Conservation Action Plan for the Ridgway's Hawk

(Buteo ridgwayi)

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(Buteo ridgwayi)

Local Partners:

Other Collaborators/Supporters:

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Foreword

Birds of prey are found around the globe, in nearly every type of terrestrial habitat and continent except for Antarctica. There are over 550 species of birds of prey, representing a high level of diversity in habitat use, prey preference, and geographic distribution. Because they occupy a high trophic level position, many raptor species require large expanses of high-quality habitat to thrive, thus efforts to protect them and their habitats can result in protection of natural areas and improved conditions for sustaining biodiversity and resilient landscapes (Sergio et al. 2006, 2008). Raptors in general, like many other top predators, are often considered keystone species and play an important role in maintaining balance in the ecosystems in which they live (O'Bryan et al. 2018; Burgas et al. 2021), for example by culling old or sick individuals from prey populations (Genovart et al. 2010; Melis et al. 2011), by helping to control rodent pests (Donázar et al. 2016), and by removing carrion (Buechley and Şekercioğlu 2016; Grilli et al. 2019).

Over the past several decades, birds in general have been suffering major population declines, and raptors particularly are often the hardest hit (McClure et al 2018; McClure and Rolek 2020). Habitat loss and degradation, human persecution, and direct or indirect poisoning (often a result of human-wildlife conflicts), as well as elimination of native prey species are some of the factors that have contributed to these species' declines around the globe (Donázar et al. 2016; McClure et al. 2018).

The Caribbean is considered a biodiversity hotspot based on its high levels of endemism and proportional loss of primary habitat (Myers et al. 2000; Mittermeier et al. 2011), with less than 6% of its natural vegetation remaining (Sloan et al. 2014). The Caribbean is also projected to lose all or a significant proportion of what remains of its natural intact vegetation by 2050 due to increased habitat conversion for agriculture and climate change (Habel et al. 2019), with endemic species most adversely impacted (Manes et al. 2021). Few other terrestrial predators colonized the Caribbean region, and so birds of prey have played a crucial ecological role on these islands. Island-endemic raptor species, however, are more vulnerable to extinction than their mainland counterparts, and are thus of elevated conservation priority (Buechley et al. 2019; McClure et al. 2023a).

The Caribbean Island of Hispaniola, which is composed of the Dominican Republic and Haiti, is home to the endemic and Critically Endangered Ridgway's Hawk (*Buteo ridgwayi*). In the past century, the Ridgway's Hawk has experienced escalating anthropogenic and natural threats including human persecution, habitat degradation, and parasitic infestations. This led to the species being listed as Endangered in 1994 and Critically Endangered in 2000 when only a few hundred individuals were known from a single small population in northeast Dominican Republic. The Peregrine Fund began working with the species in 2002, first with surveys that grew into a multifaceted conservation and recovery program.

Over the past two decades, intensified conservation efforts to prevent this species' extinction have resulted in a doubling of the population, which has also benefited other wildlife species in Hispaniola, particularly raptors. Our initial work showed convincingly that human-caused mortality in the form of poaching, capture, and nest destruction, along with *Philornis* parasitism reducing nestling survival, were key factors contributing to the species' extinction risk. Our focused environmental education initiatives highlighting the importance of preserving and celebrating raptors, and Ridgway's Hawk specifically, have shown great promise in reducing raptor persecution (Watson 2018). Similarly, we have made great strides in combating *Philornis* fly larvae parasitism of young hawk nestlings by treating nests (Hayes et al. 2019). We have also observed that the species thrives in a variety of habitats (Thorstrom et al. 2007; Woolaver 2011) including previously unoccupied areas (i.e., Punta Cana; McClure et al. 2017a).

But further work is necessary to ensure the long-term survival of the Ridgway's Hawk and other wildlife on Hispaniola. Continued efforts are required to reduce persecution of Ridgway's Hawks and other raptors, to garner local support for conservation and stewardship, and to educate more residents of Hispaniola across all age-groups and societal levels about the importance of protecting raptors and the environment. Likewise, while our approach for reducing *Philornis* infestation is labor intensive, it has proven vital in increasing growth rates and augmenting the species' small population size (Hayes et al. 2019). We suspect that the species will be able to tolerate parasitic infestations once the species' population is larger in size, since both the hawk and fly are native to Hispaniola. A detailed population viability analysis using collected demographic data associated with our work addressing *Philornis* infestation will provide the necessary guidance to allow for management adaptation while the species continues its recovery. We also need to develop a species distribution model to map associations between habitat and fledgling success to better guide the selection of future release sites. Future population modeling based on fledging success and other survival measures will enable us and our collaborators to gauge the viability of the Ridgway's Hawk population more fully. This Conservation Action Plan outlines these and other key steps needed to secure the downlisting and recovery of the Ridgway's Hawk, which, once successful, will be a model of hope for species recovery in the 21st century.

Executive Summary

Our vision for the Ridgway's Hawk is a self-sustaining population surviving across Hispaniola and satellite islands with minimal human intervention. This vision relies on two main aspects: developing strategies to reduce threats to the Ridgway's Hawk and ensuring their adoption among the people that share the same landscapes with this species. For the past 20 years, The Peregrine Fund and its local subsidiary, Fondo Peregrino República Dominicana, have worked relentlessly to develop and apply these strategies. Our management has resulted in positive outcomes that benefit the species. Total numbers of Ridgway's Hawks have more than doubled since we began intensive nest management (Table 2), our parasite management protocol has increased

probability of fledging by 179% (Hayes et al. 2019), the hawk's range has expanded due to translocations at strategically selected locations, we have mitigated many human-hawk conflicts, and educated local communities on the importance of conservation focused on Ridgway's Hawk and all the wildlife and habitat they depend on. The species' Red List justification now states:

"Successful conservation action has now reversed such declines and the species is observed to be increasing throughout both its largest extant population in Los Haitises National Park and additional reintroduced populations. If population increases continue, it may be eligible for a downlist in the near future."

However, our work is not done. We have successfully developed strategies to reduce threats to Ridgway's Hawks, but we need to ensure that these strategies are also adopted by the local community, to develop a positive sustainable relationship for both humans and the hawk, as well as other raptors and wildlife on Hispaniola.

Ridgway's Hawks still face two major threats: parasitism by *Philornis* flies and human persecution, both amplified by an already vulnerable small population size that we have been working to conserve for the past 20+ years. *Philornis* flies are obligate avian parasites that are native to the region. Their larvae infest nestlings subcutaneously and feed on their tissues, which can have a significant negative impact on nestling development depending on infestation severity and timing relative to hatch. As a native parasite to Hispaniola, they have coexisted with birds throughout the Caribbean for centuries. However, it is not known if *Philornis* populations and their ranges have increased or expanded in recent years, possibly due to climate change, anthropogenic modification of landscapes, or increased numbers of invasive bird species that can serve as additional hosts, thereby placing more stress on Ridgway's Hawk populations. More research is needed to confirm these hypotheses. Further, we plan to identify the minimum population size required by Ridgway's Hawk to sustain parasitism indefinitely if persecution, the other major threat to the species, is adequately abated.

Human persecution is the most difficult challenge that we face in managing and conserving the Ridgway's Hawk. Changing people's attitudes and behavior requires a significant effort and a diversity of strategies to connect with local communities, build relationships, and collaboratively conceive of and implement solutions. No single approach works effectively in all communities, and therefore developing strategies tailored to specific targeted populations and differing age groups is needed. Despite our progress in engaging communities in conserving the Ridgway's Hawk in several locations in the Dominican Republic, more work needs to be done.

The goal of this Conservation Action Plan is to support the growth of a robust interconnected population of Ridgway's Hawks across Hispaniola, with a population size that reaches 1,000 individuals and a distribution that expands by 20% in ten years. To achieve this goal, we will implement four main strategies: 1) translocate individuals to supplement small subpopulations, 2) treat nests with insecticide to augment productivity, 3) conduct environmental education and outreach activities to prevent

human-hawk conflict, and 4) build local capacity for science and conservation to ensure sustainability of the plan. The first two strategies aim to boost productivity, thereby increasing population size, as well as increasing the distribution and connectivity of the species, while the last two strategies will build a better relationship between humans and hawks and ensure coexistence into the future. Ultimately, a robust metapopulation of Ridgway's Hawks should be able to withstand natural threats, such as continued *Philornis* parasitism and stochastic weather events.

To address persecution, we will expand our education and outreach strategy to reach communities at all levels with personal door-to-door visits, workshops (25 participants per workshop), medium-sized events (around 250 people), and an ambitious nationwide social marketing campaign promoting environmental education and conservation. Through these actions, we will foster positive attitudes and behaviors towards Ridgway's Hawks and all wildlife. But attitudes are fleeting and, for real change to happen, we must encourage the adoption of values. Values develop once communities engage and take ownership of conservation, deriving pride from their actions. We aim to develop these values by building capacity for science and conservation through educational workshops and employing locals in conservation work. These community leaders will then have the knowledge and tools to educate their own communities, resulting in lasting change.

This Conservation Action Plan will lead the way in continuing and expanding our efforts to protect the Ridgway's Hawk, while also enriching communities. If we achieve a robust interconnected population of Ridgway's Hawks across Hispaniola and we work together with local communities to adopt conservation values, we will ultimately attain our vision of a stable, self-sustaining population of Ridgway's Hawks with minimal human intervention.

Abbreviations

ACSEH - Action pour la Sauvegarde de l'Ecologie en Haïti

AVNP - Aniana Vargas National Park

CAP - Conservation Action Plan

FPRD - Fondo Peregrino - República Dominicana

IUCN - International Union for Conservation of Nature

LHNP - Los Haitises National Park

masl - meters above sea level

TPF - The Peregrine Fund

Stakeholders and Collaborators

Local nonprofit subsidiary

Fondo Peregrino República Dominicana

Local Partners

Fundación Grupo Puntacana

ZOODOM (National Zoo of Santo Domingo)

Fundación Propagas

Other Collaborators/Supporters

Dominican Republic Ministry of the Environment and Natural Resources

Action pour la Sauvegarde de l'Ecologie en Haïti

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We are especially grateful to the local communities who continuously welcome us, open their doors, and embrace the shared mission of saving the Ridgway's Hawk. Their partnership is vital to this effort. This plan is also a tribute to the decades of hard work of past and continuing field teams. Their tireless efforts have informed our strategy for

identifying and addressing the key threats to the species and the data they collected has provided the foundation for informed decision-making and effective conservation planning.

Finally, we acknowledge the Critical Ecosystem Partnership Fund (CEPF) for their generous financial support, which made this work possible. We also thank the reviewers who provided thoughtful and constructive feedback that strengthened this plan. Together, we take another step forward in securing a brighter future for the Ridgway's Hawk, with dedication and determination guiding our path.

Compiled by

Carolina Granthon - Research Coordinator, The Peregrine Fund

Editors and Contributing Authors

Evan Buechley, PhD - Vice President of Conservation (International Programs), The Peregrine Fund

Marta Curti - Hispaniola Program Director, The Peregrine Fund

Carolina Granthon - Research Coordinator, The Peregrine Fund

Jeff Johnson, PhD - Senior Scientist, The Peregrine Fund

Russell Thorstrom - Madagascar & West Indies Conservation Director, The Peregrine Fund

Feedback provided by

Liliana Betancourt - Country Coordinator for the Dominican Republic, CEPF

Jim Goetz - Caribbean Conservation Coordinator, Vermont Center for Ecostudies

Jake Kheel – Vice President, Fundación Grupo Puntacana

Adrell Núñez, DVM - Director of Conservation and Sciences, ZOODOM

Martín Quiroga, PhD - Laboratorio de Ecología Aplicada y Conservación (ICiVet-UNL)

Spanish translation and edits

Marta Curti - Hispaniola Program Director, The Peregrine Fund

Carolina Granthon - Research Coordinator, The Peregrine Fund

Carlos Suárez - Ridgway's Hawk Program Coordinator, Fondo Peregrino República Dominicana

Design support and branding

Anne Dixon - Design Manager, The Peregrine Fund

Maps prepared by

Leah Dunn - Database Architect, The Peregrine Fund

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1. Background and Approach

1.1 Rationale

This ten-year Conservation Action Plan (CAP) for the Ridgway's Hawk was developed as a deliverable for a grant agreement between the Critical Ecosystem Partnership Fund (CEPF) and The Peregrine Fund as part of a project titled "Conservation Action Planning and Implementation for Ridgway's Hawk, Dominican Republic." The plan was developed with the aim of producing a comprehensive analysis of the conservation issues faced by this species across Hispaniola, along with a detailed strategic plan on how to address these issues. It was a collaborative effort led by The Peregrine Fund that united stakeholders, partners, and allies in seeking solutions to a common conservation goal.

Table 1. Timeline and action items for the development of the species Conservation Action Plan.

Date	Action
January 2024	Draft the situation model.
February 2024	Workshop for 25 stakeholders (50% women, 50% men) representing government, local communities & NGOs to identify shared vision & goals; identify constraints, drivers & threats; discuss potential climate change impacts; derive a list of management actions.
February 2024	Circulate the situation model for review and approval.

March - June 2024	Write collaborative strategy, monitoring & work plans for implementation of the Species CAP for next project period, with the aim of changing conservation status from Critically Endangered to Endangered by 2030 informed by all previous actions.
July 2024	First draft of CAP sent to stakeholders for review.
July 2024	Workshop for 25 stakeholders (50%w, 50%m) representing government, local communities & NGOs to discuss strategy, monitoring, and work plans for implementation of the species CAP.
August 2024	Finalize the Species CAP. Collate all information from analyses and stakeholder meetings into a formalized CAP document. Plan will be drafted by The Peregrine Fund.
September – October 2024	Circulate for review and endorsement by all key local stakeholders, including the Dominican Ministry of the Environment. Present and discuss the results with the technical staff of the Vice Ministry of Protected Areas and Biodiversity.
November 2024	Once approved, meet with the Ministry of Environment staff in Santo Domingo to discuss an implementation strategy for the CAP.
January 2025	Disseminate electronic copies of the CAP to all workshop participants, hard copies to the Dominican Ministry of the Environment and NGOs, and issue national-level media releases to convey salient points to the wider public.

1.2 Methods

The Ridgway's Hawk's biological assessment considered information from published literature, as well as expert knowledge and field records from our TPF program that has been working with the species for over 20 years. We based the logical framework on the general principles outlined by the Open Standards for the Practice of Conservation, adapting them to fit our specific needs. The species' conservation status was based on the information provided by BirdLife International through the IUCN Red List.

Two workshops were held in collaboration with stakeholders in the development of this plan, in February and July of 2024 at the Ministry of the Environment in Santo Domingo, Dominican Republic. Stakeholders, partners, and allies from nine different organizations were invited to the workshops. The first workshop was attended by 19 out of 40 delegates invited from nine different organizations, including the Vice Minister of the Environment. The second workshop was attended by 13 out of 40 delegates invited from nine different organizations.

The first workshop consisted of a brief overview on the background of the species itself and our current conservation actions, followed by an overview of our proposed framework for action, including our vision and goals, threats and their contributing factors, and strategies for implementation. Group discussions focused on four main topics: the role of education in the conservation of this species, the imminent threat of climate change and potential solutions, the threat of electrocution, and alternative

treatments for nest parasites. Ideas developed during the workshop were incorporated into the first draft of the CAP. This first draft was circulated among stakeholders and partners along with an electronic form to provide feedback on the impact and feasibility of our plan. Three participants provided feedback.

