PUERTO RICAN BROAD-WINGED HAWK
AND
PUERTO RICAN SHARP-SHINNED HAWK
RECOVERY PLAN

(*Buteo platypterus brunnescens* and *Accipiter striatus venator*)

Prepared by

Marelisa Rivera
U.S. Fish and Wildlife Service
Boquerón Field Office
Boquerón, Puerto Rico

for

U.S. Fish and Wildlife Service
Southeast Region
Atlanta, Georgia

Approved by : H. Dale Hall
Acting Regional Director

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EXECUTIVE SUMMARY OF THE PUERTO RICAN BROAD-WINGED HAWK AND THE PUERTO RICAN SHARP-SHINNED HAWK RECOVERY PLAN

Current status: The Puerto Rican broad-winged hawk and the Puerto Rican sharp-shinned hawk are listed as endangered. At present, they are restricted to montane forests along the Cordillera Central, Sierra de Cayey, and Sierra de Luquillo.

Habitat Requirements and Limiting Factors: Present distribution of the Puerto Rican broad-winged hawk includes montane habitat of three forests: Río Abajo Commonwealth Forest, Carite Commonwealth Forest, and the Caribbean National Forest. Extant breeding populations of the Puerto Rican sharp-shinned hawk are known from montane habitat of the Maricao Commonwealth Forest, Toro Negro Commonwealth Forest, Guilarte Commonwealth Forest, Carite Commonwealth Forest, and the Caribbean National Forest. Overall, populations of 124 broad-winged hawks and 154 sharp-shinned hawks have been estimated. Both species are currently threatened by destruction and modification of forested habitat; timber harvest and management practices in public forests; road construction; increase in numbers of recreational facilities and the disturbance associated with public use; mortality and habitat destruction from hurricanes; the lack of comprehensive management plans for the public forests; possible loss of genetic variation due to low population levels; and the potential for illegal shooting. The Puerto Rican sharp-shinned hawk is also affected by warble fly parasitism.

Recovery Objective: Downlisting.

Recovery Criteria: The interim criteria are to protect, enhance, and stabilize the existing populations. In order to restore the Puerto Rican sharp-shinned hawk populations to the levels known in mid 1980s, when the species was considered threatened, a breeding population of a minimum of 250 pairs island-wide (5 forests) should be maintained for at least 7 years. In each forest, breeding densities should be restored to the higher levels known in 1983 and 1985 (Carite - .42/km^2; Guilarte - .82/km^2; Luquillo - 1.03/km^2; Maricao - 1.15/km^2; and Toro Negro - 1.45/km^2). In order to downlist the Puerto Rican broad-winged hawk, a breeding population of 60 breeding pairs (20 breeding pairs in the Caribbean National Forest, Carite and Río Abajo) and 200 individuals island-wide (60 individuals in Río Abajo and Carite, and 80 individuals in the Caribbean National Forest) should be reached. There should also be additional documentation of population trends and adequate support habitat. The criteria for delisting will be developed when the species are reclassified from endangered to threatened.

Actions Needed:

1. Conduct surveys and identify habitat.
2. Protect and manage Puerto Rican broad-winged hawk and Puerto Rican sharp-shinned hawk populations and habitat.

3. Monitor Puerto Rican broad-winged hawk and Puerto Rican sharp-shinned hawk populations.
4. Develop an education program.
5. Refine recovery goals.

Date of Recovery: Downlisting should be initiated in 2025, if recovery criteria are met.

Recovery Costs: Recovery costs for both species have been estimated at $675,000 for the first 3 years of this plan. Subsequent expenditures will depend on the results of these preliminary studies and activities, and, therefore, cannot be estimated at this time.

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I. INTRODUCTION

The Puerto Rican broad-winged hawk (*Buteo platypterus brunnescens*) and the Puerto Rican sharp-shinned hawk (*Accipiter striatus venator*), both endemic to the island of Puerto Rico, are currently restricted to montane forests along the Cordillera Central, Sierra de Cayey, and Sierra de Luquillo. Both species are currently threatened by destruction and modification of forested habitat; timber harvest and management practices in public forests; road construction; the increase in numbers of recreational facilities, and the disturbance associated with public use; mortality and habitat destruction from hurricanes. In addition, both hawks are adversely affected by the lack of comprehensive management plans for the public forests; possible loss of genetic variation due to low population levels; and the potential for illegal shooting. The Puerto Rican sharp-shinned hawk is also affected by warble fly parasitism.

Both species were determined to be endangered species on September 9, 1994 (U.S. Fish and Wildlife Service 1994), pursuant to the Endangered Species Act of 1973, as amended. Critical habitat was not designated.

Description

Puerto Rican broad-winged hawk:

The Puerto Rican broad-winged hawk is a dark chocolate brown, small-sized hawk that measures approximately 39 centimeters (cm) (15.5 inches). It is smaller than the North American subspecies, *Buteo platypterus platypterus,* but larger than the Lesser Antillean subspecies. This is the darkest subspecies of the broad-winged hawk. In adults, the tail, broadly banded with black and white, and the rufous breast are characteristic. Immature birds have dark bars on the breast and lack the distinctive tail bands of the adult. Broad-wings flap more than the similar, but larger, red-tailed hawk (Raffaele 1989).

Puerto Rican sharp-shinned hawk:

The Puerto Rican sharp-shinned hawk is a small hawk measuring approximately 28 to 33 cm (11 to 13 inches). The dark slate gray upper parts and heavily barred rufous underparts of the adults are distinctive. Immature birds are brown above and heavily streaked below. In flight, the short, rounded wings and long, narrow tail are characteristic (Raffaele 1989).

Distribution

Puerto Rican broad-winged hawk:

The broad-winged hawk (*Buteo platypterus*) is a polytypic species with six subspecies distributed in North America and the West Indies. *Buteo platypterus platypterus* (Vieillot) breeds in continental North America, wintering south to South America. There are five

resident subspecies in the West Indies: *B. p. cubanensis* Burns of Cuba; *B. p.brunnescens* Danforth and Smith of Puerto Rico; *B. p. insulicola* Riley of Antigua; *B. p. rivierei* Verrill of Dominica, Martinique, and Saint Lucia; and *B. p. antillarum* Clark of Saint Vincent, the Grenadines, Grenada, and Tobago (Friedmann 1950).

The broad-winged hawk was first reported in Puerto Rico by Gundlach (1878). He reported this species as "common" in the "interior" of the island. Stahl (1883) reported the species as "transient." In the first half of the 20th century, the species was not reported by other naturalists that visited the island (Bowdish 1902, Wetmore 1914, and Danforth 1931). Wetmore (1927) believed the species extinct. Danforth and Smyth (1935) collected a specimen in Luquillo (Caribbean National Forest) and described it as a distinct resident subspecies, the Puerto Rican broad-winged hawk (*Buteo platypterus brunnescens*). Danforth (1936) reported sightings of Puerto Rican broad-winged hawks from Utuado. Leopold (1963) reported the species from Luquillo, Utuado, and Maricao forests.

