range of the caracara that might be rehabilitated for reintroduction purposes.** Caracaras once occurred in prairie habitat from northern Brevard County south to Collier County. Caracara were once reported from as far north as Nassau County and as far south as the lower Keys in Monroe County but have been extirpated over much of their former range. Efforts should be made to locate and map these formerly inhabited areas, to determine if it is feasible to restore habitat and expand the range of the caracara.
 - S1.3. **Develop standardized, systematic censusing procedures.** The census should use active territories as a variable.
- S2. **Protect and enhance existing populations of Audubon's crested caracara.**
 - S2.1. **Protect and enhance existing populations of Audubon's crested caracara on public and private land.** Caracaras currently occur on several properties managed

by the SFWMD in the Kissimmee River valley as well as other publicly owned land in south central Florida; however most pairs occur on private lands. Territories on private lands are critical to the survival and recovery of the caracara.

2.1.1. Inform landowners of the presence of caracaras on their property. Appropriate State and Federal authorities should inform landowners that their property contains resident caracaras.

2.1.2. Encourage landowners to protect caracara nesting sites by providing incentives (awards, credits for mitigation, special recognition, etc.). Inform landowners of the amount of habitat needed around each nest and the level of human activity tolerated by each pair during nesting. Encourage landowners to adhere to guidelines derived from item S3.1.4. Investigate options for monetary or tax incentives to encourage lower intensity farming operations or preservation of native habitats in occupied and restorable areas. Encourage the media to focus on these land protectors. Also, provide public recognition for proper land management.

S2.2. Develop and implement a plan to reintroduce Audubon's crested caracaras into suitable habitats within their historic range. Caracaras once occurred in prairie habitat from northern Brevard County south to Collier County. Caracara sightings were once reported from as far north as Nassau County and as far south as the lower Keys in Monroe County. Efforts should be made to locate and map these formerly inhabited areas, to determine if it is feasible to restore habitat and expand the range of the caracara. This plan must identify the specific areas that are suitable for such reintroductions, protocols for determining when habitat is suitable for a reintroduction, the size of a reintroduced population, monitoring protocols for reintroduced populations, and land management prescriptions for reintroduction areas.

S2.3. Encourage natural colonization of restored habitats by Audubon's crested caracaras. Many areas within the historic range of the caracara are being restored as part of the COE and SFWMD's restoration projects in the South Florida Ecosystem. Other areas are being restored because of a change in land use in the Kissimmee River valley (such as the expansion of Three Lakes WMA). Dispersal of the caracara into restored areas from occupied sites should be encouraged by enhancing areas adjacent to active territories.

S2.4. Introduce rehabilitated birds into expanded or restored areas whenever and wherever possible. When caracaras are taken into captivity for rehabilitation purposes, those without permanent disabilities should be considered for release into expanded or restored areas when they have recovered. Myakka River SP has been recommended as a possible location for reintroducing caracaras that have been rehabilitated.

S2.5. Establish rehabilitation centers for injured or sick caracaras found in the wild. Lyons (1984, 1985) had considerable success in rehabilitating sick and injured caracaras in Texas. Traumatic injuries in Texas usually involve leg or foot injuries (from leg-hold traps) and gunshot wounds. Lyons found that caracaras quickly adapt to captive conditions, and respond well to medical treatment. By establishing a center in Florida, sick or injured caracaras could be rehabilitated and returned to the

wild. This could also be accomplished by developing agreements with a local veterinarian, bird rehabilitation center, or university.

S2.5.1. Develop an emergency program for removing injured or sick caracaras from the wild including a hotline number for notification of responsible individuals. When a sick or injured caracara is located, it may be necessary to place the bird into a rehabilitation center where it can receive proper medical treatment. A rehabilitation center should consider such factors as housing, equipment, veterinary expertise, proximity to the present core distribution of caracaras, etc. Key individuals should be appointed to pick up sick or injured birds and transport them to the rehabilitation center. The phone numbers of these individuals should be provided to all wildlife officers within the core range of the caracara.

S2.5.2. Establish a caracara rehabilitation team, made up of rehabilitation experts, raptor biologists, veterinarians, etc.

S2.5.3. Maintain accurate and detailed records on individuals brought in for rehabilitation.

S2.5.4. Determine where recovered birds should be released into the wild. When sick or injured birds have recovered to the point that they can return to the wild, they should be released in expanded or restored habitat areas.

S2.5.5. Monitor the health and status of Audubon's crested caracara that have returned to the wild. Monitor rehabilitated birds through radiotelemetry to determine whether they survive. If the introduction of rehabilitated caracaras is successful, more widespread reintroductions could be accomplished with juvenile birds.

S2.5.6 Conduct section 7 consultations on all Federal activities that may affect caracaras and their habitat. Federal agencies shall consult with the FWS on any activities (authorized, funded, or carried out) that may affect caracaras. Such activities include: pesticide use, road building, construction of new facilities, training exercises, wetland fill, clearing for new runways, etc.