The second workshop focused on the CAP itself, providing an overview of the document and its structure and opening the floor for discussion. Feedback obtained from the first draft of the document was addressed at this time. This workshop also included a discussion on general biodiversity conservation goals for the Dominican Republic, promoting collaboration between conservation organizations to achieve broader goals that would ultimately benefit the recovery of the Ridgway's Hawk and other species.

A second draft of the CAP incorporated input from these discussions. The document was circulated for review and endorsement by all local stakeholders, including the Dominican Ministry of the Environment. The final version of the CAP will be submitted to all workshop participants, with hard copies provided to the Dominican Ministry of the Environment and NGOs, and a national-level media release will be developed to inform the wider public. Implementation will be discussed with the technical staff of the Ministry of the Environment.

2. Scope

2.1 Geographic scope

This Conservation Action Plan (CAP) for Ridgway's Hawk focuses on the entire range of the species across the island of Hispaniola, including its four subpopulations, three in the Dominican Republic managed by TPF, and one in Haiti managed by ACSEH. The subpopulation with the majority of individuals occurs in Los Haitises National Park and surrounding areas, in northeast Dominican Republic (19°00'N; 69°39'W), south of Samaná Bay. Individuals from this population have been used in translocations to establish two additional subpopulations in the Dominican Republic. One is in Punta Cana, in extreme eastern Dominican Republic (18°33'42.53"N; 68°20'42.43"W), approximately 130 km southeast of LHNP. The other is in Aniana Vargas National Park, located approximately 42 km to the west of LHNP in the Sánchez Ramírez Province (19°1' 49.044" N; 70°11' 5.388" W). The fourth subpopulation consists of 28 mature individuals recently discovered in Les Cayemites Islands, located ~2 km off the northern coast of the Tiburon Peninsula in southwest Haiti (Dean et al. 2023). The specific objectives outlined in this CAP focus primarily on the Dominican subpopulations, but actively include the Haitian subpopulation when possible.

3. Biological Assessment

3.1 History and Taxonomy

The first taxonomic description of Ridgway's Hawk as a unique species was made by Charles B. Cory using the basionym *Rupornis ridgwayi* (Cory 1883) and named after Robert Ridgway (Cory 1884) who was at the time serving as curator of birds at the Smithsonian Institute and co-founder, along with Cory and others, of the American Ornithologists' Union. Its original description was based on the type specimen (FMNH 296553) of an adult female collected on 04 April 1883 at Samaná in the Dominican Republic, which also included a brief supplemental description of an adult male collected from the same location (FMNH 296554) (see also Wetmore and Swales 1931). Both of those specimens are currently curated at the Field Museum of Natural History (Chicago, USA). Subsequent publications provided additional information on the adult male and juvenile characteristics and body measurements (Cory 1884, 1885), along with two color plates (Cory 1885) representing the first published reproductions of adult male and female (plate 17) and juvenile (plate 18) Ridgway's Hawk (Fig. 1). It was not until Peters (1931) that the species was first identified as *Buteo ridgwayi*, with a few prior references providing alternative taxonomy (e.g., *R. magnirostris ridgwayi*, Swann 1919) including Ridgway (1925) proposing its own monotypic genus, *Coryornis ridgwayi*, which was later argued against (Wetmore and Swales 1931). The species' current taxonomy within the genus *Buteo* is supported by molecular phylogenetic evidence (Reising et al. 2003; Amaral et al. 2009; Mindell et al. 2018).

Ridgway's Hawk likely evolved from a migratory buteonine species based on ancestral reconstruction using a molecular phylogeny with extant taxa (Amaral et al. 2009), and upon arrival on Hispaniola, evolved to become nonmigratory. Its isolation on Hispaniola allowed for local adaptation and further divergence from its common ancestor shared with the Red-shouldered Hawk (*Buteo lineatus*; Amaral et al. 2009) approximately 1.3 million years ago (95% HPD 0.85-1.81; Mindell et al. 2018). While the Red-shouldered Hawk has a current distribution geographically distant from the Ridgway's Hawk, located throughout much of eastern North America (United States and Mexico) including a smaller disjunct population in the western United States, it once also inhabited Cuba, as evidenced from multiple fossils identified with deposits dated from the Quaternary or late Pleistocene and early Holocene (Suárez and Olson 2003). This finding, in addition to fossils of Ridgway's Hawk on Hispaniola from the late Quaternary (Steadman et al. 2019), further suggest that insular populations of Red-shouldered Hawk, possibly from Cuba, may represent an ancestral lineage that eventually became the Ridgway's Hawk (Suárez and Olson 2003).

The species is also known locally by multiple Spanish common names that include: gavilán de la Española, gavilán de la Hispaniola, gavilán dominicano, and guaraguaíto. In Haiti, it is known as Malfini or Ti Malifini Savann.

Figure 1. Adult male and female (left) and juvenile (right) Ridgway's Hawks as first depicted in Cory (1885).

3.2 Morphology and Physiology

The Ridgway's Hawk, together with the larger Red-tailed Hawk (*B. jamaicensis*), comprise the only two resident *Buteo* hawks on the island of Hispaniola. Other *Buteo* species that have been documented on Hispaniola, but considered as vagrants, include Broad-winged Hawk (*B. platypterus*) and Swainson's Hawk (*B. swainsoni*). However, Ridgway's Hawk's smaller size, gray tail marked with narrow white bands, and pale "windows" displayed on the wing during flight easily distinguish it from these other *Buteo* species, which are overall larger with browner plumage and paler underparts. Juveniles of these species are overall harder to distinguish from each other. However, Ridgway's Hawk vocalizations, described as a "short screech, kleah," repeated in a sequence of 3 to 5 calls, further help distinguish it from other species (Wiley and Wiley 1981).

3.3 Distribution

3.3.1 Historical Distribution

The Ridgway's Hawk is endemic to the island of Hispaniola, which includes the countries of Haiti and the Dominican Republic (BirdLife International 2024). Fossil remains are few, but those described indicate that the species was present on the island in the late Pleistocene (126,000 - 11,700 years ago) based on specimens from

Trouing Jeremie #3 (Steadman et al. 2019) identified from a sinkhole located in southwest Haiti. Wiley and Wiley (1981) and Woolaver (2011) each conducted extensive reviews of the literature, museum specimens, and available databases to determine the historical distribution of Ridgway's Hawk. From each of those efforts it was determined that the species was concentrated in central to northeast Dominican Republic (Fig. 2), although this may be reflective of the fact that many of the earlier collection efforts starting in the early 1880s were done on this part of the island (e.g., Wetmore and Swales 1931).

Historically, this raptor inhabited a wide range of habitats from sea level to 2,000 masl across Haiti, the Dominican Republic, and the satellite islands of Beata, Gonâve, Île-à-Vache, and Les Cayemites (Wiley 1986, Thorstrom et al. 2007). Ridgway's Hawk has been recorded in pine forest, limestone karst forest, secondary forest, tropical and subtropical forest, wooded landscapes, open country, lowland scrub, and human-altered landscapes such as pasture lands and agricultural fields (Wiley and Wiley 1981, Keith et al. 2003, Thorstrom et al. 2007, Woolaver 2011). Therefore, it was likely once distributed widely throughout Hispaniola below 2,000 masl including the lowlands between the prominent mountain ranges.

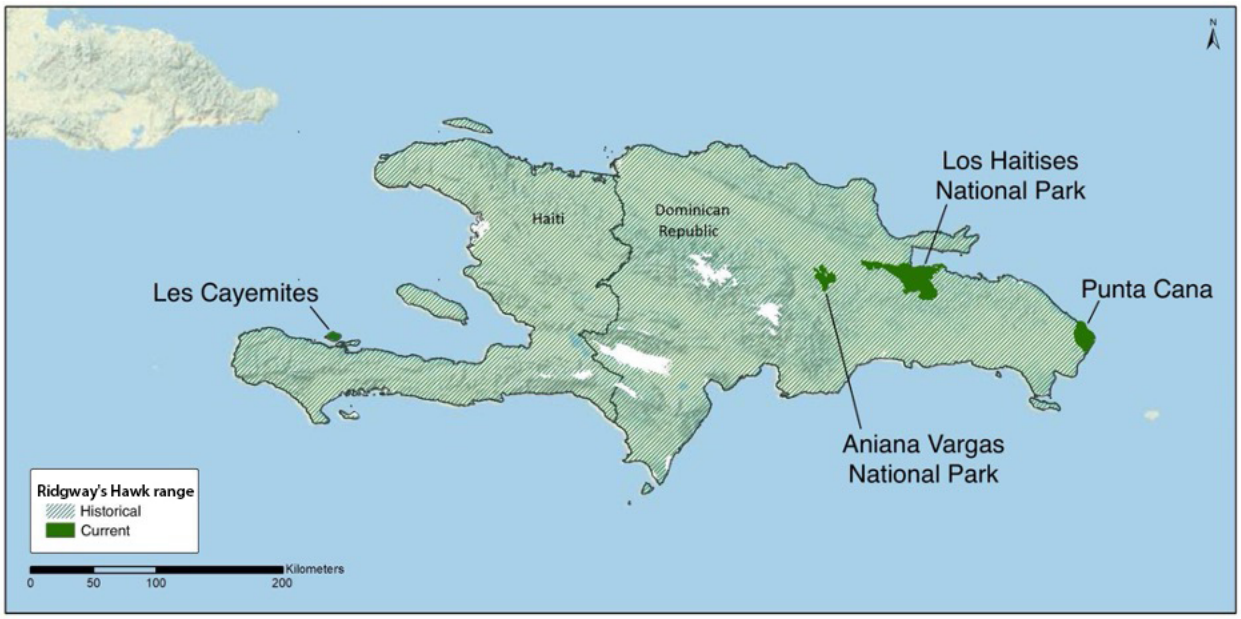

Figure 2. Current (dark green) and historical (diagonal hatched; pre-1800) range of Ridgway's Hawk in Hispaniola. White areas (with the exception of those along the coast) indicate elevations ≥ 2,000 masl, where the species is not expected to occur.

3.3.2 Current Distribution

Ridgway's Hawk is absent from most of its former range and now distributed among three distinct locations in the Dominican Republic and one location in Haiti. Two of the

four extant populations, one in each country, are remnant, whereas two in the Dominican Republic are reintroduced populations. The distances among the four locations range from 40 to 200 km among the three sites in the Dominican Republic and over 380 km between the closest Dominican site to the site in Haiti.

The three locations in the Dominican Republic where Ridgway's Hawk show confirmed breeding behavior are Los Haitises National Park, Punta Cana, and Aniana Vargas National Park.

Los Haitises National Park (LHNP), which was the last known location of the species prior to the start of recovery efforts in 2002, is in northeast Dominican Republic (19°00'N; 69°39'W), south of Samaná Bay. It encompasses 746 km^2 (Gesto de Jesús 2016). There have been several changes to the park size and boundaries since it was established in 1976 (Gesto de Jesús 2016). Elevation in the park ranges from sea level to 380 masl, with a topography consisting of mogotes (steep limestone karst hills) separated by valleys, sinkholes, cliffs, and limestone caves (Thorstrom et al. 2005). The park is in the Subtropical Wet Forest region and experiences an annual average rainfall of 180 to 210 cm (Wiley and Wiley 1981). Scattered among the forest patches are an increasing number of human-modified agricultural plots (*conucos*), livestock pastures, and some grasslands, many of which were created using slash-and-burn techniques. In 1989, an estimated 10–17% of primary vegetation cover remained (Brothers 1997), which has undoubtedly decreased since. Populations of this hawk are monitored in three areas occupying a total of 600 km^2 within the park: Laguna Cristal, Los Limones, and Sabana de la Mar (McClure et al. 2017a).

Punta Cana is one of two extant reintroduced populations and is in extreme eastern Dominican Republic (18°33'42.53"N; 68°20'42.43"W), approximately 130 km southeast of LHNP. The population received translocated individuals from LHNP starting in 2009 with annual supplement continuing through 2017, after which the population has continued to grow without any further translocations required. The area is largely a human-dominated landscape consisting of multiple golf courses, hotels, shopping areas, including both high-end residential and rural communities that provide a complex mosaic of natural and altered habitats with differing land-use patterns. The current karst topography includes fragmented scrubby second growth with subtropical dry forests and large patches of open areas consisting of manicured lawns and farmland. Elevation ranges from sea level to 30 masl with an annual rainfall between 80 to 120 cm (Dwyer et al. 2019). There are historical records of hawks observed from Higuey (Wiley and Wiley 1981), which is located approximately 40 km to the west. Hawks occur mostly within the Grupo Puntacana property, with a few pairs found in the adjacent Cap Cana Resort property, as well as a few unpaired individuals in adjacent rural communities.

Aniana Vargas National Park, established in 2009, is the location of the second extant reintroduced population, which first received translocated Ridgway's Hawks in 2019 with annual supplementation from LHNP continuing at the time of writing this plan. It is located approximately 42 km to the west of LHNP in the Sánchez Ramírez Province (19°1' 49.044" N; 70°11' 5.388" W), covering approximately 130 km^2. The park

encompasses humid subtropical forests and protects one of the most important freshwater reservoirs in the country. It also possesses the necessary prey and nesting habitat to support a reintroduced population of Ridgway's Hawks. The highest peak in the park is 575 masl. It is surrounded by small and medium-sized rural communities, many of which are heavily dependent on agriculture. The closest community to the reintroduction program release site, Los Brazos, has a population of approximately 100 people. This community relies heavily on certified organic cacao farming, which prohibits the use of pesticides, the killing of wildlife, and the cutting of forests. Historic records also indicated that Ridgway's Hawks were observed at two locations within 35 km of the park.

Between 2008 and 2012, a total of 20 individual Ridgway's Hawks were also released at Loma La Herradura (18°54'27.36"N; 69°06'37.71"W) near the town of Pedro Sánchez located approximately 48 km east of LHNP. The area contains some intact forest and elevation ranges between 89-570 masl. Reintroduction efforts at this site were ended because of relatively high human persecution of released hawks compared with those released simultaneously in Punta Cana. To our knowledge, no Ridgway's Hawks remain at this location.

In August 2019, two Ridgway's Hawks were rediscovered on Les Cayemites, a small set of satellite islands located ~2 km off the northern coast of the Tiburon Peninsula in southwest Haiti (Jean et al. 2023). Prior to that observation, the Ridgway's Hawk was last documented in Haiti in 1962 on a different satellite island, Île-à-Vache, located 52 km south of Les Cayemites off the southern coast of the Tiburon Peninsula (Woolaver 2011). The species was believed to have been extirpated from Haiti soon thereafter. Since its rediscovery, annual breeding season surveys have documented additional individuals on Les Cayemites including at least eight breeding pairs (Jean et al. 2023; TPF, unpubl. data). We are unaware of any Ridgway's Hawks currently inhabiting the main island of Haiti. Les Cayemites is composed of two islands, Grande (18°37'23.20"N; 73°44'36.35"W) and Petite (18°36'29.31"N, 73°48'42.48"W) Cayemite that are separated by <600 m. As the name implies, Grande Cayemite is the larger of the two islands, encompassing approximately 50 km² with an elevation between sea level and 225 masl, whereas Petite Cayemite is 1.65 km² with an elevation between sea level and 60 masl. There are no documented dispersal events between Grande Cayemite and the northern coast of the Tiburon Peninsula of mainland Hispaniola. However, only ~2 km separates the two, indicating that dispersal to and from the mainland is possible.