At the present time, the Puerto Rican broad-winged hawk is an uncommon and extremely local resident. Extant populations are restricted to montane habitats of three forests: Río Abajo Commonwealth Forest, Carite Commonwealth Forest, and Caribbean National Forest. Breeding has not been documented in the Carite Forest (Hernández 1980, Snyder *et al.* 1987).

The Puerto Rican broad-winged hawk has been reported from other areas, such as Cayey (next to the Carite Commonwealth Forest), Utuado, Jayuya, Adjuntas, Villalba, and the Maricao and Toro Negro Commonwealth Forests (Leopold 1963, Pérez-Rivera and Cotté-Santana 1977). Nevertheless, Delannoy (1991) established that the Maricao and Toro Negro Commonwealth Forests do not have resident populations. Puerto Rican broad-winged hawks have been searched for, but not sighted, in upland forested habitats in Utuado, Jayuya, Adjuntas, Orocovis, and Barranquitas (Delannoy 1992).

Puerto Rican sharp-shinned hawk:

The sharp-shinned hawk *(Accipiter striatus)* is also a polytypic species with nine subspecies distributed in the western hemisphere, from Alaska to Canada and south to Argentina and to the West Indies (including Cuba, Hispaniola, and Puerto Rico) (Wattel 1973). The Puerto Rican sharp-shinned hawk was first discovered in 1912 in the Maricao Forest and described as a distinct subspecies, *Accipiter striatus venator* (Wetmore 1914).

Extant breeding populations of the Puerto Rican sharp-shinned hawk have been found in the montane forests of the Maricao Commonwealth Forest, Toro Negro Commonwealth Forest, Guilarte Commonwealth Forest, Carite Commonwealth Forest, and Caribbean National Forest (Cruz and Delannoy 1986).

Although the Puerto Rican sharp-shinned hawk was previously known from the Río Abajo and Guajataca Commonwealth Forests of the karst region, Cruz and Delannoy (1986) did not find any evidence of its presence in these areas. Fossil evidence indicates that the species was once more widespread in the karst region (Wetmore 1922). Puerto Rican sharp-shinned hawks have been searched for and not sighted in the Cambalache, Vega, Susúa, and Guánica Commonwealth Forests (Cruz and Delannoy 1986).

Abundance

Puerto Rican broad-winged hawk:

In the mid 1980s, the population of Puerto Rican broad-winged hawks in the Caribbean National Forest was estimated to be 40 to 60 individuals and 15 to 20 breeding pairs (Santana and Temple 1984, Snyder *et al.* 1987). In 1992, twelve broad-winged hawks were sighted in the Caribbean National Forest and the population was estimated at 22 individuals (Delannoy 1992).

Very little is known about the Río Abajo and Carite Commonwealth Forest populations. However, it appears that the existence of the Río Abajo population was known by Danforth (1936) and Leopold (1963), since they both reported sightings of Puerto Rican broad-winged hawks from Utuado. Snyder *et al.* (1987) believed that the Río Abajo Commonwealth Forest sustained not more than 50 individuals. Delannoy (1992) reported 26 broad-winged hawks, or an estimated population of 52 individuals, in the Río Abajo Commonwealth Forest. The Puerto Rican broad-winged hawk was unknown from the Carite Commonwealth Forest until 1980, when the existence of a resident population present year-round was reported (Hernández 1980). In 1992, twenty Puerto Rican broad-winged hawks were counted in the Carite Commonwealth Forest and a population of 50 individuals was estimated (Delannoy 1992).

The 206.4 square kilometers (km^2) censussed in three forests (Río Abajo, Carite, and Caribbean National Forest) in 1992 yielded 58 Puerto Rican broad-winged hawks or an estimated population of 124 individuals (Delannoy 1992) (Table 1).

Table 1. Average density and estimated population of the Puerto Rican broad-winged hawk (Delannoy 1992).

Forest	Area censussed km^2	Number of hawks	Average density ±S.E.	Min-max	Estimated population±S.E.
Río Abajo	40.8	26	1.28±1.12	0.42-4.00	52.22±5.20
Carite	60.0	20	0.83±0.71	0.42-2.08	49.80±13.42
Luquillo	105.6	12	0.21±0.86	0.42-2.92	22.18±40.80
TOTAL	206.4	58	_	_	124.20

Puerto Rican sharp-shinned hawk:

Sixty individuals of Puerto Rican sharp-shinned hawks were counted in island-wide surveys conducted in 1983, and a breeding density of .73 hawks/km^2 was estimated (Cruz and Delannoy 1986). In 1985, seventy-two individuals were counted and a breeding population of .76 hawk/km^2 (230-250 island-wide) was estimated in island-wide surveys (Cruz and Delannoy 1986). In 1992, a total of 285.6 km^2 censused yielded 82 sharp-shinned hawks: 40 in Maricao, 30 in Toro Negro, 10 in Carite and 2 in the Caribbean National Forest. An overall population of 129 individuals has been estimated for these forests (Delannoy 1992) (Table 2). Although the Guilarte Forest population was not censussed in 1992, a population of 25 individuals was estimated for the forest in 1985 (Cruz and Delannoy 1986).

Table 2. Average density and estimated population of the Puerto Rican sharp-shinned hawk (Delannoy 1992).

Forest	Area censussed km^2	Number of hawks	Average density ±S.E.	Min-max	Estimated population ±S.E.
Maricao	60.0	40	0.93±1.09	0.83-4.17	55.8±21.7
Toro Negro	72.0	30	0.77±0.45	0.83-2.50	55.4±17.1
Carite	48.0	10	0.30±0.41	0.83-1.67	14.4±9.96
Luquillo	105.6	2	0.03	-	3.7
TOTAL	285.6	82	-	-	129.30

Habitat

Puerto Rican broad-winged hawk:

In the Caribbean National Forest, Puerto Rican broad-winged hawks were more often seen on the eastern side, and the tabonuco and palo colorado forest types were reported as preferred habitats for the species (Wiley and Bauer 1985). Delannoy (1992) reported that broad-winged hawks were observed to be clustered in the north-central part of the forest within the subtropical wet forest and subtropical rain forest life zones, where the tabonuco is the dominant forest type.

In the Carite Commonwealth Forest the species has been reported from the elfin, caimitillo, granadillo, tabonuco, and slope forest types (Hernández 1980, Delannoy 1992). Delannoy (1992) reported Puerto Rican broad-winged hawks sighted in the northeastern corner and west-central parts of the Rio Abajo forest within the subtropical moist forest

and subtropical wet forest life zones (Ewel and Whitmore 1973). Limestone hillside, sinkholes, and narrow valleys or ravines between haystack hills or "mogotes" are the dominant habitats within these life zones (Department of Natural Resources 1976).

Puerto Rican sharp-shinned hawk:

In the Carite Commonwealth Forest, territorial and epigamic activities were reported by Hernández (1980) in the northeastern and north-central parts. These areas are located in the caimitillo-granadillo forest type of the subtropical wet forest and subtropical lower montane wet forest life zones (Department of Natural Resources 1976).

Delannoy (1992) reported that in the Maricao Commonwealth Forest, the center of sharp-shinned hawk epigamic and territorial activities was located in the north-central and eastern parts. All of these areas are located within the subtropical lower montane wet forest and subtropical wet forest life zones (Ewel and Whitmore 1973). The Podocarpus and caimitillo forest types dominate these life zones (Department of Natural Resources 1976).

