

Protected Only on Paper? Three Case Studies from Protected Areas in the Dominican Republic

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Abstract - The Caribbean is a hotspot for biodiversity, yet only a small percentage of its natural habitats remain intact. Safeguarding these ecosystems is challenging in the face of limited resources and ongoing threats. Herein we evaluate 3 case studies from the Dominican Republic (DR), one of the most biologically diverse countries in the Caribbean. We focus on conflicts between the DR's national protected areas system and agriculture, tourism, and the charcoal trade. Because protected areas are widely recognized as one of the main tools to reduce biodiversity loss, with 25% of the DR's landmass legally protected as of 2015, this developing nation seemingly has taken the right steps to secure its biodiversity heritage. However, recognition and enforcement of protected areas legislation remains despairingly poor, a situation not limited to the DR and all too common in developing nations throughout the world. The crucial role of academic and non-governmental organizations in these conflicts is discussed, as well as our vision of a collaborative way forward. We conclude that park designations are an important first step but continued action is needed to protect these refuges of Caribbean biodiversity.

Introduction

Protected areas have been described as the cornerstones of biodiversity conservation and building blocks of various conservation strategies (Dudley 2008, Worboys et al. 2015). In fact, over 209,000 marine and terrestrial areas have been designated as protected, covering more than 30 million km² (Deguignet et al. 2014) or nearly 6% of the Earth's surface. Although biodiversity conservation is an important component of protected areas, these sites serve other important purposes. Many provide direct human benefits, including opportunities for relaxation and recreation in nature, purification of water and air, dispersion and cycling of nutrients, control of pests and diseases, provision of habitat for important crop pollinators, sequestration of carbon, and regulation of climate (Dudley 2008, Hockings 2003, Leverington et al. 2010). In addition, protected areas can provide revenue to local communities through nature-based tourism and can safeguard iconic heritage sites (Dudley 2008). Yet despite these benefits, habitats within many protected areas continue to be heavily degraded and destroyed. Understanding why this continues and finding ways to implement actual protection is of utmost importance as the

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threats of climate change, food insecurity, and biodiversity loss increase (Meyer and Huete-Perez 2014).

When conservation resources are limited, prioritization of protection is vital. Myers et al. (2000) designated the Caribbean Islands as one of the top 5 biodiversity hotspots in terms of endemism. The strategic protection of sites within these 5 areas could potentially conserve 45% of the world's plant and vertebrate species in only 0.4% of Earth's land area. The Caribbean, however, is one of the most damaged areas, retaining but 11.3% of its primary vegetation as of 2000 (Myers et al. 2000) and only 5.8% as of 2014 (Sloan et al. 2014). Hispaniola, comprised of Haiti and the Dominican Republic (DR), is second among Caribbean islands only to Cuba in size and species richness, with 4880 endemics described from the DR alone (Anon. 2010).

Unfortunately, the island has undergone extensive habitat loss. The DR and other countries were important reservoirs of natural resources during the European occupation of the American Tropics (NRC 1980). This exploitation resulted in severe deforestation from timber harvests, mining, and the production of sugar, coffee, and cacao for export to Europe. These actions, coupled with the consumption of mammalian food sources and the introduction of invasive rats and other alien mammals are thought to have caused the extinction of most of the island's unique terrestrial mammals, including the *Brotomys voratus* Miller (Hispaniolan Edible Rat; Turvey and Helgen 2008a), *Solenodon marcanoi* (Patterson) (Marcano's Solenodon; Turvey and Helgen 2008e), and 4 species of hutia (Turvey and Dávalos 2008; Turvey and Helgen 2008b, c, d).