3.4 Population size and trend

3.4.1 Abundance

It is possible that the Ridgway's Hawk had been historically uncommon, as some of the earlier references indicated that it was nowhere abundant and considered rare (Cory 1885; Wetmore and Swales 1931), except for a few smaller satellite Haitian islands where densities were higher (Wetmore and Swales 1931; Wetmore and Lincoln 1934;

Wiley and Wiley 1981). However, there is low confidence in Hispaniola's historic abundance estimates for most wild species prior to the late 1800s, given that there are few available historic references from that time describing the island's wildlife and their distributions. By 1932, the species was considered rare and declining on the main island, with a higher density of individuals still observed on the Cayemite Islands in southwest Haiti (Wetmore 1932). The species continued its decline and was considered extirpated from Haiti by the early 1960s when six individuals were last collected as museum specimens from the island of Île-à-Vache (Museum of Natural Science, Louisiana State University, LA, USA; Schwartz and Klinikowski 1963, Wiley and Wiley 1981, Keith et al. 2003, Woolaver 2011). By the early 2000s, the species was thought to be restricted to a small population of only a few hundred individuals in Los Haitises National Park in northeast Dominican Republic (Keith et al. 2003; Thorstrom 2005). However, after rediscovering the species on Les Cayemites islands of Haiti in 2019, it was confirmed that the smaller island population included at least 28 adults with eight breeding pairs, suggesting that it had persisted without conservation intervention given its level of isolation and the unlikely event of natural dispersal from the nearest known neighboring extant population (>380 km). Because of its much smaller geographic size, we suspect that Petite Cayemite could support no more than two Ridgway's Hawk pairs. This would suggest, therefore, that Grande Cayemite possessed sufficient habitat to support an isolated population with connectivity to Petite Cayemite (Jean et al. 2023). No Ridgway's Hawks have been documented elsewhere in Haiti besides on Grande and Petite Cayemite since 1962.

In response to extensive field surveys by TPF in 2003-2005 and 2007 and by Woolaver (2011) in 2005-2009, it was determined that the extremely low productivity of pairs meant that the population was not self-sustainable and that more intensive management was required to prevent extinction. By using a combination of approaches as described elsewhere in this action plan including the establishment of additional populations, Ridgway's Hawk abundance has steadily increased from a low of 51 documented adult hawks in 2010 to 439 in 2023 distributed among four locations, but with 77% of those individuals residing within LHNP (Table 2).

3.4.2 Status and population trend

In 1988, the Ridgway's Hawk was listed as Threatened by the IUCN (BirdLife International 2024). Loss of habitat and human persecution led to the species being categorized as Endangered in 1994. Continued alteration of habitat and direct human caused mortality, as well as other factors, led to a steep decline in the population, and a subsequent categorization of Critically Endangered in 2000 and has not changed as of its last assessment conducted in 2020. Based on monitoring data in 2000, the species was estimated to possess a 5-10% annual population decline resulting in a total decline of 80% over three generations (or 24.5 years; BirdLife International 2020). The species is currently listed as Critically Endangered following criterion C2a(i), due to a "small population size and decline", with "an observed, estimated, projected or inferred continuing decline" and a small "number of mature individuals in each subpopulation".

The BirdLife International species account estimated the total population size in 2019 at a minimum of 427 individuals including 322 mature individuals, with an increasing population trend, and an extent of occurrence of 26,700 km^2 (BirdLife International 2024). Further, the IUCN RedList assessment category justification states: "[Ridgway's Hawk] is listed as Critically Endangered because it has a small and fragmented population, which was previously in steep decline. Successful conservation action has now reversed such declines and the species is observed to be increasing throughout both its largest extant population in Los Haitises National Park and additional reintroduced populations [at the time of last assessment in 2020]. If population increases continue, it may be eligible for a downlist in the near future" (BirdLife International 2020).

Table 2. The number of adult Ridgway's Hawks counted at four locations across Hispaniola from 2010 to 2023. The Totals column represents the sum of all sites, or the total number of adult hawks documented by year.

Year	Los Haitises (DR)	Punta Cana (DR)	Aniana Vargas (DR)	Les Cayemites (Haiti)	TOTALS
2010	50	1	0	0	51
2011	72	3	0	0	75
2012	190	5	0	0	195
2013	235	5	0	0	240
2014	250	4	0	0	254
2015	196	16	0	0	212
2016	210	24	0	0	234
2017	250	34	0	0	284
2018	268	38	0	0	306
2019	288	36	0	2	326
2020	268	36	4	3	311
2021	296	40	6	19	361
2022	276	52	10	20	358
2023	340	58	13	28	439

TPF has also completed and submitted for review an IUCN Green Status of Species assessment for Ridgway's Hawk in April 2024. This assessment provided valuable information concerning the progress made toward the species' recovery and potential projected outcomes in terms of additional areas for occupancy based on the species historic distribution and future realistic conservation action. While the Species Green Score from the assessment indicated that the species is Critically Depleted with a score of 17%, it also indicated a high recovery potential with a score of at least 50% of its historic distribution if conservation action continues over the next 100 years, further highlighting its dependence on such efforts (Fig. 3; TPF, unpubl. data). A species is considered "fully recovered", for example, "if it is viable, and ecologically functional, in each part of its indigenous [historic] … range" (i.e. prior to major human impacts; IUCN 2021). For the completed assessment for Ridgway's Hawk, therefore, a Green Score of 17% indicates that the species currently occupies a greatly reduced proportion of its historic range on Hispaniola (see also Fig. 2). However, the species has reacted well to conservation actions and efforts to address identified threats as shown with increased abundance and the establishment of additional populations (Table 2). The projected Green Score of 50% suggests that the species has a good prospect of recolonizing additional areas of its historic range, and even though the species' current extinction risk is high (Critically Endangered), there is strong potential to reduce that risk with continued conservation action. The species' Green Score and recovery potential could be even higher (~70%; Fig. 3) if the species is allowed to expand and occupy additional areas within Haiti, but much uncertainty exists regarding future conservation efforts for the species in that country.

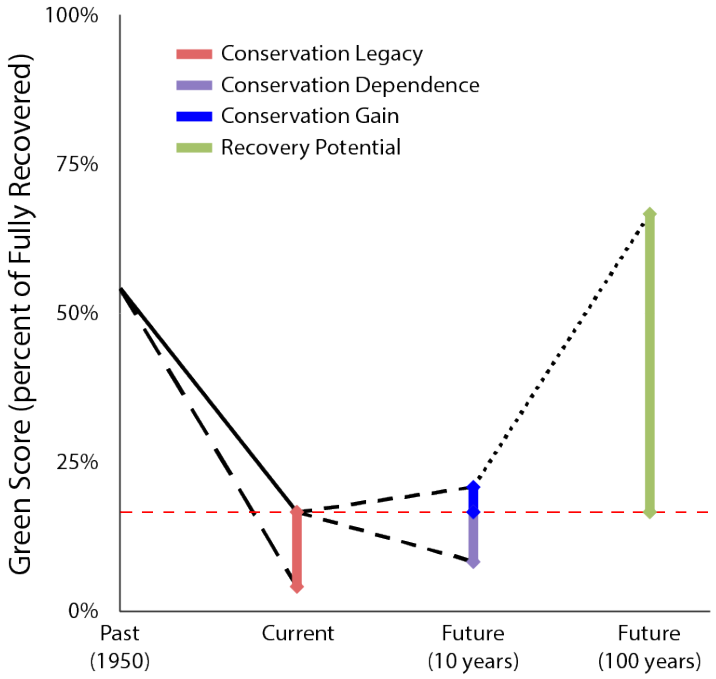

Figure 3. Green Status of Species Scores and conservation metrics (vertical arrows) for Ridgway's Hawks calculated as a percentage of fully recovered based on its historic distribution. Conservation metrics are shown as differences in the species' Green

Scores or states of recovery (solid line, observed change in state of species; dashed lines, changes expected in the absence of past conservation efforts [counterfactual or conservation legacy] and with and without current and future conservation actions over the next 10 [dependence and gain] and 100 years [recovery potential]).

3.5 Habitat

There are twenty-six island nations found in the Caribbean and they are divided into three main groups: The Bahamas Archipelago, the Greater Antilles, and the Lesser Antilles. Substantial variation in the size, precipitation, soil type, and temperature exists across the region and within individual islands leading to a high level of endemism in both flora and fauna. That variety and biodiversity makes the Caribbean an important biodiversity hotspot - one of only 36 in the world (Conservation International 2023).

The island of Hispaniola, located within the Greater Antilles, is one of the largest and most human-populated in the Caribbean. It has the most biodiversity of all the Caribbean islands (Birdlife International 2008) and encompasses the sovereign nations of the Dominican Republic and Haiti, covering an area of 76,192 km^2. There are five major mountain ranges on the island. Hispaniola boasts the highest peak in the Antilles at over 3,000 masl and the lowest point for an island nation at Lake Enriquillo, at around 40 m below sea level. Four discrete ecoregions have been identified on the island, including Hispaniolan Moist Forest, Hispaniolan Dry Forest, Hispaniolan Pine Forests, and flooded grasslands and savannas. Varied temperatures and precipitation influence the habitat types on the island. Further, human activities have created fragmented and degraded forests, agricultural plots, and sugarcane fields. Currently, only 10% of forest cover exists in Haiti, and 40% in the Dominican Republic (Marzelius and Droste 2022).

Historical records indicate that Ridgway's Hawks occurred in most terrestrial habitats on Hispaniola and some satellite islands between sea level to 2000 masl with apparent preferences for mature subtropical wet forest, woodland, and forest edge habitat (Woolaver 2011; Thorstrom et al. 2007).

Wiley and Wiley (1981) identified 10 habitat types for the species, including karst, rain, riparian, hardwood, pine, lowland dry forests, lowland scrub, pasture and agricultural areas, cut-over forests, and marshes. Bond (1971) described Ridgway's Hawk habitat as woods and open country. Los Haitises National Park (LHNP) where most of the hawks are found today, historically was covered in moist rainforest, and loss of this forest type was considered a potential threat to this species' survival (Thorstrom et al. 2007, Woolaver 2011). However, field observations suggest that the species can be described as a habitat generalist. The 74 pairs in LHNP that were surveyed by Thorstrom et al. (2007) and the more than 150 pairs TPF is currently monitoring, indicate that a majority nest within agricultural plots (*canucos*), disturbed forest, and along forest edges, suggesting that the species is tolerant of, or perhaps even favors, the observed forest cover changes if adequate nesting structures and low levels of human persecution exist.

This is further supported by a growing reintroduced population of Ridgway's Hawk in Punta Cana that inhabits an area composed of housing complexes, hotels, rural communities, golf courses, lowland dry forest patches, roads, and beachfront (T. Hayes and R. Thorstrom, unpubl. data; McClure et al. 2017a). This evidence, combined with its sister-taxa relationship with the habitat generalist Red-shouldered Hawk (Mindell et al. 2018) and the potential for shared traits, further supports a high degree of flexibility in habitat use and behavioral tolerance for Ridgway's Hawk (Thorstrom et al. 2007).

Les Cayemites, home to the last known population of this species in Haiti, is composed of two islands. Grande Cayemite (~50 km^2) is characterized by thorn scrub and mid-elevation dry forest and an agroforestry system over limestone karst topography (Wetmore 1932; A. Jean, pers. comm.). Petite Cayemite ranges between 0–60 masl and is much smaller (~1.65 km^2), with maturing secondary forest and very limited agriculture. Some of the coastlines of both islands are densely protected by mangroves (primarily red mangrove (*Rhizophora mangle*). Similarly, a higher density reptile prey base exists for Ridgway's Hawk on Les Cayemites compared to the main island likely because invasive mongooses (*Urva auropunctata*) are absent (A. Jean, unpubl. data; see also Jean et al. 2023), which may have an influence on why Ridgway's Hawk is not known on the mainland near Les Cayemites.

3.6 Home range and dispersal

Wiley and Wiley (1981) estimated the mean territory size (± SD) among three pairs in LHNP to be 57.8 ± 12.9 ha with pairwise distances between nests ranging from 300 to 1000 m (mean ± SD = 727 ± 374 m). These estimates are similar to those obtained by Woolaver (2011) based on 16 to 39 monitored pairs over a five-year period in LHNP with an estimated mean territory size of 33.2 ± 7.1 ha and pairwise nest distance ranging from 199 to 1197 m (mean ± SD = 607 ± 276 m). Pairs remain on and defend their territories year-round with a 91.1% to 94.2% re-occupancy rate based on 19 to 41 territories over a five-year period (Woolaver 2011).

While most juveniles do not disperse far, establishing territories within a few kilometers from their natal territories, on four known occasions juvenile Ridgway's Hawks dispersed over 20 km (TPF, unpubl. data). Two hawks, on two separate occasions, traveled from the release site in Punta Cana to San Rafael de Yuma (>35 km). The first was captured by a community member and died in captivity. The second was rescued by community members after it had been attacked by chickens. It is currently under our care awaiting release. Another hawk released in Punta Cana dispersed approximately 20 km and was found injured by staff at the Hard Rock Resort. She is currently under our care until we determine if she can be released. One juvenile hawk dispersed from the AVNP release site to Masi Pedro (>27 km), where it was shot and killed by a local farmer.

3.7 Ecology

3.7.1 Diet

Woolaver et al. (2013) studied a sample of 22 nests in LHNP, and identified reptiles as being the primary food source, augmented by small mammals, small birds, and arthropods. Although prey diversity in nests was high, lizards and snakes dominated the diet in terms of both frequency (65.5% and 14.4%, respectively), and biomass (50.4% and 18.1%, respectively; Woolaver et al. 2013). Reptiles that feature frequently in the diet are skinks, anoles, tree snakes, and false boas (Woolaver et al. 2013).

In an earlier study, Wiley and Wiley (1981) found that reptiles made up roughly 28% of the prey items brought to the nest, followed by mammals (19.5%), and birds (8.5%). However, based on biomass, mammals (48.1%) accounted for most food delivered, followed by lizards (20.7%), and snakes (17.6%).

More recent nest camera footage shows that hawks also feed on young domestic fowl. This footage showed additional prey species such as woodpeckers, frogs, and bats (TPF, unpubl. data).

3.7.2 Nest Trees

Thorstrom et al. (2007) found 131 Ridgway's Hawk nests over a four year period (2002 - 2005) in 12 species of living trees in LHNP, with half of the nests (n = 69) in Hispaniola Royal Palm trees (*Roystonea borinquena*), and the others in *Sideroxylon foetidissium* (16), *Spondias mombin* (10), *Ceiba pentandra* (6), *Clusia rosea* (6), *Bombacopsis emarginata* (6), *Cocos nucifera* (6), *Sloanea berteriene* (6), *Ficus mitrophora* (3), *Inga vera* (2), and *Cordia alliodora* (1). Over two of those years (2004 - 2005), 62% of nests (99) were built on top of the bulky nest structures of the endemic colonial-nesting Palmchat (*Dulus dominicus*) with 38% located in areas of agricultural activity, 37% in agricultural areas that had been abandoned for 7 to 30 years, 20% in primary and secondary forests, and 4% in pasture (Thorstrom et al. 2007).