In Toro Negro, the Puerto Rican sharp-shinned hawk territorial and epigamic activities were reported in the eastern segment of the forest (Delannoy 1992). These activities took place in the elfin woodland, sierra palm, caimitillo-granadillo, and tabonuco forest types of the subtropical wet forest and subtropical lower montane wet forest life zones (Department of Natural Resources 1976).

A solitary territorial sharp-shinned hawk pair was reported by Delannoy (1992) in the south-central part of the Caribbean National Forest. This area is located within the palo colorado forest type of the lower montane forest life zone (Ewel and Whitmore 1973).

Nesting Habitat

Puerto Rican broad-winged hawk:

The nesting habitat for Puerto Rican broad-winged hawks in the Rio Abajo Forest was characterized by Delannoy (1995a). Nesting sites were defined as areas where the following behaviors were observed: (1) hawks engaging in courtship and territorial displays; (2) a pair present near a nest or involved in nest building behavior; (3) adults incubating or rearing chicks in the nest; and (4) adults repeatedly carrying prey into an area.

A total of 11 nesting sites was located in the forest. Six of the nesting sites were found in plantations where dominant species included maría (*Calophyllum calaba*, Guttiferae); teca (*Tectona grandis*, Verbenaceae); caoba hondureña (*Swietenia macrophylla*, Meliaceae); guaraguao (*Guarea guidonia*, Meliaceae); and mahoe (*Hibiscus elatus*, Malvaceae). Three of the nesting sites were found in second growth forests. Forest types in two nesting sites were not assessed.

In this same study, the author described the structure of the vegetation within 100 meters from nests or the center of other Puerto Rican broad-winged hawk activity (Table 3). The study revealed the relatively young nature of both plantation and second growth forest. Although he found a high average of total tree density in both types of stands, 83.6 percent and 87.8 percent of trees in plantation and second growth forest nesting sites, respectively, were small trees (25.6 cm or less in diameter at breast height (dbh)).

Table 3. Characteristics of the Puerto Rican broad-winged hawk nesting site habitat in the Río Abajo Commonwealth Forest (Delannoy 1995a). Data are expressed as sample means, standard deviations, and ranges. N=number of plots.

Variables	Plantation (N=53)	Secondary Forest (N=23)
6.4-12.8 cm dbh class (trees/hectare (ha))	385.3±243.9 (0-1200)	393.5±158.7 (175-900)
12.9-19.2 cm dbh class (trees/ha)	188.7±108.7 (0-450)	193.5±117.5 (0-475)
19.3-25.6 cm dbh class (trees/ha)	102.4±63.0 (0-225)	114.1±74.5 (25-300)
25.7-32.0 cm dbh class (trees/ha)	58.5±48.7 (0-200)	42.4±43.6 (0-175)
32.1 cm ≥ dbh class (trees/ha)	74.5±54.9 (0-250)	55.4±39.1 (0-150)
Total tress/ha	809.4±365.2 (150-1800)	798.9±252.0 (350-1425)
Basal area canopy trees (square meters/ha)	17.4±7.9 (5.2-37.4)	10.9±5.71*** (1.2-22.8)
Basal area understory trees (square meters/ha)	8.3±3.7 (2.4-16.3)	8.9±3.9 (2.3-18.9)
Percentage canopy cover	83.7±14.0 (35-100)	82.5±14.7 (47.5-100)
Percentage ground cover	45.9±14.2 (17.5-75)	45.3±15.0 (12.5-72.5)
Canopy height (meters)	16.0±2.6 (9.8-24.2)	15.2±3.4 (4.5-22.7)
Shrub density (stems ≤2.5 cm/0.04 ha)	95.3±34.7 (18-200)	94.5±57.6 (12-227)
Slope (degrees)	26.6±11.5 (3-48)	26.7±10.4 (5-44)

***p≤.001 Basal area was calculated in a 0.04 ha circular plot.

Average basal area of canopy trees in plantation nesting sites was approximately 1.5 times that in nesting sites in second growth forests. This was the only significant difference between the two forest types found by the author. Canopy trees occupied 2.09 times more area than understory trees in plantations. In contrast, canopy trees occupied 1.22 times more area than understory trees in secondary forests. Although canopy height and cover were, on average, higher in plantation than in second growth forest nesting sites, these features were not significantly different. Maximum canopy height exceeded 22 meters in nesting sites of both forest types. The understory vegetation was well developed in both plantation and second growth forest nesting sites. Ground cover averaged slightly over 45 percent and the density of the shrub layer was approximately 95 stems per 0.04 hectare (ha). Slopes averaged slightly over 26 degrees, with maximum values exceeding 40 degrees.

Three nest structures were located in the Río Abajo Commonwealth Forest, two in maría trees and one in laurel prieto (*Nectandra membranaceae*, Lauraceae). Puerto Rican broad-winged hawks consistently chose tall, large diameter trees with large crown dimensions. Nest structures were placed relatively high. Nest structures averaged approximately 200 meters in distance from the nearest forest opening and slightly over 500 meters from water.

In summary, Puerto Rican broad-winged hawk nesting site habitat was of two types: plantation and second growth forests. Nesting site habitat types had relatively high tree density, mostly small trees, closed canopy, well developed understory, and moderate to average slopes. The most consistent nest tree selection criteria were height, dbh, and canopy dimensions.

Puerto Rican sharp-shinned hawk:

Studies on breeding and nesting habitat of this species, conducted by Cruz and Delannoy (1986), showed that the Puerto Rican sharp-shinned hawk population in the Maricao Commonwealth Forest nests in both natural forest and maría plantations. Plantation nest sites tended to have more large canopy trees and less understory than natural forest nest sites (Table 4). Sharp-shinned hawks appear to select plantation and natural forest nest sites with similar vegetative structure and topography. The authors found that nest sites in natural vegetation had significantly higher total tree densities than nest sites in plantations. They found that a very high percent (87.5 percent) of the trees in natural forest nest sites were in the smaller size classes.

In plantations, they found that 57.9 percent of the trees were in these same size classes. In plantations, 42.1 percent of the trees were in larger size classes, in contrast to only 12.5 percent of trees in natural forest that were found in these same size classes.

These authors found that vegetation structural requirements (closed canopies and dense stands) were sought by the Puerto Rican sharp-shinned hawks in the selection of nest sites in the Maricao Commonwealth Forest and apparently in other parts of its range in Puerto Rico. They also found that Puerto Rican sharp-shinned hawks placed their platforms nests below the canopy on horizontal branches against the trunk or in crotches away from the trunk.

Table 4. Characteristics of the Puerto Rican sharp-shinned hawk nesting site habitat in the Maricao Forest (Cruz and Delannoy 1986). Data are expressed as sample means, standard deviations, and ranges. N=number of plots.