S3. Conduct research to determine the basic biological needs of the caracara. Although considerable research has been done on the biology and ecology of the Audubon's crested caracara, more information is necessary before this species can be properly managed and effects of habitat management actions assessed. Biological studies should be continued to complete our knowledge of the demographics of caracara populations (survivorship, fecundity, mortality, dispersal) and the relationship of these demographic variables to habitat availability and quality, particularly water regimes and fire management.

S3.1. Determine habitat requirements of the caracara in Florida. Habitat loss is believed to be the primary cause of caracara decline in Florida. Research to determine precise details are ongoing, but more information is needed on nesting and feeding habitat requirements, the percentage of forest or agricultural encroachment caracaras will tolerate, and their need for water. Precise details are also needed on the extent of caracara movement into other habitats for feeding and drinking purposes.

S3.1.1. Determine essential habitat components. Identify all the components that make up prime habitat. Prime habitat is the sum of all essential

- components, where their absence would make the habitat suboptimal or result in abandonment of the area for nesting and/or feeding. Determine the habitat components necessary for successful nesting and roosting. Determine the need for water in proximity to nests, and the level of tolerance to human disturbance during early and late reproductive stages. This action should involve the use of Geographic Information Systems and remote mapping since much of the occupied caracara territories are present on private lands.
- S3.1.2. Determine the minimum amount of nesting and feeding habitat needed to support a population of caracaras.** Determine the amount of nesting and feeding habitat needed to support a single pair of caracaras. Nesting habitat is relatively restricted, but territories extend over large areas. Therefore, maintaining nesting habitat might be the crucial factor in protecting the birds. Protection of nest sites from predators may be necessary at some nesting sites.
- S3.1.3. Formulate estimates of habitat carrying capacity under optimum conditions.** Determine the carrying capacity of nesting and feeding habitats of the Florida population of Audubon's crested caracara. This will allow scientists to evaluate which habitats are underutilized or overutilized. This knowledge is essential for management of the birds.
- S3.1.4. Establish habitat management guidelines to protect the nests and nesting pairs of Audubon's crested caracaras.** These guidelines should be modeled after the "Habitat Management Guidelines for the Bald Eagle in the Southeast Region" (FWS 1987). Their purpose will be to assist land owners, land managers, and regulatory biologists in avoiding impacts to caracaras.
- S3.1.5. Utilize current information and conduct additional research to develop a Population Viability Analysis for the caracara.** This analysis would be used to evaluate management and regulatory actions as well as other conservation strategies, including the development of reintroduced populations. It would also aid in determining which ecological factors are most critical for the survival and recovery of the species.
- S3.2. Compile caracara data into a central database at one location.** Gather historic data from all researchers. This data would be an important element in determining recovery of the population.
- S4. Develop and implement a program to monitor the status and trends of wild Audubon's crested caracara populations.** It will be necessary to continually monitor the stability and health of existing wild populations to assess recovery efforts.
- S4.1. Develop monitoring protocols and techniques for the Audubon's crested caracara.** Develop a set of monitoring protocols that are able to identify small changes in the size and distribution of Audubon's crested caracara populations over time.
- S4.2. Monitor Audubon's crested caracara populations on public lands to evaluate management actions.** Establish monitoring programs for the Audubon's crested caracara on public lands in south-central Florida to determine if fire management, water management, and other management actions are consistent with the recovery

needs of the caracara.

- S4.3. Monitor the success of reintroduced Audubon crested caracara populations.** To determine whether recovery efforts are successful, it will be necessary to conduct periodic censuses and surveys of all introduced populations.
- S5. Increase public awareness of the biology, ecology, status and trends of the Audubon's crested caracara.** The public must be made more aware of the status and trends of the Audubon's crested caracara, its recovery needs, and opportunities to participate in the caracara's recovery. This public awareness program must include an effort to contact owners of lands that support populations of Audubon's crested caracaras; it must also include development and distribution of materials developed specifically to inform the public about the Audubon's crested caracara.
- S6. Assess reclassification criteria based on the results of research projects; revise as necessary.** One condition required to reach the recovery objective for the caracara is to ensure that the amount of nesting and feeding habitat needed to maintain stable or expanding populations remains stable or increases over a 10-year period.