Additional nest tree species identified by Woolaver (2011) include *Ficus maxima, Terminalia domingensis, Nectandra coriacea, Tetragastris balsamifera, Sloanea berteriana, Bucida buceras, Guatteria blainii, Margaritaria nobilis, Cecropia peltata, Ziziplms rhodoxylon,* and *Calophyllum calaba*. In Les Cayemites, Haiti, researchers have located nests in mango (*Mangifera sp*.) and gumbo limbo (*Bursera simaruba*) trees (Jean et al. 2023).

4. Threats

Threats were rated based on their scope, severity, and irreversibility following guidelines from the Miradi^{TM} software (http://www.miradishare.org).

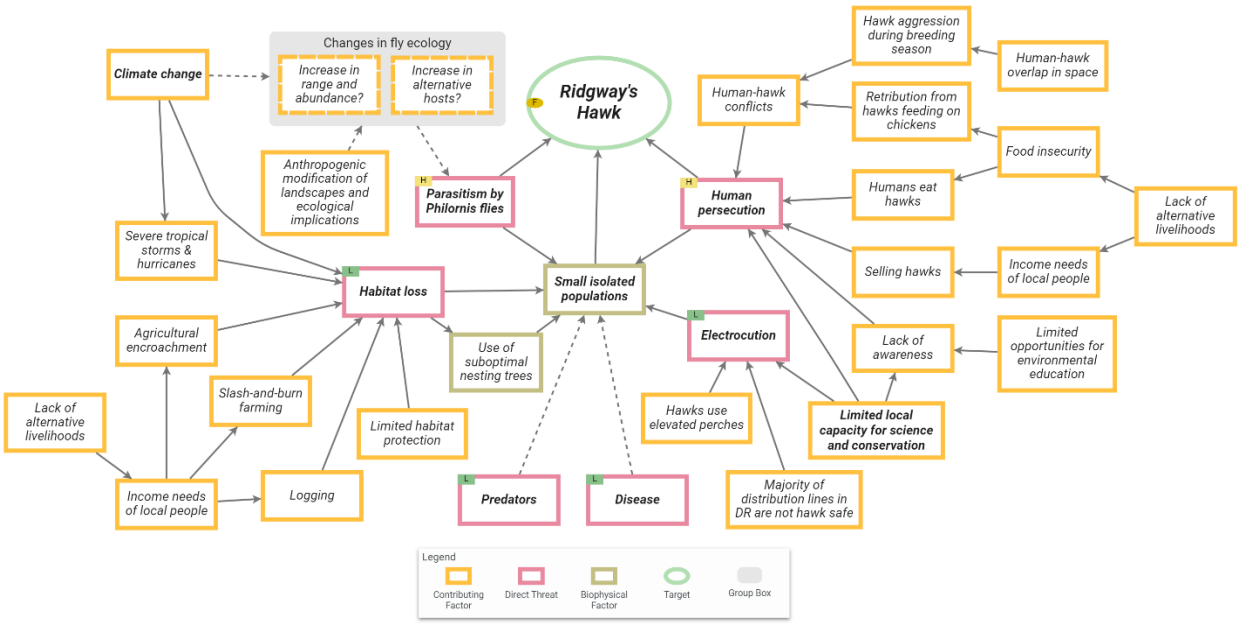

Figure 4. Issues relevant to the long-term viability of wild Ridgway's Hawks, including their underlying causes, as identified by the Ridgway's Hawk Program Leads and Science Team at The Peregrine Fund. Dashed arrows depict uncertain effects. Bolded factors are explained below.

4.1 Major Threats

Threats that have the most significant negative impact on the species, ranked as 'High' or 'Very High' in the summary rating. Ridgway's Hawks are affected by two major threats, parasitism by *Philornis* flies and human persecution, both amplified by an already vulnerable small population size, which we've included as a biophysical factor (Fig. 4). A biophysical factor is one that makes the connection between a direct threat and the conservation target. It does not directly cause the decline of the species, but it is central to the issue, with many identified threats contributing directly to it.

4.1.1 Parasitic Nest Flies Limit Breeding Productivity

There are approximately 50 species of parasitic muscid nest flies of the genus *Philornis*, that are found throughout the Neotropics, of which all but two are obligate larval parasites of nestling birds (Dudaniec and Kleindorfer 2006; McNew and Clayton 2018). Adult flies rely on an avian host for their larvae development. They lay their eggs in the nests and on nestlings of a variety of avian species. Upon hatching, larvae of most of the parasitic species burrow beneath the flesh of nestlings and consume their blood

until they pupate and emerge as adult flies. *Philornis* infestations have been documented in roughly 250 species of birds (Quiroga et al. 2020) and have had detrimental effects on breeding productivity and nestling development on many of these. The overall effect of *Philornis* parasitism on host fitness depends on several factors including the level of nestling infestation and body location (Arendt 1985; Koop et al. 2011; Knutie et al. 2016), the timing of infestation relative to nestling development (Kleindorfer et al. 2014), parental provisioning and nest attendance (O'Connor et al. 2014; Kleindorfer et al. 2021), and environmental conditions (Dudaniec et al. 2007; Antoniazzi et al. 2011; McNew et al. 2019). Though *Philornis* primarily parasitize nestlings, there are cases of parasitism in adult birds, often females which are likely parasitized during incubation (Quiroga et al. 2020).

In some cases, such as on the Galapagos Islands, introduced *Philornis downsi* has been identified as the main cause of nest failure for the Critically Endangered Darwin's Medium Tree Finch (*Camarhynchus pauper*), while Galápagos Mockingbird (*Mimus parvulus*) nestlings were more likely to survive heavy parasite loads with increased begging and parental food provisioning behavior (Knutie et al. 2016). In a separate system in the Caribbean, researchers documented a 75% mortality rate of endemic and Endangered Puerto Rican Sharp-shinned Hawk (*Accipiter striatus venator*) nestlings due to infestations by a *Philornis* species (Delannoy and Cruz 1991).

The genus *Philornis* was first described in 1853 when *P. pici* (Macquart 1853) was discovered on Hispaniola. Although this suggests that *Philornis pici* is native to the island and that Ridgway's Hawk had likely evolved with this parasite, it is not known whether human-caused environmental changes such as deforestation, introduction of livestock or other non-native species, or changes in weather patterns due to climate change have caused *Philornis* to increase in numbers and thereby increase their negative impact on the survival of nestling Ridgway´s Hawks (but see Hayes et al. 2021). Three additional *Philornis* species (*P. portreri, P. querula, and P. glaucinis*) have also been identified to parasitize Ridgway's Hawk nestlings (M. Quiroga, unpubl. data) and it is not known whether they affect their hosts differently. *Philornis* infestations have also been documented in other endemic species in Dominican Republic including Hispaniolan Woodpecker (*Melanerpes striatus*) and the Palmchat (*Dulus dominicus;* Wiley and Wiley 1981, Woolaver 2011).

In 1976, Wiley and Wiley (1981) reported a nestling Ridgway's Hawk being parasitized by *Philornis pici*, with a total of six larvae located in its body. This nestling apparently survived. Woolaver (2011) reported that *Philornis pici* parasitism was the cause of 11.7% of known nest failures for Ridgway's Hawk during his study in LHNP, in which more than half (56%) of the nestlings he observed had been parasitized. More recent research in LHNP has identified much higher rates of infestations with 59 of 66 Ridgway's Hawk nestlings (89%) and 39 of 42 nests (93%) parasitized, resulting in 45 of 50 nestling mortalities (90%) attributed to *Philornis* (Hayes et al. 2021). It is not known if the apparent increase in the rate of *Philornis* infestation over the past several decades is real or an artifact of increased survey efforts for the parasite on nestlings, or a potential additive effect, as mortality due to human persecution subsides. Additional

research is warranted to determine the factors that influence *Philornis* infestation rate and frequency with the species.

4.1.2 Human Persecution

Direct persecution by humans is one of the major threats to the survival of adult Ridgway's Hawk and is an important cause of nest failure (Thorstrom et al. 2007, Woolaver et al. 2014). Human communities perceive the hawk (and other raptors) as a threat to their chickens and shoot them. For example, one person living near Los Haitises National Park claims to have killed more than 100 hawks in his lifetime. Although predation on small domestic fowl does occur, Ridgway's Hawks more often prey on other species such as lizards, snakes, and rats. Though rarer, hawks (adults and young) are also killed for human consumption.

Human disturbance during the breeding season caused 61% (n=51) of all known nest failures between 2005 and 2009 (Woolaver et al. 2014). Overall, human persecution has a drastic impact on the species and has likely been the primary reason that the hawk is so endangered. Unlike other neotropical raptors that use hardwoods for nesting, the Ridgway's Hawk primarily nests in royal palm trees. This is likely a recent adaptation to the continued loss of native hardwoods from unabated cutting and burning of the forest for agriculture (Woolaver et al. 2014). In Haiti, the belief that Ridgway’s Hawks bring drought causes farmers to cut down large trees that are used for nesting by this species. Raptors, and other bird species, are also captured for pets or to be sold via illegal animal trade.

4.1.3 Small and Isolated Population

Island endemic species are often more vulnerable to extinction due to their limited ranges and distribution, relatively small population sizes, and low genetic diversity (Jamieson 2007). Human encroachment on their habitat and persecution only exacerbates those risks. Additionally, top predators, such as birds of prey, are generally more susceptible to anthropogenic threats - often being the first to disappear from ecosystems (Sergio et al. 2008).

The Ridgway's Hawk, an island endemic and the top predator within its ecosystem, was once found across the island. The species declined markedly in the early 1900s. By the 1960s it was believed to have been extirpated from Haiti, and by the early 2000s only one known population remained. This population in LHNP, Dominican Republic, was estimated to be only a few hundred individuals (Thorstrom et al. 2005). Although this park is technically a protected area, it has a volatile history with changing boundaries, slash-and-burn farming, and human settlements.

Small and isolated populations are at greater risk of extinction due to their small population size and reduced genetic diversity, which can negatively impact fitness and the ability to adapt to a changing environment (Evans and Sheldon 2008; Kardos et al. 2021). Woolaver et al. (2013) documented high pairwise relatedness among four of

seven sampled Ridgway's Hawk breeding pairs and that the species appeared to have experienced a recent genetic bottleneck based on an excess of heterozygous individuals than expected. Further, of the four breeding pairs with high pairwise relatedness, their hatching success was lower (63%) compared to the other two unrelated pairs (100%) suggesting inbreeding depression (Woolaver et al. 2013). While based on a small sample size, lower hatching success is often observed among bird species that have experienced recent bottlenecks (Heber and Briskie 2010) and/or threatened with extinction (Marshall et al. 2023).

The species' isolation also makes it highly vulnerable to extinction from a number of additional factors, including disease, human persecution, and natural disasters, such as hurricanes, which are a frequent occurrence on the island. Although TPF's conservation efforts have resulted in the species occurring in a total of four locations on Hispaniola, the population in LHNP is still the largest population of Ridgway's Hawk (Table 2) and serves as the source population for reintroduction efforts (e.g., McClure et al. 2017a). Increasing the number of locations and connectivity between areas through genetic rescue would help buffer against extinction (Hufbauer et al. 2015; Fitzpatrick et al. 2020; Ralls et al. 2020; Kardos et al. 2021).**4.2. Minor Threats**

Threats that have a lower negative impact on the species, ranked as 'Medium' or 'Low' in the summary rating.

4.2.1 Habitat Loss

Loss of habitat from unregulated and haphazard agricultural encroachment, slash-and burn farming techniques, and cutting of native timber trees from protected areas and private lands is a significant conservation problem in the Dominican Republic, though not as severe for the adaptable Ridgway's Hawk.

Haiti covers 27,750 km^2 and has a population of over 11,000,000 inhabitants. It has a tropical climate, with elevational differences creating a variety of different vegetation types and habitats. Dry forest, scrub, montane forest, wetland, coastlines and more make up a mosaic of habitats across the country. Haiti is the poorest country in the Latin America/Caribbean region and one of the poorest nations in the Western Hemisphere (World Bank 2022). A large percentage of the population relies on subsistence agriculture and the harvesting of trees for charcoal. Destruction of habitat and deforestation are widespread across the country and in many areas, desertification is occurring (BirdLife International 2008). In the mid-1920s, Haiti still had approximately 60% of its forest cover remaining (BirdLife International 2008), but today only 10% remains and is highly fragmented (Marzelius and Droste 2022) with only 1% consisting of primary forest (Hedges et al. 2018). Haiti has a network of four protected areas that together cover around 25,000 hectares or 1% of the country's total landmass (BirdLife International 2008). However, additional protected areas have been proposed.

The Dominican Republic covers 48,442 km^2 (⅔ of the island of Hispaniola) with a human population of nearly 11,000,000 inhabitants. Four main mountain systems

dominate the topography, including Cordillera Septentrional, Cordillera Central (Massif du Nord in Haiti), Sierra de Neiba (Montagnes du Trou d´Eau in Haiti), and Sierra de Bahoruco (Massif de la Selle in Haiti). This topography has allowed for the formation of the most voluminous rivers in the Caribbean: Yaque del Norte, Yaque del Sur, Yuna, Camú, and Nizao (Perdomo and Arias 2009). A wide range of habitats and ecosystems make up the nation's landscape including coastline, wetlands, dry pine and broadleaf forests, arid zones, scrub, and savannas. There are roughly 86 protected areas (or approximately 25.4% of the nation's land area) (Perdomo and Arias 2009). However, these areas are vulnerable to human encroachment and have limited effective protection. Over the past century, the Dominican Republic has suffered major changes to its natural landscape, mainly due to anthropogenic factors, which are having a deeply negative impact on the native wildlife and the humans that depend on access to natural resources. Roughly 40% of the land surface is still forested (Marzelius and Droste 2022), with some loss continuing.

As deforestation and forest fragmentation continue, top predators such as Ridgway's Hawks and other raptors, some of which need large areas of connected forest for dispersal, are negatively affected (e.g., Miranda et al. 2021). Impoverished people from local communities who are generally highly dependent on the ecosystem services that forests provide are also most severely impacted once those forests become degraded due to deforestation (FAO and UNEP 2020). Because deforestation also contributes to an increase in atmospheric CO_2 and warmer temperatures that further exacerbates global climate change, forest destruction further impacts the sustainable development prospects of the human communities on the island (e.g., Reyer et al. 2017).

Conversion of forest to agricultural plots and pastures has been perceived as a threat to Ridgway's Hawk (Thorstrom 2007), but the species is likely more flexible in habitat use than previously thought, as evidenced by the species' growing population in Punta Cana, an area of human residences and golf courses (McClure et al. 2017a). Additional study is warranted to explore how productivity may differ among breeding pairs across habitat types. Overall survival of released juveniles in Punta Cana was similar to wild reared Ridgway's Hawks in LHNP, suggesting that habitat was not limiting between areas (McClure et al. 2017a). However, no formal analysis has been conducted to determine whether productivity differs according to habitat type or quality at the individual nest level in areas where Ridgway's Hawk are currently known to breed.

Though palm trees provide the hawks with relatively abundant adequate nesting sites in the absence of hardwood trees, they also pose a risk to nesting success. Palm fronds peel away from the trunk, eventually falling to the forest floor. If palm fronds that form the main support for a nest begin to fall, the nest material may begin to separate. Eventually, the entire nest or parts of it may also fall to the ground. If this occurs during critical nesting stages – when there are eggs or very young nestlings – there is little possibility that those birds will survive without conservation intervention.