Variables	Plantations N=28	Natural Forest N=15
6.4-12.8 cm dbh class (trees/ha.)	218.0±192.9 (0-675)	742.3±279.4 (200-1100)
12.9-19.2 cm dbh class (trees/ha.)	212.0±174.7 (35-700)	290.4±103.4 (150-423)
19.3-25.6 cm dbh class (trees/ha.)	120.0±103.6 (72-375)	92.3±55.3 (25-175)
25.7-32.0 cm dbh class (trees/ha.)	126.0±147.5 (30-700)	25.0±27.0 (7-75)
32.1 cm ≥ dbh class (trees/ha.)	67.0±81.9 (0-325)	30.8±29.1 (8-75)
Total trees/ha	743.0±306.2 (350-1425)	1180±328.7 (575-1625)
Basal area canopy trees(square meters/ha.)	2374.0±1489.0 (657-7195)	1233.3±428.2 (480-1982)
Basal area understory trees (square meters/ha.)	322.2±321.9 0-1087)	740.4±487.7 (97-1490)
Percentage canopy cover	78.5±12.7 (51-97)	70.4±13.2 (50-96)
Canopy height (meters)	12.0±3.4 (7-21)	10.0±2.2 (6-14)
Slope (Percent)	16.8±9.1 (5-40)	20.4±8.6 (7-35)

Nesting range

Puerto Rican broad-winged hawk:

Nesting range size was determined for seven of eleven Puerto Rican broad-winged hawk nesting sites in the Río Abajo Commonwealth Forest (Delannoy 1995a). He determined that the Puerto Rican broad-winged hawk spacing requirements for nesting averaged 41.1 ha (range from 22.3 to 76.9 ha). One year later in the same forest, Delannoy (1995b) found that nesting ranges varied in size from 22.1 to 76.9 ha, and averaged 39.5 ha. Nesting range overlap was minimal. All nesting ranges occupied in 1994 were reoccupied in 1995.

Puerto Rican sharp-shinned hawk:

Cruz and Delannoy (1986) estimated home range size for Puerto Rican sharp-shinned hawks in Maricao Commonwealth Forest using measure of nest spacing. Assumptions for this kind of estimate included that home ranges are mutually exclusive and circular, all habitats are suitable for foraging and/or nesting, and habitats are at carrying capacity. By dividing the average distance between nesting areas in half, the authors obtained a home range radius of 690.4 meters, which represented a home range size of 149.5 ha. They estimated that there would be approximately 28 nesting pairs in the 4150 ha of the forest, if the assumptions were correct. Five nesting sites had reoccupancy rates of 80 percent or higher and none of the remaining four nesting sites had reoccupancy rates of less than 50 percent.

Breeding biology

Puerto Rican broad-winged hawk:

Delannoy (1994) estimated the Río Abajo Commonwealth Forest breeding population to be between 10 to 12 pairs. Considering that the estimated Río Abajo population was 52 broad-winged hawks, the effective population (fraction of the population that breeds) calculated by this author was between 38.4 percent (20/52) and 46.2 percent (24/52).

Delannoy (1995b) reported that Puerto Rican broad-winged hawks were more active in territorial and epigamic displays from December through March. Nest building occurred in February until early March. Nests with nestlings were found in late March through early April. Young fledged in late April and May.

Clutch sizes are fairly consistent in this species, with 2 to 4 eggs being typical. There is a clear division of labor during incubation, with the female incubating and the male hunting. The male only covers the eggs during times that the female is eating food brought by the male. The incubation period may vary from 28 to 31 days. The young are brooded fairly intensively and through the night, for the first few weeks after hatching until they are

about 21 to 24 days old. They are fed by the female until they are about 29 to 30 days old, and at that time begin venturing out of the nest. They begin to produce an adultlike whistle at 30 to 36 days of age, and become able fliers during their sixth week after hatching (Johnsgard 1990).

Puerto Rican sharp-shinned hawk:

Cruz and Delannoy (1936) found that most of the Puerto Rican sharp-shinned hawk activities during early occupancy of nesting sites (December to January) consisted of courtship and territorial display flights. Both males and females participated in display flights that were initiated shortly after sunrise and lasted, in some nesting sites, until mid-morning. These authors reported that most Puerto Rican sharp-shinned hawks started the construction of their nests shortly after remaining permanently on their nesting areas in January of each year. They found that both the male and female became more active in the nest building process 3 to 4 weeks before laying eggs. In February, the females stopped hunting and stayed near the nest. The males provided all the food at this stage and during the following months. Egg laying occurred during March and April. The laying of second clutches occurred irregularly from May to July. They also found that females laid second clutches only after losing a brood. It took two females approximately 27 and 30 days, respectively, to lay again after losing their first broods.

Cruz and Delannoy (1986) found that, in Puerto Rican sharp-shinned hawks, only the female incubated and that the role of the male was to provide food to the incubating female. They reported an incubation period, from laying to hatching of the last egg, of 32 days. The nestling period ended when the young flew short distances from the nest and roosted in trees located 10 to 15 meters from the nest. These authors found that the combined average fledging age was 30 days and an average clutch size of 2.63 eggs. Of the 105 eggs laid, 62.9 percent hatched and 29.5 percent of the eggs survived to the fledgling stage. Less than half (47 percent) of the nestlings survived to fledging. They found that the combined nest success was 28.6 percent including renesting. Warble fly (*Philornis* sp., Diptera, Muscidae) parasitism accounted for 69.2 percent of the nest failures during the post-hatching stage.

Foraging Biology

Puerto Rican broad-winged hawk:

Snyder *et al.* (1987) conducted food-habit studies on one of the three nests of Puerto Rican broad-wing hawks found in the Caribbean National Forest in 1976 and one nest found in the Río Abajo Commonwealth Forest in 1978. They found that the prey types taken included centipedes, frogs, lizards, mice, rats, and birds (as large as 200 grams).

These authors reported that the Puerto Rican broad-winged hawk appeared to be less versatile in its hunting techniques than the red-tailed hawk. They mentioned that they had never observed the Puerto Rican broad-winged hawk capturing prey by a stoop from high in the air. In the Caribbean National Forest, these authors reported soaring broad-winged hawks approaching and briefly chasing flocks of flying Puerto Rican parrots (*Amazona vittatta vittatta*), but they considered that these chases were not predation attempts. They also reported other occasions when soaring Puerto Rican broad-winged hawks ignored parrots flying nearby.

Also observed by these authors were Puerto Rican broad-winged hawks hunting mainly from perches just below the canopy where they have a good view of the ground, such as along wooded roads, streams, or wide trails where the ground cover and understory are quite thin. They reported that Puerto Rican broad-winged hawks avoided hunting along the edges of broad openings, but foraged where the canopy was closed overhead or nearly so.

Puerto Rican sharp-shinned hawk:

In 1974 and 1977, Snyder *et al.* (1987) studied the diet at two Puerto Rican sharp-shinned hawk nests in West Fork area, Caribbean National Forest. All 148 identified prey observed at these nests were small birds, almost without exception the size of tanagers (30 grams) or smaller. They had only one apparent record of a thrasher (100 grams) taken by male sharp-shinned hawks, which were considerably smaller than female broad-winged hawks (about 70 grams less), and it was possible that female hawks take thrashers with some regularity.