The landscape of the DR continues to change to accommodate a rapidly increasing human population (Geilfus 1994). The population density was 18.6 people per km² in the 1920s and 207 people per km² in 2010 (ONE 2012). By 2013, it was 215 people per km² (World Bank 2013). In tandem with the growing population, infrastructure has advanced and various types of developments have become necessary to support this high human density. More roads dissect the country. Agricultural projects ranging from subsistence farming to production for export have caused forest cutting and a general misuse of the land (Juergens et al. 2012). Development for tourism, often with little to no regulation, has caused degradation and fragmentation of many coastal ecosystems (Juergens et al. 2012). In addition, many rural communities depend directly and unsustainably on resources, such as plant-derived charcoal, for subsistence. With these continued threats to DR's biodiversity, the number of species now considered threatened is 162 according to the IUCN Red List (IUCN 2015) and over 1000 according to the National Red List of Endangered Species (Ministerio Ambiente 2011). The majority of species have not yet been assessed by the IUCN. Of those groups that have been more fully assessed, such as amphibians (with 44 known species in the DR according to Caribherp.org), 82% (32 of 39 of those assessed) are listed as threatened (IUCN 2015). Conserving biodiversity while simultaneously attempting to address the issues related to rapid population growth is thus a difficult though critically important task in the DR.

The history of protected areas in the DR is complicated. In 1924, when the US Marines evacuated the DR, they left Rafael Trujillo, then head of the National

Guard, in charge. He soon became an iron-fisted dictator, ruling until his assassination in 1961. Once in power, he set up a system of sawmills and sugar estates that destroyed huge tracks of forests for his family's private profits (Geilfus 2002, Holmes 2010, SEMARENA and JICA 2002, Watts 1995). Trujillo's family controlled 50–60% of all arable land during his reign (Brothers 1997). By 1974, when the National Direction of Parks was created to manage 5 newly created protected areas, many of Trujillo's enterprises were taken over by powerful individuals who had been close to his regime. In 1985, Laws 290 and 291 were postulated to promote the adequate management and protection of forests by improving management of the sawmills, restricting tree cutting, and allowing the use of salvaged trees (Ovalles 2011). In 2000, with the creation of the Ministry of the Environment and Natural Resources, the National System of Protected Areas (SINAP) was placed under the supervision of the Division of Protected Areas and Biodiversity. In 2007, Law 197-07 allowed for municipalities to declare protected areas, but to date these are small in number and area. This is the management system that persists today.

In the 1920s, the intact forest cover of the DR was approximately 75% (Durland 1922); the level had decreased to 60% by the end of Trujillo's reign in 1961, to only 14% by 1981 (Comprehensive Research Inventory and Evaluation System Project 1984), and to just 10% by 1989 (Dirección Nacional de Parques et al. 1991, Schubert 1993). All the while the percentage of the nation's area set aside as terrestrial protected areas was increasing from less than 1% in 1974 to 11.2% in 1989 to 25% by 2009, totaling 123 geographic units under a range of protection categories (Fig. 1; Ministerio Ambiente 2012, Schelhas et al. 2002, Valdez Sierra and Mateo Felix 1989, WRI 1998). In other words, a vast system of protected areas was being created while forests were disappearing. In contrast to general definitions of protected areas, those in the DR often were intended to exclude human use, following the ideals of former president Joaquin Balaguer, who was elected in 1966 (Holmes 2010). In some cases, these areas have protected the ecosystems within them, particularly in preventing large-scale projects, such as mining operations and mass tourism development. However, many parks appear only on paper and are not actually afforded any on-the-ground protection, either due to a lack of staff or a lack of protective actions being taken by staff. Holmes (2010) explicitly noted that very few protected areas have management plans and not all have full-time staff.

In addition to national-level policies for protected areas, in recent times the DR has become actively involved in international initiatives linked to protected areas. For example, the United Nations Education, Science, and Cooperation Organization (UNESCO) approved a proposal from the DR to declare the Jaragua-Bahoruco-Enriquillo area, with 3 large National Parks as its core areas, as a Biosphere Reserve in 2002. The DR also has ratified a variety of international conventions requiring parties to protect portions of their territories, in particular the Convention on Biological Diversity (CBD), the Convention on Wetlands of International Importance (Ramsar Convention), and the Cartagena Convention. The CBD Strategic Plan 2002–2010 (CBD 2002) recommended that all parties protect at least 17% of their terrestrial and inland water areas and 10% of coastal and marine areas. The DR,

with 25% of its land areas and 54% of its territorial seas under legal protection, has far exceeded this goal. In fact, as of 2000, the DR was 16th among nations in the percentage of area under protection (Powell and Inchaustegui 2011)—at least on paper. However, without actual management, many of these areas are still under severe pressure.