4.2.2 Electrocution on Power Poles

Throughout the world, power distribution lines and associated infrastructure pose a serious threat from electrocution and collision for many bird species, especially large raptors that perch or nest on the structures (Eccleston and Harness 2018; Slater et al. 2020). Only in the past few decades have power line engineers begun to take notice, and now, with increasing awareness, efforts to mitigate the problem are starting to be implemented by addressing power pole design and placement to reduce electrocution risk to wildlife (APLIC 2006; Slater et al. 2020).

In 2011, TPF confirmed that several Ridgway's Hawks released in Punta Cana had been electrocuted on hazardous power poles (Dwyer et al. 2019). Additional species of birds including Turkey Vulture (*Cathartes aura*), Red-tailed Hawk, Peregrine Falcon, American Kestrel (*F. sparverius*), Osprey (*Pandion haliaetus*), Great Blue Heron (*Ardea herodias*), and Yellow-crowned (*Nyctanassa violacea*) and Black-crowned Night Herons (*Nycticorax nycticorax*) were also found electrocuted below hazardous poles. While tracking Ridgway's Hawks in Punta Cana, TPF field biologists also found several smaller species such as White-winged Doves (*Zenaida asiatica*), Smooth-Billed Anis (*Crotophaga ani*), and Northern Mockingbirds (*Mimus polyglottos*) below power poles that showed evidence that they had been electrocuted (unpubl. data). It is not known if power poles elsewhere on Hispaniola are also hazardous to wildlife, but significant concern exists because the same power pole construction design known to result in high wildlife mortality in Punta Cana (i.e., grounded concrete poles with metal crossarms) have been used frequently throughout the island.

4.2.3 Predation

Though there are relatively few predators on the island, feral cats and the introduced Indian Mongoose (*Herpestes auropunctatus*), as well as large boas, are capable of killing young hawks and some owls may prey on young in the nest. Harassment by White-necked Crows (*Corvus leucognathus*), which may prey on eggs and nestlings, may also reduce productivity (Thorstrom et al. 2005).

4.2.4 Disease

West Nile virus has been found in resident birds in LHNP (Komar et al. 2003), and this may pose an additional threat to Ridgway's Hawk, since it is known to negatively affect raptor species disproportionately (Wünschmann et al. 2004; Vidaña et al. 2020). Additionally, the number of avian influenza outbreaks in animals is increasing worldwide (Szablewski et al. 2023) and may soon become a growing threat to raptors in the Caribbean through transmission of highly pathogenic strains from migratory birds (Ramey et al. 2022). Susceptibility to avian influenza appears to vary among species, but raptors in general do appear at elevated risk to mortality once infected (e.g., Shearn-Bochsler et al. 2019; Ringenberg et al. 2023). The first occurrence of the highly pathogenic avian influenza (HPAI) virus in the Caribbean was in 2023 among both wild

and domestic birds at a zoological park in Cuba (WOAH 2023), but to our knowledge, the virus has yet to be reported on Hispaniola.

4.3. Important contributing factors

Factors that play a significant role in driving more than one threat. Often viewed as entry points for conservation actions.

4.3.1 Limited Local Capacity for Science and Conservation

Conservation initiatives are most successful when led by local individuals and institutions. These entities contribute greatly to these efforts using local knowledge, cultural norms, and traditions. However, in some areas, lack of financial resources, experience, or scientific knowledge can be limiting factors in the successful execution of conservation. Within the larger cities, such as Santo Domingo, there are opportunities for studying biology and other related topics in an educational setting. However, rural areas, often those closest to protected areas or other important biodiversity hotspots, lack opportunities for higher education or training in skills needed to carry out scientific research or conservation actions.

In Hispaniola, and throughout much of the Caribbean, little research or conservation work is being carried out on birds of prey. On Hispaniola, to our knowledge, FPRD and the Haitian conservation NGO ACSEH are the only organizations working directly to conserve diurnal raptors.

4.3.2 Climate Change

Researchers have shown a strong positive correlation between the intensity of tropical storms and hurricanes with sea-surface temperatures in the north Atlantic and agree that climate change is a major factor influencing those patterns; however, consensus on its influence on the frequency of such storms has not been met (Méndez-Tejeda and Hernández-Ayala 2023). Recent studies also indicate that the observed increase in extreme rainfall events associated with hurricanes is enhanced by climate change and continued warming will lead to further increases in hurricane season extreme rainfall rates and accumulated amounts (Reed et al. 2022). Because Hispaniola is prone to hurricanes, Ridgway's Hawk has and will continue to be exposed to such extreme weather events. While there is no direct evidence that hurricanes have contributed to declines in the Ridgway's Hawk, they have dramatically impacted other raptor species in the Caribbean (Gallardo and Vilella 2017; McClure et al. 2023b) and coastal Central America (Martínez-Ruiz and Renton 2018). Increasing abundance and the number of populations, including their eventual connectivity, will increase the species' resilience to survive hurricanes and tropical storms.

Similarly, climate change scenarios are also projected to influence Hispaniola in terms of its hydroclimate with an increased frequency and severity of longer durations of drought (Herrera et al. 2020). This change will impact annual mean precipitation and

surface soil moisture, thereby influencing not only habitat availability for Ridgway's Hawk directly, but also enhance indirect drivers such as additional stressors on human food security (e.g., Herrera et al. 2018) that will likely further impact habitat for the species and a potential for increased persecution.

5. Past and Present Conservation Efforts

TPF began studying the status of Ridgway's Hawk in 2002, when staff and local biologists searched for the species in areas of historical record within Los Haitises, Sierra de Bahoruco, and Sierra de Neiba National Parks, as well as in Cambita and Los Cacaos. We found Ridgway's Hawk only in LHNP. In 2005 and 2007, we continued surveys within LHNP to locate additional pairs, individuals, and territories, and estimated the total population size to be around 250-300 individuals. Extremely low productivity of pairs in this last stronghold of the species meant that the population was not self-sustaining. Identified threats included human persecution, infestation of young by parasitic nest flies (*Philornis sp*), and habitat destruction, including slash-and-burn agriculture. To mitigate these threats, we began a program to conserve the last known remaining stronghold of Ridgway's Hawks in LHNP, expand the species' distribution and abundance, and develop local interest and capacity for sustainable conservation. Continued to this day, our efforts incorporate scientific research, nest management and monitoring to increase species abundance, reintroductions to expand the distribution, and local capacity development, community engagement, job opportunities, and environmental education to decrease human persecution.

5.1 Nest Monitoring and Management

The Peregrine Fund (TPF) and Fondo Peregrino Republica Dominicana (PFRD) have intensively managed Ridgway's Hawk populations in LHNP since 2011 and the re-established populations in Punta Cana and AVNP since 2013 and 2021, respectively, in an effort to increase productivity of pairs and increase abundance. Nest monitoring and management takes place between January and July each year during the Ridgway's Hawk nesting season. The work is currently accomplished by six teams of Dominicans, each consisting of 1 team leader and 3-4 field technicians, most of which are working in their communities of origin. Early in the season, the teams monitor known hawk territories to locate as many pairs and their nests as possible. Active nests are then monitored approximately once a week throughout the nesting period. New pairs are sometimes found during these surveys, or are reported by locals, and then confirmed by our teams. Nestlings from all accessible nests are banded prior to fledging to inform viability estimates. Nest management is focused on treating nests with an insecticide to reduce *Philornis* parasitism.

In 2012, with guidance from Dr. Linenberger at Habitat Veterinary Hospital in the US, TPF/FPRD field biologists experimented with several methods for treating *Philornis* infestations including Carbaryl (broad-based insecticide found in Sevin), diatomaceous earth, and Ivermectin (anthelmintic insecticide). These methods proved to be ineffective

under the field conditions, time-consuming, and difficult to confirm as harmless to the nestlings. In 2013, the National Zoological Park's Conservation and Science team in the Dominican Republic joined the effort, carrying out several initial trips in order to recommend an effective treatment against ectoparasites (Núñez and Hayes., unpublished data). In this way, the use of Fipronil (broad-based insecticide found in Frontline® Spray) was implemented, through topical application. This treatment had been previously implemented on other raptors at the National Zoological Park, with no evidence of side effects for the birds. Application of the product directly to the apteria (areas of bare feathers in chicks and adults) and under the wings (from the armpits to the digits) was recommended (Núñez and Hayes, unpublished data). Blood samples were collected to compare if there was any variation within the blood chemistry values before and after treatment with Fipronil, with clinically normal results, without significant changes (Núñez and Hayes, unpublished data).

While the treatment of nestlings was effective in controlling *Philornis* infestations of Ridgway's Hawks, it was extremely labor intensive for our team and created stress on the adults and nestlings each time we accessed the nest. In 2015, TPF/FPRD initiated a collaboration with Dr. Martin Quiroga, an ornithologist who specializes in studying the relationship between birds and nest flies (*Philornis spp*.). This collaboration continued through 2020, during which time a new treatment method was developed using the insecticide permethrin (PermaCap). The new treatment consisted in spraying the nest once against *Philornis* infestation, approximately 10 days prior to eggs hatching, and has resulted in a significant reduction in project cost and effort and reduced nest disturbance. Treatment with PermaCap has increased productivity by threefold compared to untreated nests (TPF unpubl. data).

5.2 Reintroductions

To increase the species' distribution and abundance, TPF/FPRD initiated two multi-year reintroduction projects in 2008 and 2009 in Loma la Herradura and Punta Cana, respectively (Table 3), using LHNP as the source population for young hawks. Loma la Herradura and Punta Cana are located ~48 km to the east and ~130 km to the southeast of LHNP, respectively.

Over a five-year period, a total of 20 hawks were released at the Loma la Herradura site, but we stopped after 2012 because TPF/FPRD observed a much higher human persecution rate compared to what was observed with a similar number of hawks released at Punta Cana.

At Punta Cana, between 2009 and 2017, a total of 127 young hawks were released. Initial releases consisted of 3-6 birds per year and approximately 25-31 young hawks per year starting in 2014. Punta Cana's first wild pair of hawks produced young in 2013. As of 2023, there are a total of 28 pairs in Punta Cana and second and third-generation hawks are producing young, with over 130 wild fledglings documented to date.

In 2018, AVNP was identified as a good location to initiate a third release site. Based on experiences in Loma la Herradura, TPF/FPRD initiated an environmental education and community engagement program to gain support and local approval prior to beginning releases in the area. Community participation is essential to reduce persecution of Ridgway's Hawks by the local communities. This resulted in increased awareness and support prior to initiating releases. The release of 25 young, translocated Ridgway's Hawks from LHNP began in AVNP the following year. Due to the Covid-19 pandemic, releases in 2020 were suspended, and then 25 young hawks were again released per year between 2021 and 2023. A total of 4 pairs have so far been documented in the area with the first documented nest fledging two hawks in 2022. TPF/FPRD plan to continue translocating Ridgway's Hawks from LHNP to AVNP until a robust breeding population is established.

Table 3. Number of Ridgway's Hawk juveniles translocated from Los Haitises National Park to three release sites in the Dominican Republic between 2009 to 2023.

	Years of active releases	Males	Females	Totals
Punta Cana	*2009-2017*	62	65	127
Aniana Vargas	*2019; 2021-ongoing*	52	47	99
Loma La Herradura	*2008-2012*	8	12	20
TOTALS		**122**	**124**	**246**

5.3 Human Persecution of Hawks

After several reintroduced hawks were found shot in communities around the Punta Cana and Loma La Herradura release sites, TPF/FPRD began an intensive education program in 2013 in 12 communities. Through surveys, TPF/FPRD identified that people targeted raptors for four main reasons: 1) hawks prey on chickens, 2) hawks are aggressive towards people during the nesting season, 3) people harvest them to eat, and 4) people trap them for pets or trade.

This information has guided the development of methodologies that enabled TPF/FPRD to target specific knowledge gaps or concerns and address issues in a way that is effective and culturally appropriate. The results have been used to design presentations, classroom activities, brochures, and teacher training manuals for targeted communities to focus on the cultural importance of Ridgway's Hawk and how the species' persistence benefits their community.

Activities employed by TPF/FPRD include making door-to-door visits to increase knowledge and positive attitudes and influence positive actions towards hawks by building trust and camaraderie between program staff and local community members. TPF/FPRD has found that people often feel more comfortable asking questions in those

settings and express concerns about the hawk, with this approach being the most effective way of building trust between staff and community members. TPF/FPRD staff members have experienced several cases of positive changes in people's actions towards Ridgway's Hawks, thanks to those efforts.

TPF/FPRD and partners present in schools and communities and Ridgway's Hawk Day Celebrations with Ambassador Hawks to help people create a deeper connection with birds of prey through one-on-one contact with raptors. These programs include live hawk presentations, art, games, and other activities.

TPF/FPRD and partners lead training workshops to build local capacity for future generations to conserve and teach about the Ridgway's Hawk. Those workshops include participants such as schoolteachers, field technicians from the Ministry of the Environment, students, and community leaders that are provided the necessary tools to carry out environmental education in their communities and classrooms, including conservation-based lessons that use raptors to teach math, language, art, and even physical education. Participants also receive training in environmental education techniques and methods, such as how to develop a guided nature walk, how to give a presentation, how to speak about sensitive issues one-on-one with community members, and how to utilize available materials to create fun and dynamic learning experiences for their target audiences. They also learn about Ridgway's Hawk and other raptors, food chain biology, threats to wildlife, and possible conservation solutions. To our knowledge, TPF/FPRD provides the only conservation-themed workshop for public school teachers in the country.

Since the project began, TPF/FPRD and partners have reached more than 25,600 individuals through direct education programs that have resulted in positive changes in people's attitudes and actions toward raptors and specifically the Ridgway's Hawk. Ultimately, this approach is used to motivate a change in actions towards birds of prey through these knowledge gains and attitude changes, and by working with local communities to collaboratively design solutions to mitigate human-raptor conflicts and creating an environment where humans and raptors thrive together.

For example, in cases where Ridgway's Hawk (or other raptors) are preying on domestic fowl, TPF/FPRD provides free chicken coops. Field staff also advise people to keep chicks in the coops until they are two to three weeks old. At this age they are large enough that predation by a Ridgway's Hawk is unlikely. This not only prevents the loss of their poultry by Ridgway's Hawk, but also prevents predation by other predators. Upon receiving the coops, recipients sign a form promising not to kill or harm Ridgway's Hawks or other raptors, and not to maintain wild animals in captivity, while agreeing that the coop is to be used only to house domestic fowl.

5.4 Community-Based Conservation

Since 2002, TPF/FPRD has helped to improve the livelihoods of several members of communities in and around LHNP. Individuals receive on-the-job training and full-time,

part-time, or seasonal employment, allowing them to make their living or supplement their income in conservation and research projects.

In 2023, a total of 28 local field technicians worked with TPF/FPRD and partners. In addition to hiring employees to work directly with the conservation effort, other local individuals are employed to help with the crew's daily tasks, including water collection, cooking, sewing, and providing transportation. These small jobs have a significant impact on the local economy of small, impoverished communities and are appreciated by the local people. Hiring residents to work in conservation has also removed at least a few individuals from their dependence on subsistence agriculture inside LHNP - an additional step to prevent deforestation in this protected area.