Reasons for Listing and Threats to the Species

Recent Population Declines:

Status surveys conducted in 1991 and 1992 indicated that both species have experienced recent population declines. The Puerto Rican broad-winged hawk experienced a local population decline of approximately 50 percent in the Caribbean National Forest (from 50 individuals in 1984 to 22 individuals in 1992). The Puerto Rican sharp-shinned hawk experienced a 40 percent population decline in a period of 7 years (from about 250 individuals in 1985 to 150 in 1992). Locally, the Puerto Rican sharp-shinned hawk population experienced a 60 percent decline in the Carite Commonwealth Forest and a 93 percent decline in the Caribbean National Forest.

Habitat Destruction:

The destruction and modification of forested habitats in Puerto Rico may be one of the most significant factors affecting the numbers and distribution of these hawk species and is one of the most important threat to the species. The patchy distribution of both species

may have resulted from the fragmentation of forested habitats. During the first half of the 20th century, forested areas were drastically reduced for intensive agricultural uses. In the last half of this century early secondary forests have developed in areas that are no longer under intensive cultivation and these secondary forests connect patches of more mature forests that were previously isolated.

Timber harvest without considering the vegetation structural features needed by both species and inappropriate management practices in public forests could result in negative effects on these species, reducing the number of individuals and/or diminishing habitat quality. For species already limited in their abundance and distribution, these activities can reduce effective population size resulting in detriment to the species.

Road construction in several forests has resulted in substantial habitat alteration and fragmentation. Road construction and/or road repair have been proposed and/or conducted in the Caribbean National Forest, Río Abajo Commonwealth Forest, and Maricao Commonwealth Forest. In the Río Abajo Commonwealth Forest, the construction of highway P.R. 10 from Arecibo to Ponce, which has been under way for several years, affected the Puerto Rican broad-winged hawk population. The construction of this highway eliminated 205.9 ha of the Puerto Rican broad-winged hawk's habitat or five potential territories (U.S. Fish and Wildlife Service 1995). In addition to the substantial habitat alteration and fragmentation produced by the construction of the highway, this road will also provide a source of human disturbance, reducing habitat effectiveness for species with a strong need for isolation, and could increase illegal shooting and the introduction of exotic fauna. The disturbance produced by the construction activities may result in the loss of the offspring to be produced. In the Maricao Commonwealth Forest, the reconstruction of Road 362 destroyed approximately 15.4 ha of Puerto Rican sharp-shinned habitat.

Construction of recreation facilities has been proposed for the western and northern sides of the Caribbean National Forest, areas where both species occur. Such recreation facilities could potentially eliminate habitat or bring human activities too close to preferred nesting areas. Raptors are particularly sensitive to disturbance near their nesting territories. In the Carite Commonwealth Forest, increasing pressure for new recreation facilities has been identified (Delannoy 1992). In the Maricao Commonwealth Forest, Cruz and Delannoy (1986) found that nest failures related to direct human harassment ranked third in importance. Five nesting areas in Maricao Commonwealth Forest are in, or less than 100 meters from, the camping and picnic areas. Some of the traditional nesting areas for the Puerto Rican sharp-shinned hawk in the Toro Negro Commonwealth Forest lie near recreation facilities (Cruz and Delannoy 1986). Increased pressure for recreation from a growing human population could bring about frequent and regular human disturbance near nest sites.

Increased pressure for new right-of-way access to farms through the Carite Commonwealth Forest land and the establishment of new communication facilities could also destroy prime habitat or bring human activities too close to Puerto Rican broad-winged hawks. Delannoy (1992) documented that destruction of substantial caimitillo-granadillo habitat occurred in the right-of-way-access through Camino El Seis in the north-central part of this forest. This author also reported the establishment of new communication facilities along an access road through sector Farallón in the northwestern part of the forest where the highest broad-winged hawk densities have been reported. In the Maricao Commonwealth Forest, the Puerto Rico Energy and Power Authority has a power substation located in the lower montane wet forest life zone, the center of Puerto Rican sharp-shinned hawk nesting habitat. Many kilometers of aerial power lines run through forest lands. The access road for the substation is located adjacent to sharp-shinned hawk habitat in the subtropical wet forest life zone (Delannoy 1992). The construction of this access road resulted in the destruction of approximately 2.6 ha of Puerto Rican sharp-shinned hawk habitat (Delannoy 1992). The construction of new or the enlargement of the existing, communication infrastructure could potentially eliminate important sharp-shinned hawk habitat.

Low Numbers and Restricted Distribution:

One of the most important factors affecting these species in Puerto Rico is their low numbers and their limited distribution. Extant populations of the Puerto Rican broad-winged hawk and the Puerto Rican sharp-shinned hawk are restricted only to three and five montane forests, respectively. Significant adverse effects to these species or their habitat could drive them to extinction.

Devastation from Hurricanes:

The extensive devastation from hurricanes may be particularly detrimental to species with small population sizes and long generation times, such as the broad-winged hawk and sharp-shinned hawk. Additionally, there may also be a long-term reduction in effective population size if the hawks prove to require habitat characteristics not presently available in the storm-damaged forest.

Decline of both species has been attributed to possible direct and indirect effects of Hurricane Hugo in 1989 by Delannoy (1992). Dr. J.M. Wunderle (International Institute of Tropical Forestry, personal communication 1997), however, believes that it is unlikely that these hawk species were strongly affected by the hurricane unless their nest sites were reduced or eliminated. Nevertheless, he believes that the latter suggestion is unlikely given the patchy nature of the storm damage in the forests. He also mentioned that the 60 percent decline of Puerto Rican sharp-shinned hawks in the Carite Commonwealth

Forest after Hurricane Hugo seems like an unexpectedly high value given that the hurricane damage to habitat in that forest was very light, and limited to some of the highest ridges. He also mentioned that in the few cases where raptor populations were quantified both before and after hurricanes, no significant declines were detected.

Parasitism by warble fly:

The mortality of sharp-shinned hawk nestlings due to parasitism by the warble fly *Philornis* sp. has been documented. Studies conducted in Maricao Commonwealth Forest attributed 61 percent of nestling mortality to *Philornis* parasitism (Cruz and Delannoy 1986).

Lack of Comprehensive Management Plans:

The lack of comprehensive management plans for the Commonwealth Forests could be considered a serious threat to these species. In absence of such plans, policy makers and managers lack basic information on which to base decisions related to the best use and management of forest resources.

Conservation Measures

Conservation measures provided to federally listed species include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing encourages and results in conservation actions by Federal and Commonwealth agencies, and private groups and individuals. The Endangered Species Act provides for possible land acquisition and cooperation with the Commonwealth, and requires that recovery actions be carried out for all listed species.

Section 7(a)(2) requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species or to destroy or adversely modify its critical habitat. If a Federal action may adversely affect a listed species or its critical habitat, the responsible Federal agency must enter into formal consultation with the Fish and Wildlife Service.

The U.S. Forest Service, Caribbean National Forest, has developed the following standards to promote the recovery and conservation of endangered raptors while conducting other forest management or research activities:

1. Protect nest and roost sites for raptors such as the endangered Puerto Rican broad-winged hawk and the Puerto Rican sharp-shinned hawk.

    (a) Conduct no management activities within 150 meters of nest trees or roosts.

(b) Conduct only compatible management activities (*e.g.*, non-manipulative research, placement of parrot nests, bee traps, or thrasher boxes, etc.) within 500 meters from nest trees or roosts.