Habitat-level Recovery Actions

- H1. Protect and enhance currently occupied habitat.** Alteration and habitat loss are primary threats to prairie species. As much of the remaining prairie habitat as possible must be secured. State and COE efforts to restore the Kissimmee River floodplain may provide habitat for prairie dependent species.
- H1.1. Protect privately owned, occupied lands wherever possible.** Particular effort should be made to acquire or protect lands on which prairie species reside.
- H1.1.1. Encourage the purchase of unprotected lands that support caracaras.** State, county, and local governments and private organizations can purchase lands. The FWS can consider purchase of land to protect endangered or threatened species through its Land Acquisition Planning System.
- H1.1.2. Use conservation easements and other non fee-title ownership options to maintain habitat.** Conservation easements, recognized under both Federal and State law, may protect habitat while allowing it to remain in private ownership. Non-binding conservation agreements with landowners may also prove useful. Investigating tax and monetary assistance or incentives should be a high priority for willing landowners.
- H1.1.3. Where private lands cannot be acquired, or protected through conservation easements, encourage landowners to maintain suitable habitat for the benefit of prairie species.** The private landowner must be informed of the needs and value of caracaras in order to obtain their cooperation in providing protection.
- H1.1.4. Maintain and enhance habitat on acquired lands or lands under conservation easements or agreements.** Conduct prescribed burns, selective thinning, or mechanical manipulation at periodic intervals to maintain dry prairie and pasture habitat and prevent forest encroachment.

Plant scattered cabbage palms, where needed, to serve as nesting sites for caracaras. Intensive rangeland improvements should be discouraged in prairie areas to maintain as many native vegetative species as possible.

H1.2 Protect and enhance habitat on public lands. Occupied caracara territories present on public land should be protected and enhanced for this species. Public lands that are occupied by caracara include Avon Park AFR in Polk and Highlands counties, and the Latt Maxcy property (Kissimmee Prairie State Preserve) in Okeechobee County. Federal land management agencies should try to protect, maintain, and enhance occupied habitat on all lands they manage. Habitat must be maintained in an early stage of succession through selective thinning and prescribed burning. Since caracara nesting is minimal on Avon Park AFR and this site is essential for the survival of the Florida grasshopper sparrow (*Ammodramus savannarum floridanus*), grazing should not be increased in this area, and prairie management should focus on the grasshopper sparrow. Other public lands should utilize the recommendations obtained from habitat component research on the caracara to determine which management actions are compatible with the survival of this species and the Florida grasshopper sparrow.

H1.2.1. Conduct prescribed burns at periodic intervals. Occupied areas should be burned in a mosaic fashion on a periodic rotational basis to maintain early stages of succession.

H1.2.2. Maintain pastures in native vegetation to the extent possible. Prairie species may be adversely affected if pasture lands are improved to the point where native vegetation is totally removed.

H1.2.3. Do not allow reforestation of prairies. Prairie species prefer unforested areas. Small patches of cabbage palm areas should be maintained to afford nesting sites for caracaras.

H1.2.4. Establish appropriate burn seasonality. Fire management should be conducted in all seasons although the majority of natural fire occurs in summer.

H2. Create, restore, or expand occupied habitat wherever possible. Habitat loss has occurred throughout the range of the caracara, and has been the primary factor threatening the survival of these animals. Conversion to higher intensity agricultural uses (e.g. sugar cane) may reduce the amount of useable habitat within a territory to the point that caracaras are unable to survive and reproduce. These areas can be enhanced to become suitable again. Mosaics of agriculture and native prairie may afford the landowner best use of their land while maintaining enough suitable habitat for caracaras.

H2.1. Expand habitat in currently occupied areas. Wherever possible, enhance prairie habitat in the vicinity of occupied habitat. Use prescribed burning and mechanical treatment or planting of cabbage palms to enhance areas to attract caracaras.

H2.2. Restore habitat in currently unoccupied areas. Delineate areas which once supported the caracara but are no longer suitable and restore them to a suitable condition. This may involve cabbage palm plantings and fire management.

H3. Conduct research on caracara response to habitat modifications. Little is known concerning the level of tolerance or the extent to which habitat within caracara home ranges may be modified before the birds abandon the site. The response to habitat modification from rangeland to a higher intensity agricultural use should be investigated. A study employing

radiotelemetry should be designed and implemented.

- H3.1. Determine why certain habitat areas are not used.** Certain areas are apparently unsuitable for caracaras since they are not used. The cause(s) for the lack of use should be investigated.
- H3.2. Determine which elements need to be modified to make unused areas suitable for the caracara.** The unoccupied habitat may lack suitable nest trees or be too wooded. Pesticide contamination, especially in agricultural areas, may be a factor. Water quality analysis should be conducted to determine whether agricultural chemicals are making water unsuitable for caracaras. Blood sampling of individual caracaras should be used to determine levels of various chemicals present in the population. Adverse conditions present on potentially suitable habitat must be recognized and corrected before caracaras can expand their range, or be reintroduced.
- H4. Use satellite imagery and updated aerial photographs to monitor changes in land use in the core of the caracara population.** This information may be essential in determining the probability of recovery of caracaras, especially in response to agricultural development pressure.
- H5. Inform the public.** Prairie communities are unique to central Florida and both the caracara and Florida grasshopper sparrow are only found in this community. The general public needs to be informed of the value of prairie, and its management needs.