Field technicians are trained in several skills which will be useful to them throughout their careers: nest climbing, banding birds, treating for parasitic nest fly infestations, recording data, use of GPS, computer data entry, and leadership skills. They also have opportunities to teach during community workshops, give presentations, and learn other education-related skills.

5.5 Retrofitting Power Lines to Prevent Electrocutions

In 2011, TPF/FPRD and Fundación Grupo Puntacana began working to reduce electrocution risk for Ridgway's Hawks in Punta Cana. From 2012 - 2014, Grupo Puntacana placed wooden perches on power poles directly above the energized crossarms where birds had been electrocuted. These perches offered an alternative safe perch where birds could sit without being electrocuted. In July 2014, Rick Harness of EDM International (www.edmlink.com), an expert in mitigating avian electrocution, visited the area and determined that the power pole configurations used in the area, which were mainly concrete poles with metal cross arms, were extremely hazardous for birds due to their increased risk of electrocution. These types of poles are used throughout the Dominican Republic, likely due to the materials' ability to withstand the harsh environment.

As a result, TPF/FPRD, EDM International, and Fundación Grupo Puntacana collaborated with the local power company to purchase and install over 200 phase covers to retrofit poles in the immediate release area for Ridgway's Hawk in Punta Cana. This accomplishment has not only reduced Ridgway's Hawk mortality caused by electrocution (Dwyer et al. 2019) but has also benefited many other bird species that frequently use the power poles as perches. Encouragingly, the local power company continues to retrofit hazardous power poles to reduce electrocution risk to birds and other wildlife at their own cost.

5.6 Supporting Our Partners in Haiti

In 2007, a young, Haitian biologist, Anderson Jean, visited our project in LHNP. He went into the field with our biologists and learned to search for and identify Ridgway's Hawks. Twelve years later, in 2019, Anderson, together with other local biologists, rediscovered

Ridgway's Hawk on Les Cayemites island in Haiti (Jean et al. 2023). The following year, a TPF biologist joined Anderson and his team, where they located three hawks. To date, 28 individuals have been documented on Les Cayemites, including successful nesting attempts and the first nestlings banded in 2023. We continue to support the efforts of the Haitian biologists through funding, training, equipment, and educational materials in Haitian Creole.

6. Information Needs

Over the past 20+ years, we, along with other researchers, have gained valuable information about the biology and ecology of the Ridgway's Hawk. Information on diet, breeding ecology, and major threats has allowed us to design and implement highly effective conservation strategies that have resulted in great success for the conservation of species. However, some important information is still needed for us to have a more complete picture of the species' needs, status, and behaviors, in order to adapt our program approaches for the long-term sustainability of this species and conservation on Hispaniola. Activities addressing these needs are included within the action plan.

6.1 Accurate Estimate of Population Size

An updated comprehensive population size estimate is needed that includes areas that are not actively managed within and near each of the four known extant subpopulations, including areas on the main island nearest to Les Cayemites in Haiti. While still informative, current estimates should be considered minimum population levels. These estimates are derived from non-probabilistic nest surveys and do not fully capture the necessary information for an accurate estimate of population size. Formal probabilistic surveys should be conducted using methods that account for differences in detectability including those that quantify non-breeding individuals. Each of the four subpopulations are of differing size, which can influence responses to ongoing stressors in their immediate environments, and therefore, their accuracy is important to further inform and prioritize management concerning best practices specific to each subpopulation.

6.2 Habitat Preference

Historic survey records indicate that the species was found throughout much of Hispaniola in a wide variety of habitat types, but mainly in mature wet forests, woodlands, and forest edge habitat ranging in elevation from sea level to 2,000 masl. More recent surveys conducted during the breeding season, specifically in LHNP and Punta Cana, suggest that Ridgway's Hawk may be more tolerant of habitat modification than previously thought. They have been found nesting in more human-altered habitats, including degraded forest fragments, active and abandoned agricultural areas, pasture lands, and even in more urbanized landscapes that include manicured lawns, shopping

centers, and golf courses. Breeding Ridgway's Hawks have fledged nestlings in many of these different habitat types, but a formal analysis is still lacking to determine if productivity, and therefore quality, differs among specific habitat types. Having a better understanding of the optimal habitat needs of Ridgway's Hawk would provide the necessary information to more effectively identify and ensure the availability of suitable habitat for the species.

6.3 Dispersal Within Subpopulations

A large proportion of the Ridgway's Hawk population in the Dominican Republic has unique alphanumeric color-coded metal bands on their lower legs to aid in their identification, for monitoring nest site productivity, turnover, and movement patterns. To date, the collection and analysis of band return data for gauging dispersal distances has been opportunistic when, for example, banded individuals are recovered after being trapped or shot and then reported to our field crew or partners. From those cases, we know that juveniles can disperse away from the managed areas with distances as far as 35 km from where they were banded as nestlings. A more concerted effort to resight banded hawks along with more formal analyses are needed to obtain a better understanding of the dispersal patterns of Ridgway's Hawk within and among each of the subpopulations. To our knowledge, no individuals have been documented dispersing between the four known subpopulations.

6.4 *Philornis* Ecology and Infestation

With the effective treatment and reduction of *Philornis* abundance by 89% in Ridgway's Hawk nests followed by an increase of up to 3x the number of fledglings per nest, there is little doubt that the parasite has had a major impact on the species' ability to persist in recent years (Hayes et al. 2019; Hayes et al. 2021). We suspect, however, that *Philornis pici*, the most prevalent *Philornis* species to infect the Ridgway's Hawk, has been parasitizing the hawk for over 150 years, since it was first described on Hispaniola in 1853 (Macquart 1853). What is not known is if the parasite has increased in abundance over this same period, resulting in a concurrent change in its overall impact on Ridgway's Hawk's demographics. It is further unknown to what degree its associations with other bird species, including introduced species, may have altered its distribution or abundance. In fact, very little is known about *Philornis* ecology in general, and much work is needed to better understand how its environment influences its abundance across all stages of the parasite's life cycle.

The limited research that has been done investigating *Philornis* ecology in the Dominican Republic suggests that changes in vegetative cover may influence *Philornis* parasitism abundance among Ridgway's Hawk nestlings. Hayes et al. (2021) found an inverse relationship between percent grass-cover near Ridgway's Hawk nests in LHNP and *Philornis* abundance among parasitized nestlings, whereas other vegetation-

associated variables in their analysis had no correlated effect with parasitism. The researchers speculated that the level of humidity may also play an important role in influencing *Philornis* abundance, with areas that possess more grass having lower relative humidity and fewer *Philornis* than forested or shrub-covered areas (Hayes et al. 2021; see also Wiedenfeld et al. 2007; McNew and Clayton 2018). Another possible explanation that the researchers proposed was that the areas with higher proportion of grass may provide less cover from predation and food for *Philornis* adults, thereby reducing their abundance and impact on their potential hosts (Hayes et al. 2021).

Interestingly, previous field surveys had suggested that Palmchats (*Dulus dominicus*), a small passerine endemic to Hispaniola that occupies the same elevation gradient and habitat as Ridgway's Hawk, could serve as a reservoir host allowing for a greater abundance of *Philornis* within the local environment. Palmchats nest in large colonies and their nestlings are also often parasitized by *Philornis* (Wetmore and Swales 1931; Hayes et al. 2019, 2021). However, despite observing 36 of the 42 (86%) Ridgway's Hawk nests being constructed on top of concurrently used Palmchat nests, the association was not correlated with *Philornis* parasitism among hawk nestlings (Hayes et al. 2021). Having a high proportion of associated nests in their study may have also resulted in a low power to detect any correlation between palmchat nests and *Philornis* parasitism abundance. Interestingly, *Philornis* parasitism has not been found in the Haitian subpopulation yet, albeit from a small sample of nests. So far, breeding pairs have been observed building nests in gumbo limbo (*Bursera simaruba*) and mango (*Mangifera indica*) trees, as opposed to using Palmchat nests. Additional study is warranted using larger sample sizes to investigate if any interaction between percent grass-cover and Palmchat nesting prevalence may help explain *Philornis* parasitism abundance and prevalence among Ridgway's Hawk nestlings.

Multiple *Philornis* species are known to infect Ridgway's Hawk and other bird species in Hispaniola (M. Quiroga, unpubl. data), but their abundance may be more dependent on the population dynamics of specific host species as shown elsewhere (Manzoli et al. 2021). Host specificity, however, can vary depending on the *Philornis* species (McNew and Clayton 2018). While Ridgway's Hawk is unlikely to be the parasites' preferred host given its historic low abundance, the parasites' overall impact on its ability to persist has likely been magnified with its population decline and fragmented distribution (e.g., McCallum and Dobson 1995; Heard et al. 2013). Additional research is needed to determine how *Philornis* nestling parasitism impacts Ridgway's Hawk population dynamics as it continues to increase in population size. This information is important to help prioritize management and gauge the application and frequency of nest treatment against *Philornis* infestation depending on its predicted impact on Ridgway's Hawk population growth and viability.

7. Framework for Action

7.1 Vision

We envision a stable self-sustaining population of Ridgway's Hawks surviving across Hispaniola and satellite islands with minimal human intervention. We further envision that Ridgway's Hawks are valued both socially and culturally throughout Hispaniola as important components of the island's ecology and a symbol for widespread conservation representing a sense of pride and ownership with this species. We envision that the conservation of Ridgway's Hawks contributes to the downlisting of the species and significantly advances the protection of other raptors, wildlife, and habitats across the island of Hispaniola.

7.2 Goals and Strategies

Goal: to support the growth of a robust interconnected population of Ridgway's Hawks across Hispaniola, with a population size that reaches 1,000 individuals and a distribution that expands by 20% in ten years.

Strategies:

1. Translocate individuals to supplement small subpopulations.
2. Treat nests with insecticide to augment productivity.
3. Conduct environmental education and outreach activities to prevent human-hawk conflict.
4. Build local capacity for science and conservation to ensure sustainability.

7.3 Objectives and Indicators

Strategy 1. Translocate individuals to supplement small subpopulations.

Objective 1. Increase the number of breeding pairs in Aniana Vargas National Park.

Rationale:

Small populations are more prone to stochastic fluctuations in population size and loss of genetic diversity, and, therefore, are at a higher risk of extinction than larger populations. Translocating individuals between populations can provide an important management tool to allow for dispersal between isolated areas in the short-term, until natural dispersal is possible in the long-term. TPF/FPRD have ample experience translocating individuals from large populations to supplement small populations and have done so successfully with Ridgway's Hawks in the Dominican Republic for over a decade. The Ridgway's Hawk population in LHNP is the stronghold for the species, with high overall numbers (at least 340 adult individuals) and high productivity assisted by our nest management practices. We will continue to translocate young hawks from

LHNP to AVNP, where populations of Ridgway's Hawks are still small (approximately 13 adult individuals) and at risk.

Indicator: Number of nests monitored in LHNP.

Indicator: Number of young hawks collected and released in new site.

Indicator: First year survival of translocated individuals.

Indicator: Number of breeding pairs in new site.

Objective 2. Support conservationists to study and conserve the Ridgway's Hawk subpopulation in Haiti.

Rationale:

The newly discovered (2019) subpopulation of Ridgway's Hawks in Haiti is being monitored and studied by the local Haitian conservation NGO Action pour la Sauvegarde de l'Ecologie en Haïti (ACSEH). We aim to support this team by sharing knowledge, resources, and the technical skills to effectively monitor Ridgway's Hawks.

This subpopulation brings hope that the species is more resilient than we originally thought. It faces slightly different threats than the populations in DR. The relatively small human population on Les Cayemites is generally found along the coastlines, rather than inland, since it depends on a fishing economy, apparently creating a relative safe haven for Ridgway's Hawks within the inland forested areas.

Fewer people, in general, have domestic fowl on the island, which equals fewer human-wildlife conflicts. However, these communities also depend on agriculture. Many farmers believe that drought, and the subsequent loss of crops and cattle, is brought about if a Ridgway's Hawk is nesting on their farmland. Therefore, farmers often destroy both active and inactive nests, or cut down large numbers of mature *Bursera simaruba* trees to reduce the possibility that hawks will nest on their property. This, of course, has a detrimental effect on hawk survival and nesting success. Environmental education and capacity development will be important components of conservation efforts here.

Indicator: Number of team leader meetings to discuss species' management.

Indicator: Number of field and educational tools supplied to the Haitian team.

Indicator: Number of Haitian team members trained on tree climbing, bird handling and banding, and nest searching.

Objective 3. Update information on population size and range and identify what constitutes high-quality habitat for the species.

Rationale:

Ridgway's Hawks are currently distributed among four subpopulations that vary in habitat characteristics and overall size. Uncertainty exists concerning the species' habitat preference and if productivity varies by habitat quality. To help inform the species' conservation status, it is important to conduct formal quantitative field surveys to determine accurate population size estimates and map the current distribution to identify habitat associations. The most recent assessments available are brief and not comprehensive, highlighting the need for updated surveys.

We will enlist the help of TPF's Science Team to design a formal population survey across the entire projected range for Ridgway's Hawk. The survey will capture population counts, demographics, location, and vegetation types. The results will be compiled with annual productivity surveys.

Due to the unstable political and security situation in Haiti, a formal population survey of Ridgway's Hawk may not be possible. However, we will continue to collaborate with ACSEH and collect as much information as possible.

Indicator: Date of most recent population size assessment.

Indicator: Date of most recent species' range assessment.

Indicator: Date of most recent habitat assessment.

Objective 4. Evaluate a new Ridgway's Hawk translocation plan following IUCN's guidelines for reintroductions.

Rationale:

Connectivity is important within the Ridgway's Hawk subpopulations in the Dominican Republic. An interconnected population provides protection from extinction, where dispersal from one subpopulation to the next can help rescue declining subpopulations and contribute to maintaining genetic diversity, making them more likely to persist. Adding a new subpopulation will help increase not only population size and range, but also the resilience of the species. Nevertheless, translocations also come with challenges, requiring in-depth assessments of proposed locations and careful strategic planning. We will create a translocation plan that closely follows IUCN's guidelines for reintroductions.

Indicator: Biological and social feasibility assessment.

Indicator: Risk assessment.

Indicator: Translocation plan and strategy.

Strategy 2. Treat nests with insecticide to augment productivity.

Objective 5. Increase productivity in treated nests.

Rationale:

Philornis is a genus of parasitic nest flies found in Central and South America. They are common in the Caribbean islands, and they parasitize a wide range of bird species. Flies lay their eggs in bird nests and when the larvae emerge, they feed on the young nestlings, inhibiting their growth, and often leading to their death. The effect of parasitism varies in severity between bird species and appears to be particularly detrimental to Ridgway's Hawks.

To reduce the effect of parasitism on Ridgway's Hawks, our team sprays all accessible nests with an insecticide before the eggs hatch. The insecticide used, permethrin, is available for commercial use, and extremely effective at killing many invertebrate adults and their larvae without negatively harming the vertebrate host when used in low doses (Causton and Lincango 2014). The use of insecticides on Ridgway's Hawks nests and nestlings has been shown to increase productivity by up to 179% (Hayes et al. 2019).

Indicator: Number of nests monitored annually.

Indicator: Percent of accessible nests sprayed annually.

Indicator: Overall productivity in treated nests.

Strategy 3. Conduct environmental education and outreach activities.