(c) Plan other activities (*e.g.*, recreational development, timber demonstration, etc.) at least 500 meters from nest sites, following biological assessment and consultation with the Fish and Wildlife Service.

(d) Timber demonstration or other silvicultural activities planned near nesting areas should be designed to result in stand conditions favorable to raptor recovery.

(e) Plan any activity with potential to disturb raptors 350 meters away from nest or roost sites; or time it to avoid the nest selection and breeding time (*i.e.*, activities may occur from August through November).

(f) Conduct raptor inventories during nest selection/breeding seasons, prior to planning forest management activities.

Summary of Comments Received

Copies of the Technical/Agency Draft Puerto Rican Broad-winged Hawk and Puerto Rican Sharp-shinned Hawk Recovery Plan were sent to 36 individuals, including four peer reviewers, for review and comments. A notice of availability of the draft plan was published in the *Federal Register*. Nine comment letters were received. Comments providing supplemental data and editorial corrections have been incorporated into the appropriate sections of this plan.

The Puerto Rico Planning Board supported the recovery plan and mentioned that they will coordinate with Federal agencies, National and local conservation organizations, and other interested parties toward the recovery of these species.

The U.S. Forest Service, Caribbean National Forest, provided comments on the plan supporting the recovery of these species. They have developed standards to promote the recovery and conservation of endangered raptors while conducting other forest management or research activities. Such measures were included in the Conservation Measures section of this plan. They suggested that these protective standards be implemented in non-National Forest lands. Several proposed trails, timber demonstration units, and recreational facilities which could potentially have posed threats to raptors were changed in the forest management plans to eliminate such impacts.

The Caribbean National Forest also suggested that all agencies involved in the recovery of these species develop and implement a standard census protocol to conduct surveys to improve the understanding and manipulation of field data reports in order to conduct population analyses. They recommended the establishment of a technical committee to promote recovery plan goals, develop census and management protocols, and identify future needs for these species. In addition, the Caribbean National Forest proposed to obtain and compile all observation reports for raptor species on the forest, including previous research efforts, and update existing information on species distribution, relative abundance, and habitat utilization in the forest. They also mentioned the intention of preparing and implementing a monitoring plan to track known individuals, breeding pairs, and nest areas, and identify territorial ranges. They expressed willingness to work with the Fish and Wildlife Service in the design of an environmental education program to promote species recovery and reduce potential threats.

Dr. Carlos Delannoy provided comments regarding the recovery criteria. The draft plan called for a Puerto Rican broad-winged hawk breeding population of 200 pairs in three forests to downlist this species. Dr. Delannoy recommended a more realistic number of 60 breeding pairs and 200 individuals (20 breeding pairs in the Caribbean National Forest, Carite and Río Abajo; 60 individuals in Río Abajo and Carite; and 80 individuals in the Caribbean National Forest). These changes were incorporated into the plan. Dr. Delannoy recommended that a management plan also be prepared for the forests where the Puerto Rican sharp-shinned hawk has been reported and could be re-introduced like Guajataca Commonwealth Forest. He recommended that the effects of the interaction of the two endangered hawks and the red-tail hawk also be studied in the other forests, not only in the Caribbean National Forest.

Dr. Delannoy commented that it is very important for the Puerto Rico Highway Authority, the Authority for Public Works, and the Puerto Rico Planning Board to consult with the Department of Natural and Environmental Resources and the Fish and Wildlife Service during the planning and designing of projects. He also recommended that educational efforts for these species be extended to include radio and television.

Dr. Joseph M. Wunderle, Wildlife Team Leader and Research Wildlife Biologist from the International Institute of Tropical Forestry, U.S. Forest Service, provided comments regarding possible effects of hurricanes on both hawk species and recovery efforts that should be conducted. In general, Dr. Wunderle believes that it is unlikely that these species were strongly affected by Hurricane Hugo, based on information he collected for other raptor species before and after the hurricane. He agreed that obtaining biological information and identifying mortality factors and threats should be of the highest priority. He mentioned that as part of the studies related to translocation, it is essential to ensure that the stresses that caused the decline in the first place be removed or eliminated. He specified that translocation without elimination of the stresses will result in loss of valuable individuals. He suggested that the high populations of pearly-eyed thrashers and warble fly parasitism may be contributing factors to the decline of these species in the Caribbean National Forest.

II. RECOVERY

A. Recovery Objective

Objective: To reclassify the Puerto Rican broad-winged hawk and the Puerto Rican sharp-shinned hawk from endangered to threatened status.

The interim criteria are to protect, enhance, and stabilize the existing populations. To restore the Puerto Rican sharp-shinned hawk populations to the levels known in the mid-1980s, when the species was considered threatened, and to maintain such levels at least 7 years, a breeding population of a minimum of 250 pairs island-wide (five forests) should be reached. In each forest, breeding densities should be restored to the higher levels known in 1983 and 1985 (Carite - .42/km^2, Guilarte - .82/km^2, Luquillo - 1.03/km^2, Maricao - 1.15/km^2, and Toro Negro - 1.45/km^2).

To downlist the Puerto Rican broad-winged hawk, a breeding population of 60 breeding pairs (20 breeding pairs in the Caribbean National Forest, Carite, and Río Abajo) and 200 individuals island-wide (60 individuals in Río Abajo and Carite, and 80 individuals in the Caribbean National Forest) should be reached. There should be additional documentation of population trends and adequate support habitat. The criteria for delisting will be developed when the species are reclassified from endangered to threatened.

B. Narrative Outline

1. Monitor Puerto Rican broad-winged hawk and Puerto Rican sharp-shinned hawk populations. Continued monitoring of the Puerto Rican broad-winged hawk and the Puerto Rican sharp-shinned hawk populations is needed in order to update the information on distribution, relative abundance, and habitat utilization. This information is vital to determine population trends, obtain population biology information, evaluate mortality factors, and identify imminent threats to the species. The gathering and analysis of such information will allow the development and implementation of actions needed to prevent the species from declining irreversibly in the foreseeable future.

    11. Conduct surveys within the known range of the species and determine population trends. Surveys should be conducted in the six public forests and adjacent lands where the species are known in order to update information on the present distribution and relative abundance of the Puerto Rican broad-winged hawk and the Puerto Rican sharp-shinned hawk. The last surveys were conducted in 1992, and Guilarte was not surveyed. The Caribbean National Forest, which is the largest forest from where the species are known, was only surveyed for 2 days.

Periodic censuses of extant populations should continue on a regular basis, at least once every 2 years, to determine relative abundance and population trends of the species.

To reduce potential error in population estimates, a standard census protocol should be adopted by all agencies involved in the recovery of the species. This will improve the understanding and manipulation of field data reports and will allow population analysis.

12. Identify and characterize currently used habitat. The habitat that the Puerto Rican broad-winged hawk and the Puerto Rican sharp-shinned hawk are utilizing in Carite, Guilarte, Toro Negro, and the Caribbean National Forest has not been characterized. Although, habitat characterization studies have been conducted for the Puerto Rican broad-winged hawk in Río Abajo and for the Puerto Rican sharp-shinned hawk in Maricao, addi-tional studies in these two forests should be conducted in order to include the habitat utilized by these species outside the nesting season.

13. Identify additional habitat for the species. After the identification and characterization of the habitat currently used by these two hawk species in the six public forests and adjacent lands, additional suitable and available habitat that is not being used by these species should be identified. Potential habitat that can be enhanced through management practices for future utilization should also be identified and quantified. Current use and management practices should be described. Recommendations to enhance these habitats will be provided. Photo-interpretation studies, utilizing the habitat characteristics gathered by the characterization studies, may be utilized to identify this additional habitat.

14. Search for new populations. Utilizing historic records, anecdotal information, habitat characterization, and photo-interpretation studies, potential habitat should be surveyed in order to searched for new populations.

15. Determine spatial and temporal usage of habitat. It is important to delineate nesting and feeding areas in each of the forests to develop and implement protection guidelines and actions. Use of radiotelemetry, periodic counts, and surveillance of broad-winged hawk and sharp-shinned hawk activities will provide important information on dispersal and movement patterns.

16. Obtain population biology information. Basic population biology data, such as fertility, nest success, mortality rates, sex ratio, age structure, recruitment, and effective population size, should be obtained. This information will be needed to understand population dynamics, to forecast trends, implement management practices to maintain population viability, and to establish delisting recovery criteria.

17. Identify imminent mortality factors and threats. The nature of and relative severity of mortality factors should be identified for both species. Particularly, the impacts of the parasitism of *Philornis* on sharp-shins and adverse impacts of road construction activities in Río Abajo and Maricao on Puerto Rican broad-winged and Puerto Rican sharp-shinned hawks, respectively.

18. Evaluate possible adverse impacts of red-tailed hawks on broad-wings and sharp-shins in the Caribbean National Forest. Before identifying measures to increase both species' populations to mid-1980's levels, studies to evaluate possible impacts of red-tail hawks on both species should be conducted.

19. Study the possibility of translocating individuals. In order to restore the population of the Puerto Rican sharp-shinned hawk in the Caribbean National Forest, the possibility of translocating individuals should be studied. Translocation of individuals of both species should be also studied in other forests.

2. Protect and manage populations and habitats of the Puerto Rican broad-winged hawk and Puerto Rican sharp-shinned hawk. Preventing further decline of the species and habitat loss is essential for the continued survival and recovery of these species. The protection of the integrity of all the forests where the species are found is a priority. Both species are restricted in distribution, occur in very low numbers, and are extremely localized in montane forests. The patchy distribution of both species may have resulted from fragmentation of forested habitat and the specific requirements that both species seem to have to select nesting sites.

21. Develop management plans. Plans should be developed for the management and protection of the Puerto Rican broad-winged hawk and the Puerto Rican sharp-shinned hawk and their habitat in the six public forests that they inhabit (Carite, Guilarte, Maricao, Toro Negro, Río Abajo, and the Caribbean National Forest). These plans should include the habitats used by the species, areas available but not being used, and areas with potential habitat that can be enhanced for future use by the hawks. The plan should also include the forest management practices that are currently being conducted in the forests and the practices that are planned to be conducted within the previously identified habitat. An analysis of possible impacts and strategies to avoid or minimize those impacts should be also identified in the plan. After these components have been identified, the plan should specify what particular actions will need to be taken by the agencies to prevent habitat loss, fragmentation or degradation.

22. Implement management plans. Inter-agency agreements or Memorandums of Understanding should be signed in order to specify the responsibilities and actions to be taken by each agency identified in the management plans.

23. Enforce existing Commonwealth and Federal endangered species regulations. The Endangered Species Act of 1973, as amended, and the Department of Natural Resources' Regulation to Govern the Management of Threatened and Endangered Species of 1985 provides for criminal penalties for illegal take of the species. The Endangered Species Act and implementing regulations set forth a series of general prohibitions and exceptions that apply to all endangered wildlife. Permits may be issued to carry out otherwise prohibited activities involving endangered wildlife species under certain circumstances.

    Development projects which occur on privately owned land may be funded through local or Federal agencies or require Federal or local permits. Section 10 of the Commonwealth regulation provides for consultation on endangered species which may be affected by a particular project, similar to Section 7 of the Federal Endangered Species Act. A Section 7 consultation would be necessary for any Federal action that might affect the species.

24. Obtain protective status for habitat on privately-owned lands. Privately-owned habitat should be protected through land acquisition, the establishment of conservation easements, the development of Habitat Conservation Plans, and the implementation of private land incentive programs and landowner agreements with the Department of Natural and Environmental Resources, U.S. Department of Agriculture, and the Service.

3. Develop an education program. Both Commonwealth and Federal agencies should become involved in the education of the public regarding protection and conservation of threatened and endangered species, the laws protecting them, and general conservation values.

    31. Incorporate the Puerto Rican broad-winged hawk and the Puerto Rican sharp-shinned hawk into existing education program. Both species should be included in brochures and slide presentations presented to local schools and organizations.

4. Refine recovery goals. As additional information on the biology, ecology, and management of the Puerto Rican broad-winged hawk and the Puerto Rican sharp-shinned hawk is gathered, it will be necessary to better define the recovery criteria.

    41. Determine number of individuals and populations necessary to ensure species stability, security, and self-perpetuation. Population studies, together with the relative success of protection measures, will allow more precise and realistic recovery criteria to be established and met.

    42. Determine what additional actions, if any, are required to achieve recovery objectives. If any additional recovery actions become necessary for the species survival and well-being, they must be incorporated into the plan.

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III. IMPLEMENTATION SCHEDULE

The following Implementation Schedule outlines actions and estimated costs for the recovery of the Puerto Rican broad-winged hawk and the Puerto Rican sharp-shinned hawk over the next 3 years, beginning in 1997.

Key to Implementation Schedule Column 1:

Priority 1: Those actions that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

Priority 2: Those actions that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.

Priority 3: All other actions necessary to provide for full recovery of the species

Key to Agency Designations in Column 5 and Column 6:

FWS-	U.S. Fish and Wildlife Service
R4-	FWS Region 4
ES-	FWS Division of Ecological Services
LE-	FWS Division of Law Enforcement
DNER-	Puerto Rico Department of Natural and Environmental Resources
USFS-	U.S. Forest Service
UNIV-	Universities
Cons.Org.-	Conservation Organizations

IMPLEMENTATION SCHEDULE

Task Priority	Task Description	Task Number	Task Duration	Responsible Organization FWS	Responsible Organization Other	Cost Estimates ($000) FY 1	FY 2	FY 3	Comments
1	Conduct surveys within the known range of the species and determine population trends.	11.	annual	R4, ES	DNER, USFS	50	50	50	
1	Identify and characterize currently used habitat.	12.	annual	R4, ES	DNER, USFS	70	70	70	
1	Obtain population biology information.	16.	annual	R4, ES	DNER, USFS, Cons. Org.	50	25	25	
1	Identify imminent mortality factors and threats.	17.	annual	R4, ES	DNER, USFS, UNIV	20			
1	Enforce existing Commonwealth and Federal endangered species regulations.	23.	ongoing	R4, ES, LE	DNER, USFS	No cost anticipated.			
1	Obtain protective status for habitat on privately-owned lands.	24.	ongoing	R4, ES	DNER, USFS				
2	Identify additional habitat for the species.	13.	annual	R4, ES	DNER, UNIV	15	15		
2	Search for new populations.	14.	annual	R4, ES	DNER, UNIV	25			
2	Determine spatial and temporal usage of habitat.	15.	annual	R4, ES	DNER, USFS, UNIV, Cons.Org.	20	20	20	