Objective 6. Reach people from local communities through education and outreach activities.

Rationale:

One of the most difficult challenges of conservation work is to achieve among stakeholders a balance between environmental, economic, and societal needs. Differing values exist concerning the importance of the environment and its preservation. We aim

to change people's attitudes and behaviors towards the environment, and more specifically Ridgway's Hawk, by engaging with local communities, understanding their needs and perspectives, and working together to promote conservation values that are culturally relevant.

After several reintroduced hawks were found shot in communities around the Punta Cana release site starting in 2009, we began an intensive education program in 2013 among 12 local communities. Since the project began, we have reached more than 33,000 individuals through direct education programs and have expanded the number of communities we work with to over 100. We have already seen a positive change in people's attitudes and actions toward the hawks. We have three main aims for our education program: to increase knowledge about Ridgway's Hawk, to change attitudes about all birds of prey, and to inspire positive actions for their conservation.

Indicator: Number of people reached in schools through education and outreach activities.

Indicator: Number of people reached in communities from door-to-door visits.

Indicator: Number of people reached by public education and outreach events.

Indicator: Number of educational and outreach events attended by raptor ambassadors.

Objective 7. Work collaboratively with local communities to prevent human-hawk conflict.

Rationale:

From our robust experience working in the Dominican Republic, we know that the main human-hawk conflict comes from hawks preying on young poultry. Rural communities rely on chickens for food and as an economic resource, and maintain fighting roosters, "gallos de calidad", for popular cock fighting events. This reliance on chickens can exacerbate negative feelings and even retaliation events when hawks prey on, or are perceived as being a threat to, domestic fowl.

To solve this problem, we have provided chicken coops to protect the smaller poultry from predation. While this has proven successful at reducing conflict, it is not sustainable and creates an atmosphere of dependence where community members rely on (and expect) us to continue providing these coops.

Going forward, we plan to conduct workshops where we collaboratively design and create chicken coops with community members. By providing the knowledge and

technical guidance, we aim for community members to build coops on their own as needed, using accessible materials.

Indicator: List of any additional sources of human-hawk conflicts with solutions for mitigation.

Indicator: Number of human-hawk conflict mitigation workshops or events.

Indicator: Percent of people reached using mitigation tools.

Objective 8. Conduct a nationwide social marketing campaign in support of Ridgway's Hawk conservation.

Rationale:

Our education and outreach work in the Dominican Republic has occurred primarily at the local scale around Ridgway's Hawk habitat. We have prioritized connecting with rural communities and individual households to promote conservation values. However, we believe that for Ridgway's Hawk conservation to be sustainable in the long term, it must become a national symbol and a source of pride for all citizens of the Dominican Republic. We aim to achieve this by conducting a nationwide social marketing campaign in support of Ridgway's Hawk conservation.

Our campaign will encourage people to adopt certain behaviors that are positive for themselves and the environment, which we hope will have long-term lasting benefits for people and wildlife in DR. Social marketing campaigns have been shown to be successful in changing human behavior, and the Ridgway's Hawk would be an ideal species for a campaign because it is endemic, charismatic, beautiful, and plays a key role in the ecosystems in which it lives.

Indicator: List of media outlets covering the social marketing campaign.

Indicator: Number of people surveyed about values and attitudes towards Ridgway's Hawks.

Indicator: Percent of people surveyed with increased scores on values and attitudes towards Ridgway's Hawks after the social marketing campaign.

Strategy 4. Build local capacity for science and conservation.

Objective 9. Conduct environmental education training workshops.

Rationale:

Change is easier to adopt if it comes from within one's community. To create a lasting impact within the communities that we work with, we aim to build capacity by training local leaders and teachers in environmental education and conservation. We will conduct workshops, provide them with educational materials, and support them to become conservation leaders and educate their own communities.

Additionally, we will target key stakeholders from local NGOs and the Dominican Ministry of the Environment to help us educate others and maintain their support for environmental work.

It is also important to provide continuing capacity development for our established field team and any new recruits, which will help them not only have the skills necessary for their work to conserve the Ridgway's Hawk through field work, but also expand their skills in communication within Hispaniola and internationally.

Indicator: Number of environmental education training workshops conducted.

Indicator: Number of participants attending workshops.

Indicator: Percent of participants with increased understanding of science and conservation and increased skills to teach others, after attending a workshop.

Indicator: Percent of trained workshop participants using the skills acquired.

Objective 10. Provide employment opportunities in science and conservation.

Rationale:

Another way to create local capacity and engage the public in science and conservation is to provide them with employment and learning opportunities within our program. We already employ several local technicians who closely monitor Ridgway's Hawk populations. We also hire community members in supporting roles to the project, showing them that it is possible to make a living from conservation work. Additionally, we are always open to receiving visitors and volunteers who want to learn more about what we do or help and become involved in conservation. We believe these activities will engage the public and inspire them to take ownership of conservation.

Indicator: Percent of FPRD employees that are Hispaniolan.

Indicator: Number of Hispaniolans hired by the project.

7.4 Activities, priorities, timeframe, and responsibilities

Objective 1. Increase the number of breeding pairs in Aniana Vargas National Park.

To perform these translocations, it is essential that we continue monitoring the population in LHNP (Activity 1.1.1) to select young for translocations and to boost productivity through nest management. Nestlings are collected at ~23 days old (Activity 1.1.2), banded, and transported to AVNP, where they are slowly reintroduced using a hacking technique (Activity 1.1.3). Once these individuals are released at the new site, intense monitoring efforts are needed to evaluate survival, reproduction, and dispersal (Activity 1.1.4). These methods have been successful in establishing a new breeding population of Ridgway's Hawks in Punta Cana. We expect these activities to increase the abundance of Ridgway's Hawks in AVNP, establishing it as a solid third subpopulation in the Dominican Republic.

Results	Activities	Category	Time frame (years)	Priority	Responsibility
Result 1.1. The subpopulation of Ridgway's Hawks in Aniana Vargas National Park increases and settles as a solid third subpopulation in the Dominican Republic.	1.1.1. Weekly monitor 125-150 nests for the entire known population of Ridgway's Hawk in Los Haitises National Park.	Direct Conservation Action	Ongoing	Essential	FPRD leadership and field teams
	1.1.2. Collect ~25 nestlings from successful nests with more than one young.	Direct Conservation Action	3-5	High	FPRD leadership and field teams
	1.1.3. Translocate and hack collected young into Aniana Vargas National Park.	Direct Conservation Action	3-5	High	FPRD leadership and field teams
	1.1.4. Monitor translocated individuals throughout the remainder of the year to study survival, reproduction, and dispersal.	Direct Conservation Action	Ongoing	High	FPRD leadership and field teams

Objective 2. Support conservationists to study and conserve the Ridgway's Hawk subpopulation in Haiti.

We have been collaborating with ACSEH since the rediscovery of Ridgway's Hawks in Haiti in 2019 and will continue to do so by maintaining regular meetings to discuss management needs and knowledge gaps (Activity 2.1.1). We will supply field equipment annually (including climbing gear, bands, and binoculars) to assist ACSEH, and educational materials in Haitian Creole for their distribution in local communities for outreach purposes (Activity 2.1.2). We will also conduct workshops to train local Haitians to monitor, study, and protect the Ridgway's Hawk, including training on safe climbing techniques, bird handling and banding, and nest searching, as needed (Activity 2.1.3). We will include this subpopulation in the Conservation Action Plan and will continue to collaborate with ACSEH to manage and protect the Ridgway's Hawk population on Les Cayemites.

Results	**Activities**	**Category**	**Time frame (years)**	**Priority**	**Responsibility**
Result 2.1. The Ridgway's Hawk subpopulation in Haiti remains stable and is managed by a team of trained individuals.	2.1.1. Maintain quarterly meetings with ACSEH to discuss management of the Ridgway's Hawk's subpopulation in Haiti.	Research & Monitoring	1-2	High	TPF and FPRD leadership
	2.1.2. Continue supplying field and educational tools to the Haitian team.	Direct Conservation Action	Ongoing	High	TPF and FPRD leadership
	2.1.3. Conduct training workshops with Haitian team for hawk surveying, tree climbing, nestling banding, etc, as needed.	Direct Conservation Action	Need based	Medium	TPF and FPRD leadership

Objective 3. Update information on population size and range and identify what constitutes high-quality habitat for the species.

To monitor our progress in the recovery of this species, it is important to update the species' status. We will design and conduct a thorough field survey of all Ridgway's Hawks subpopulations to update its population size estimate and range (Activities 3.1.1 and 3.1.4). While conducting this survey, we will record habitat associations to update habitat use and preference by Ridgway's Hawks (Activity 3.1.2) and further test a potential effect of habitat type on productivity (Activity 3.1.3). We expect these activities to provide updated and more comprehensive estimates of Ridgway's Hawk's status, contributing to the downlisting of the species, and allowing for better management.

Results	Activities	Category	Time frame (years)	Priority	Responsibility
Result 3.1. Updated population estimates, range metrics, and habitat use allow for better management of Ridgway's Hawks and contribute to the downlisting of the species.	3.1.1. Conduct a thorough survey of all Ridgway's Hawks subpopulations for an accurate population size estimate.	Research & Monitoring	1-2	High	FPRD leadership and field teams
	3.1.2. Investigate current distribution of Ridgway's Hawks and habitat associations.	Research & Monitoring	1-2	Medium	TPF leadership and science team
	3.1.3. Investigate how habitat type and quality correlate with productivity of Ridgway's Hawks.	Research & Monitoring	1-2	Medium	TPF leadership and science team
	3.1.4. Calculate range metrics for Ridgway's Hawks	Research & Monitoring	1-2	High	TPF leadership and science team

Objective 4. Evaluate a new Ridgway's Hawk translocation plan following IUCN's guidelines for reintroductions.

To inform future translocations of Ridgway's Hawks we will conduct thorough feasibility and risk assessments (Activity 4.1.1) and further highlight the critical role of reintroductions within the species' conservation action plan. We will identify new target release sites within the species' historical range, considering the species' ecological needs and minimizing the threat of human persecution (Activity 4.1.2). Once a suitable release site is identified, we will design an implementation plan including environmental education and outreach efforts in adjacent communities (Activity 4.1.3). The plan will closely follow IUCN's guidelines for reintroductions.

Results	Activities	Category	Time frame (years)	Priority	Responsibility
Result 4.1. A thorough translocation justification and guided plan informs future translocations of Ridgway's Hawks.	4.1.1 Conduct translocation feasibility and risk assessments for Ridgway's Hawks.	Research & Monitoring	2	Medium	TPF and FPRD leadership and science team
	4.1.2 Identify new target release sites for Ridgway's Hawks using ecological and sociological criteria.	Research & Monitoring	2	Medium	FPRD leadership and field teams
	4.1.3 Design an implementation plan using assessment criteria.	Research & Monitoring	2	Medium	TPF and FPRD leadership and science team

Objective 5. Increase productivity in treated nests.

To conduct this management activity, we first need to monitor Ridgway's Hawk populations and locate and treat nests against *Philornis* infestation (Activity 5.1.1). Technicians are also trained in safe tree climbing skills as they often must climb trees to reach the nests. We already have evidence of *Philornis* being a critical threat to Ridgway's Hawks, so all accessible nests are sprayed with an insecticide (1% permethrin) before the young hatch (Activity 5.1.2). The eggs are carefully removed from the nest before spraying and returned shortly after the insecticide has dried. The use of insecticides on nests and nestlings has been shown to increase productivity by up to 179% in Ridgway's Hawks and are essential tools for the species' recovery. After the treatment is applied, technicians continue to monitor the population and evaluate nesting success (Activity 5.1.3). We will consider new and improved nest treatments as they become available and as needed, for example the use of an extendable pole to spray inaccessible nests (Activity 5.1.4). We expect these activities to exponentially increase Ridgway's Hawk productivity.

Results	Activities	Category	Time frame (years)	Priority	Responsibility
Result 5.1. Ridgway's Hawk's productivity increases as a result of nest treatment practices.	5.1.1. Locate and monitor all known Ridgway's Hawk nests.	Direct Conservation Action	Ongoing	Essential	FPRD leadership and field teams
	5.1.2. Spray all accessible nests once with insecticide (permethrin) before the young hatch.	Direct Conservation Action	Ongoing	Essential	FPRD leadership and field teams
	5.1.3. Monitor annual productivity at all known Ridgway's Hawk's nests.	Direct Conservation Action	Ongoing	High	FPRD leadership and field teams
	5.1.4. Develop new and improve old strategies for treating nests.	Research & Monitoring	Need based	Medium	TPF and FPRD leadership

Objective 6. Reach people from local communities through education and outreach activities.

We will expand our current program by identifying additional local communities within Ridgway's Hawk habitat to target for education and outreach efforts (Activity 6.1.1). It is essential that we continue to build relationships and trust with local communities so we can better understand their needs and challenges and communicate our conservation message. We will achieve this through workshops, activities, and events (Activity 6.1.2), including visits from our raptor ambassadors (Activity 6.1.5), and on a more personal scale through door-to-door visits (Activity 6.1.3). We will hire 4 - 5 environmental educators as part-time employees to help expand the number of individuals and communities reached (Activity 6.1.4). We expect these activities to increase local understanding of raptor conservation and help develop positive attitudes towards Ridgway's Hawks.

Results	Activities	Category	Time frame (years)	Priority	Responsibility
Result 6.1. Local communities have a better understanding of raptor conservation and develop positive attitudes towards Ridgway's Hawks.	6.1.1. Identify communities within core Ridgway's Hawk habitat to target for education and outreach.	Research & Monitoring	Ongoing	Essential	TPF and FPRD leadership
	6.1.2. Conduct environmental education in classrooms, workshops, and local events, including visits with our raptor ambassadors.	Education & Awareness	Ongoing	Essential	TPF and FPRD leadership
	6.1.3. Conduct door-to-door visits to increase knowledge and positive attitudes towards Ridgway's Hawks.	Education & Awareness	Ongoing	Essential	TPF and FPRD leadership
	6.1.4. Hire 4-5 environmental educators as regular part-time employees to continue expanding education and outreach activities.	Education & Awareness	Ongoing	High	TPF and FPRD leadership
	6.1.5. Maintain a small group of raptor ambassadors to promote environmental education.	Education & Awareness	Ongoing	High	FPRD Ambassador Hawk Project Coordinator

Objective 7. Work collaboratively with local communities to prevent human-hawk conflict.

We will work together with local communities to provide the knowledge and technical guidance for community members to build poultry coops on their own as needed, using accessible materials (Activity 7.1.2), to reduce the main source of human-hawk conflict. We will continue to encourage and monitor the use of poultry coops (Activity 7.1.3) and maintain open communication with local communities to promptly identify any new conflicts that may arise (Activity 7.1.1). We expect these activities to drastically reduce human-hawk conflict resulting in less animosity and reasons to target Ridgway's Hawks.

Results	Activities	Category	Time frame (years)	Priority	Responsibility
Result 7.1. Reduced human-hawk conflict reduces animosity and reasons to target Ridgway's Hawks.	7.1.1. Identify sources of human-hawk conflict and work together with communities to innovate solutions to mitigate them.	Research & Monitoring	Ongoing	Essential	TPF and FPRD leadership
	7.1.2. Hold poultry coop construction workshops to facilitate protection of small chickens and reduce retribution towards hawks.	Education & Awareness	3-5	High	TPF and FPRD leadership
	7.1.3. Monitor use of poultry coops and changes in attitudes towards Ridgway's Hawks.	Research & Monitoring	3-7	High	TPF and FPRD leadership

Objective 8. Conduct a nationwide social marketing campaign in support of Ridgway's Hawk conservation.

For this campaign to be successful, we will involve the public through representative focus groups where they will help us pick campaign materials that are compelling to our target audience (Activity 8.1.3). We will then implement the campaign through as many media outlets as possible to reach a wide audience (Activity 8.1.4). To evaluate the effectiveness of the campaign we will design, test, and conduct baseline surveys of awareness and perceptions of Ridgway's Hawks and general raptor conservation (Activities 8.1.1 and 8.1.2) and compare them to mid- and post-campaign surveys (Activity 8.1.5). We expect this campaign to help develop a nationwide value for raptor conservation.

Results	Activities	Category	Time frame (years)	Priority	Responsibility
Result 8.1. A value for raptor conservation is developed nation-wide.	8.1.1. Design and test surveys of awareness and perceptions of Ridgway's Hawks and raptor conservation.	Research & Monitoring	1	Medium	TPF and FPRD leadership
	8.1.2. Conduct baseline surveys throughout the Dominican Republic.	Research & Monitoring	1-2	Medium	TPF and FPRD leadership
	8.1.3. Design campaign materials and test them with representative focus groups.	Research & Monitoring	1	Medium	TPF and FPRD leadership
	8.1.4. Implement the campaign nation-wide through widespread media engagements.	Education & Awareness	2-5	Medium	TPF and FPRD leadership
	8.1.5. Conduct mid and post-campaign surveys nation-wide to evaluate campaign effectiveness.	Research & Monitoring	3-7	Medium	TPF and FPRD leadership

Objective 9. Conduct environmental education training workshops.

To ensure the sustainability of our conservation efforts, it is essential that we identify leaders within the local communities who can continue to spread the message (Activity 9.1.1). We will hold training workshops and compare participant's knowledge of science and conservation before and after the workshops (Activity 9.1.2). We will provide educational resources to the newly trained participants so they can educate in their own communities and we will follow up with them to evaluate the effectiveness of our strategy (Activity 9.1.3). We will also maintain relationships with local organizations and partners to keep as allies in conservation (Activity 9.1.4). We expect these activities to develop local advocates that continue promoting science and conservation in their own communities.

Results	Activities	Category	Time frame (years)	Priority	Responsibility
Result 9.1. Local leaders and key stakeholders are trained in environmental education and promote science and conservation in their own communities.	9.1.1. Identify community leaders and key stakeholders to receive environmental education and conservation training.	Research & Monitoring	Ongoing	Essential	TPF and FPRD leadership
	9.1.2. Conduct training workshops.	Direct Conservation Action	Ongoing	Essential	TPF and FPRD leadership
	9.1.3. Provide opportunities and resources for local leaders to educate in their own communities.	Direct Conservation Action	Ongoing	High	TPF and FPRD leadership
	9.1.4. Maintain relationships with local NGOs, the Dominican government, and other partners.	Direct Conservation Action	Ongoing	High	TPF and FPRD leadership

Objective 10. Provide employment opportunities in science and conservation.

Our FPRD staff is composed of 100% local employees, and we will continue to hire locals to work on the project and in supporting roles to conservation actions (Activities 10.1.1 and 10.1.2). These essential activities will help improve local capacity, provide continued learning opportunities, job growth, and the fostering and development of future conservationists and conservation initiatives. We will also continue to provide volunteer opportunities to learn and participate in our project (Activity 10.1.3). We expect these activities to benefit local communities and keep them involved in science and conservation.

Results	Activities	Category	Time frame (years)	Priority	Responsibility
Result 10.1. Local communities are involved in science and conservation and directly or indirectly benefit from it.	10.1.1. Hire locals to work on the project in their own communities and develop skills in science and conservation.	Direct Conservation Action	Ongoing	Essential	FPRD leadership
	10.1.2. Hire locals in supporting roles to conservation actions.	Direct Conservation Action	Ongoing	Essential	FPRD leadership
	10.1.3. Provide volunteer opportunities to learn about and participate in our project.	Education & Awareness	Ongoing	High	FPRD leadership

8. Implementation

8.1 Organizational Chart for the Implementation Team

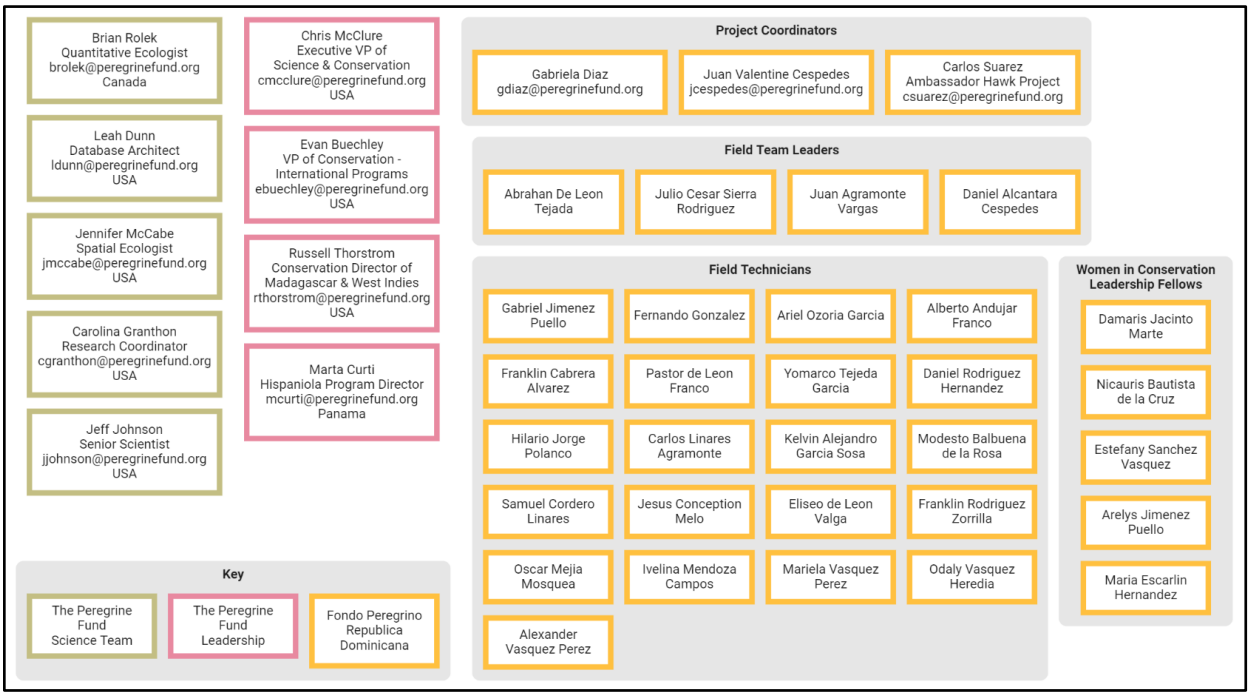

Figure 5. Organizational chart of the key members of the implementation team, composed of The Peregrine Fund's leadership (pink boxes) and science team (green boxes), and Fondo Peregrino República Dominicana's (orange boxes) project coordinators, field team leaders, field technicians, and women in conservation leadership fellows. All TPF boxes contain names, email addresses, location, and titles. All FPRD employees are located in the Dominican Republic, and all their boxes contain names, are grouped by title, and include email addresses for all project coordinators.

8.2 Monitoring, Evaluation, and Learning

Monitoring is essential for tracking the implementation of actions and achievement of goals and objectives. Most of the activities are conducted on an annual basis by the implementation team (Fig. 5), and progress reports will follow that timeline, reporting on specific indicators by the end of the year. Progress towards objectives will be evaluated annually against target values, and classified as ‘Completed’, ‘In-progress’, ‘Scheduled’, ‘Minor issues’, or ‘Major issues.’

The viability of the species will be assessed by an annual evaluation of the key attributes and their respective indicators, outlined in Table 5. These key attributes include measures of population size and dispersal that aim to describe the species’ overall health. The implementation team will continue to monitor all subpopulations of Ridgway’s Hawks and collect demographic data to track changes in the species’ viability through an integrated population model (IPM).

This CAP will be reviewed annually, to evaluate assumptions, strategy, reduce uncertainties, reflect on potential risks, learn from information collected, and adapt if necessary.

Table 4. Current and target indicator values for all objectives under the Ridgway’s Hawk Conservation Action Plan.

Objective	Indicator	Baseline value	Target value
1. Increase the number of breeding pairs in Aniana Vargas National Park.	Number of nests monitored in LHNP.	125-150	125-150
	Number of young hawks collected and released in newly established subpopulation.	25	25
	First year survival of translocated individuals.	TBD	TBD
	Number of breeding pairs in newly established subpopulation.	4	25
2. Support conservationists to study and conserve the Ridgway’s Hawk subpopulation in Haiti.	Number of team leader meetings to discuss species' management.	4	4
	Number of field and educational tools supplied to the Haitian team.	5	5

	Number of Haitian team members trained on tree climbing, bird handling and banding, and nest searching.	-	-
3. Update information on population size and range and identify what constitutes high-quality habitat for the species.	Date of most recent population size assessment.	2019	2025
	Date of most recent species' range assessment.	2019	2025
	Date of most recent habitat assessment.	2011	2025
4. Evaluate a new Ridgway's Hawk translocation plan following IUCN's guidelines for reintroductions.	Biological and social feasibility assessment.	0	1
	Risk assessment.	0	1
	Translocation plan and strategy.	0	1
5. Increase productivity in treated nests.	Number of nests monitored annually.	125-150	>200
	Percent of accessible nests sprayed annually.	100%	100%
	Overall productivity in treated nests.	1.41	>1.00
6. Reach people from local communities through environmental education and outreach activities.	Number of people reached in schools through education and outreach activities.	1271	10,000
	Number of people reached in communities from door-to-door visits.	475	
	Number of people reached by public education and outreach events.	523	
	Number of educational and outreach events attended by raptor ambassadors.	7	15

7. Work collaboratively with local communities to prevent human-hawk conflict.	List of any additional sources of human-hawk conflicts with solutions for mitigation.	-	-
	Number of human-hawk conflict mitigation workshops or events.	0	1-2
	Percent of people reached using mitigation tools.	0	>50%
8. Conduct a nationwide social marketing campaign in support of Ridgway's Hawk conservation.	List of media outlets covering the social marketing campaign.	0	1
	Number of people surveyed about values and attitudes towards Ridgway's Hawks.	89	2,000
	Percent of people surveyed with increased scores on values and attitudes towards Ridgway's Hawks after the social marketing campaign.	0	75%
9. Conduct environmental education training workshops.	Number of environmental education training workshops conducted.	1-2	1-2
	Number of participants attending workshops.	20-25	20-25
	Percent of participants with increased understanding of science and conservation and increased skills to teach others, after attending an education training workshop.	90%	100%
	Percent of trained workshop participants using the skills acquired.	TBD	20%
10. Provide employment opportunities in science and conservation.	Percent of FPRD staff that are Hipaniolan.	100%	100%
	Number of Hispaniolans hired by the project.	33	33-40

Table 5. Key attributes and indicators to assess annual viability and recovery status of Ridgway's Hawk throughout its range.

Key Attribute	Indicator	Current Value	Target Value (10 yrs)
Population size	Total number of individuals	>412*	>1,000
	Total number of mature individuals	365*	>1,000
Distribution	Area of occupancy (AOO)	TBD	>2,000 km^2
	Extent of occurrence (EOO)	26,700 km^2	>32,000 km^2

*Expected counts for 2023 given the mean survey effort in LHNP and Punta Cana + observed counts for AVNP and Haiti

9. Risks to Success

9.1 Regulatory

Until recently, the only extant Ridgway's Hawk populations were thought to be restricted to the Dominican Republic, but a recent rediscovery in Les Cayemites Islands, Haiti, places the species' range in two distinct countries with separate regulations. Cross-political boundaries can present challenges for species' conservation plans, incorporating different policies and regulations. TPF and FPRD work together with ACSEH, the organization managing the subpopulation of Ridgway's Hawks in Haiti, to set up joint management strategies for the conservation of the species. This includes maintaining regular communication, sharing of information, and the implementation of best practices for a consistent framework that crosses political boundaries.

9.2 Financial

Despite increasing numbers of Ridgway's Hawks, their recovery is still a long-term project that will require significant financial investment. Many strategies require ongoing management, monitoring, and evaluation to ensure adoption of positive societal behaviors towards Ridgway's Hawks, prevent future threats, and develop and maintain sustainable practices. The situation is more challenging in Haiti, where there is very limited capacity and funding for conservation.

9.3 Environmental

Island species are particularly vulnerable to environmental pressures, especially those resulting from climate change. The uncertainty associated with climate change effects and severe weather patterns poses a threat to Ridgway's Hawk, which is particularly susceptible to stochastic events that may drastically reduce the species' population size, further exposing the species to additional threats that would have otherwise been less impactful on the species. Our goal to support the growth of a robust interconnected population of Ridgway's Hawks across their range throughout Hispaniola, addresses this risk, as a large metapopulation would better navigate and help buffer against the uncertainty associated with climate change and severe weather patterns.

9.4 Social/Cultural

We acknowledge that to achieve sustainable change we must involve local communities and stakeholders who may be impacted by our project. We will continue to consult and include the local people through our education and outreach efforts, which include both large events as well as more personalized door-to-door visits, with the goal of creating a value for conservation and improving attitudes towards Ridgway's Hawk and other wildlife.

9.5 Institutional

Lack of institutional capacity can be a major risk in the conservation of any species and endanger the successful implementation of an action plan. Fortunately, FPRD, our local subsidiary, is supported by TPF's 50+ years of experience and commitment to conserving birds of prey worldwide, while still being composed of 100% Dominican staff. One of the main goals of this action plan is to continue building capacity for science and conservation among the local communities in core Ridgway's Hawk habitat, to ensure the ongoing success of the plan and the sustainable conservation of the species.

10. Conclusion and Next Steps

Despite intensive past and current conservation efforts, much work is still needed to sustain Ridgway's Hawk populations into the future. Our education efforts have helped reduce human persecution of hawks, while simultaneously boosting their populations and expanding their range with our nest management and translocation efforts. Ridgway's Hawks are on track to recovery, but without management, the species would likely reverse to its previous imperiled state. Our vision of a stable Ridgway's Hawk population with minimal management actions can still be achieved, but we need to expand our efforts and create sustainability. We also need more comprehensive population level information to help make decisions regarding the future of the species and begin to make the switch from conservation-reliant to self-sustaining. This can be accomplished by expanding our environmental education program nationwide. Working with locals, we aim to promote a value for conservation, where Dominicans and Haitians take pride in their biodiversity and pledge to conserve it, and where environmental conservation becomes ingrained in the culture and contributes to people's livelihoods, benefiting ecosystems and humans alike. And where robust interconnected Ridgway's Hawk populations can withstand current and future threats, persevering in their native habitat with minimal human intervention. This CAP provides a path to sustainability for the Ridgway's Hawk that may have profound impacts on all biodiversity on Hispaniola, particularly birds of prey, and may serve as a template throughout the Caribbean. The next step is implementation.

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