Task Priority	Task Description	Task Number	Task Duration	Responsible Organization FWS	Other	Cost Estimates ($000) FY 1	FY 2	FY 3	Comments
2	Evaluate possible impacts of red-tailed hawks on broad-wings and sharp-shins in the Caribbean National Forest.	18.	annual	R4, ES	USFS, UNIV, Cons. Org.	50			
2	Study the possibility of translocating individuals.	19.	annual	R4, ES	USFS, UNIV	10			
2	Develop management plans.	21.	ongoing	R4, ES	DNER, USFS	No cost anticipated.			
2	Implement management plans.	22.	ongoing	R4, ES	DNER, USFS	No cost anticipated.			
2	Determine number of individuals and populations necessary to ensure species stability, security, and self-perpetuation.	41.	annual	R4, ES	DNER, USFS, UNIV, Cons. Org.	20			
3	Incorporate the Puerto Rican broad-winged hawk and the Puerto Rican sharp-shinned hawk into existing education program.	31.	ongoing	R4, ES	DNER, USFS				
3	Determine what additional actions, if any, are required to achieve recovery objectives.	42.	annual	R4, ES	DNER, USFS				

IV. LIST OF REVIEWERS

Dr. Pedro Gelabert
Secretary
Department of Natural and Environmental Resources
P.O. Box 9066600
San Juan, Puerto Rico 00906-6600

Mr. José Chabert
Terrestrial Ecology Section
Department of Natural and Environmental Resources
P.O. Box 9066600
San Juan, Puerto Rico 00906-6600

Mr. Vicente Quevedo
Natural Heritage Program
Department of Natural and Environmental Resources
P.O. Box 9066600
San Juan, Puerto Rico 00906-6600

Mr. Edgardo González
Forest Service Area
Department of Natural Resources
P.O. Box 9066600
San Juan, Puerto Rico 00906-6600

Comandante Edwin Perez
Department of Natural and Environmental Resources
P.O. Box 9066600
San Juan, Puerto Rico 00906-6600

Ms. Doris Betancourt
Acting Director
Department of Biology
Mayaguez Campus - UPR
P.O. Box 5000
Mayaguez, Puerto Rico 00681

Ms. Ana María Vera
Fundación Puertorriqueña de Conservación
Calle O' Neill No.11
Hato Rey, Puerto Rico 00918

Mr. Francisco Javier Blanco
Fideicomiso de Conservación de Puerto Rico
P.O. Box 4747
San Juan, Puerto Rico 00902-4747

Mr. Francisco Ferrer
Sociedad de Historia Natural de Puerto Rico
Apartado 361036
San Juan, Puerto Rico 00936

Dr. Ariel Lugo
International Institute of Tropical Forestry
U.S. Forest Service
Call Box 25000, Experimental Station
Río Piedras, Puerto Rico 00928

Ms. Suzette Delgado
Servicios Científicos y Técnicos
Cond. El Centro, Oficina 1401
San Juan, Puerto Rico 00936

Mr. Agustin Valido
Puerto Rican Parrot Field Office
U.S. Fish and Wildlife Service
P.O. Box 1000
Luquillo, Puerto Rico 00773

Environmental Protection Agency
Hazard Evaluation Division - EEB (TS769C)
401 M Street, S.W.
Washington, D.C. 20460

Mr. Carl A. Soderberg
Director
U.S. Environmental Protection Agency
Caribbean Field Office
1413 Fernandez Juncos Ave., Office 2A
Santurce, Puerto Rico 00909

Lt. Col. Chester D. Fowler
Deputy District Engineer
U.S. Army Corps of Engineers
400 Fernandez Juncos Avenue
San Juan, Puerto Rico 00906

Mr. Hector Russé Martínez
President
Environmental Quality Board
P.O. Box 11488
Santurce, Puerto Rico 00909

Ms. Norma E. Burgos
President
Puerto Rico Planning Board
P.O. Box 41119
San Juan, Puerto Rico 00940

U.S.D.A. Soil Conservation Service
Caribbean Area Service
P.O. Box 364868
San Juan, Puerto Rico 00936-4868

Mr. Nelson Castellanos
Federal Highway Administration
Federal Building - Room 329
Carlos Chardon Street
Hato Rey, Puerto Rico 00918

Ms. Ileana Echegoyen
State Director
Farmer's Home Administration
GPO Box 6106-G
San Juan, Puerto Rico 00936

Housing and Urban Development
Caribbean Office
159 Carlos Chardon Avenue
Hato Rey, Puerto Rico 00918-1804

Dr. Enrique Hernández-Prieto
Biology Department
University of Puerto Rico
Humacao Campus
Humacao, Puerto Rico 00971

Dr. Carlos A. Delannoy (*)
Biology Department
University of Puerto Rico - RUM
P.O. Box 5000
Mayaguez, Puerto Rico 00681

Mr. Raúl Pérez
Biology Department
University of Puerto Rico
Humacao Campus
Humacao, Puerto Rico 00971

Dr. Alex Cruz
Department of EPO Biology
B-334
University of Colorado
Boulder, Colorado 80309-0334

Dr. James Wiley (*)
2201 Ashland Street
Ruston, Louisiana 71270

Mr. Herbert A. Raffaele
5232 Cherokee Avenue
Alexandria, Virginia 22312

Mr. Carlos Díaz
Federal Aid Program
U.S. Fish and Wildlife Service
P.O. Box 1000
Luquillo, Puerto Rico 00773

Mr. Fernando Nuñez-García (*)
Puerto Rican Parrot Field Office
U.S. Fish and Wildlife Service
P.O. Box 1000
Luquillo, Puerto Rico 00773

Dr. Allen Lewis
Biology Department
University of Puerto Rico - RUM
P.O. Box 5000
Mayaguez, Puerto Rico 00681

Dr. William Post
The Charleston Museum
360 Meeting Street
Charleston, South Carolina 29403

Mr. Shaw Davis
Refuge Manager
Caribbean Island National Widlife Refuge
P.O. Box 510
Boquerón, Puerto Rico 00622

Dr. Joseph Wunderle (*)
President
Caribbean Ornithological Society
U.S. Forest Service
Call Box 25000, Experimental Station
Río Piedras, Puerto Rico 00928

Dr. Jaime Collazo
NC Coop. Unit
Department of Zoology
Box 7617, Rm.4110
Raleigh, North Carolina 27695-7617

Dr. Francisco Vilella
Mississippi State University
School of Forest Resources
Forest and Wildlife Research Center
Mississippi State, Mississippi 39762

Mr. Pablo Cruz
U.S. Forest Service
Caribbean National Forest
P.O. Box 490
Palmer, Puerto Rico 00721

(*) - PEER REVIEWERS