In the following section, we review 3 selected case studies of events occurring in protected areas within the DR. These illustrate how threats to local biodiversity and ecosystem services persist despite the extensive system of national protected areas and the strict definition of protected areas employed by the DR itself. These case studies were chosen because they demonstrate the complexities of protecting natural habitats in developing countries, illustrate some of the pitfalls in protected area management, exemplify the greatest threats to biodiversity in the country, and are those with which the authors are most familiar. We are thus able to provide the best documentation of these situations given our own experiences supplemented by published information. We hope this discussion will raise international awareness of the need for effective management of protected areas in the DR, such that additional losses to Caribbean biodiversity can be averted.

Case Study I: Tourism in Jaragua and Del Este National Parks

With a coastline of approximately 1700 km, the DR is famous for its beautiful beaches and resorts, making it one of the top Caribbean tourist destinations. Tourism is thus one of the most dynamic industries in the country, accounting for approximately 16% of GDP (Turner 2015). Given the coastal location of most tourism projects, ecosystems such as mangrove forests, saltmarshes, sea grass beds, and coral reefs, have been destroyed or degraded (SEMARENA 2005) and populations of threatened marine turtles, primarily *Eretmochelys imbricata* (L.) (Hawksbill Sea Turtle) and *Dermochelys coriacea* (Vandelli) (Leatherback Sea Turtle), as well as *Cyclura cornuta* (Bonnaterre) (Rhinoceros Rock Iguana), have been affected and even locally extirpated by the degradation of nesting beaches (Revuelta et al. 2012; Y.M. León, R.C. De León, and S.A. Pasachnik, pers. observ.).

As the tourist industry sought to expand in recent years, the most appealing beaches remaining were those within protected areas. Thus, well-connected tourism and real estate entrepreneurs lobbied congress to remove protection of beaches in 2 National Parks by amending the Protected Areas Sectorial Law while Congress was reviewing this legislation in 2004 (Holmes 2010, Ramírez Tejada 2006). Civil society successfully opposed this amendment; however, these areas were still lowered from IUCN category II to IV (Ramírez Tejada 2006). This reclassification affected Bahía de las Aguilas, Playa Blanca, and Playa Larga in Jaragua National Park and some of the western beaches in Del Este National Park (Fig. 1).

Bahía de las Aguilas, a pristine 4-km-long white sandy beach, has been part of Jaragua National Park since 1983. As part of the Jaragua-Bahoruco-Enriquillo Biosphere Reserve, this area has been named an Important Bird Area (IBA) by BirdLife International, a Key Biodiversity Area (KBA) by the Critical Ecosystems Partnership Fund, and is a Specially Protected Area under the SPAW Protocol of UNEP's

Cartagena Convention. This National Park is considered one of the most important areas on Hispaniola for avian biodiversity (Latta 2005) and hosts a vital nesting beach for Leatherback Sea Turtles (Revueña et al. 2014). Attempts to exploit Bahía de las Águilas for mass tourism have been ongoing for decades, although Wielgus et al. (2010) indicated that this area cannot support that level of tourism. In the late 1990s, the Dominican Agrarian Institute (IAD), a governmental agency, appropriated the beaches within the National Park by fabricating land titles to alleged farmers from the local community under a land reform scheme (Acosta-Lora 2006, León and Arias 2014). These were then quickly sold to third parties with an interest in development for tourism (Ramírez Tejada 2002). Fortunately, the former Director of the National Land Tenure Registry exposed this scam, and legal action was filed against the title-holders (Ramírez Tejada 2002). The defendants' lawyers were able to delay the case for 16 years based on a series of technicalities until the statute of limitations had passed. In 2013, a new attempt to validate the land titles was made, this time through a Presidential Executive order (Vásquez 2014). Once again, civil opposition to the development of Bahía de las Águilas helped revoke this executive order. The court case was then reopened and all of the land titles were declared invalid (Y.M. León, pers. observ.). However, in April 2014, a plan was initiated to revamp the main access road to Bahía de las Águilas beach in Jaragua National Park

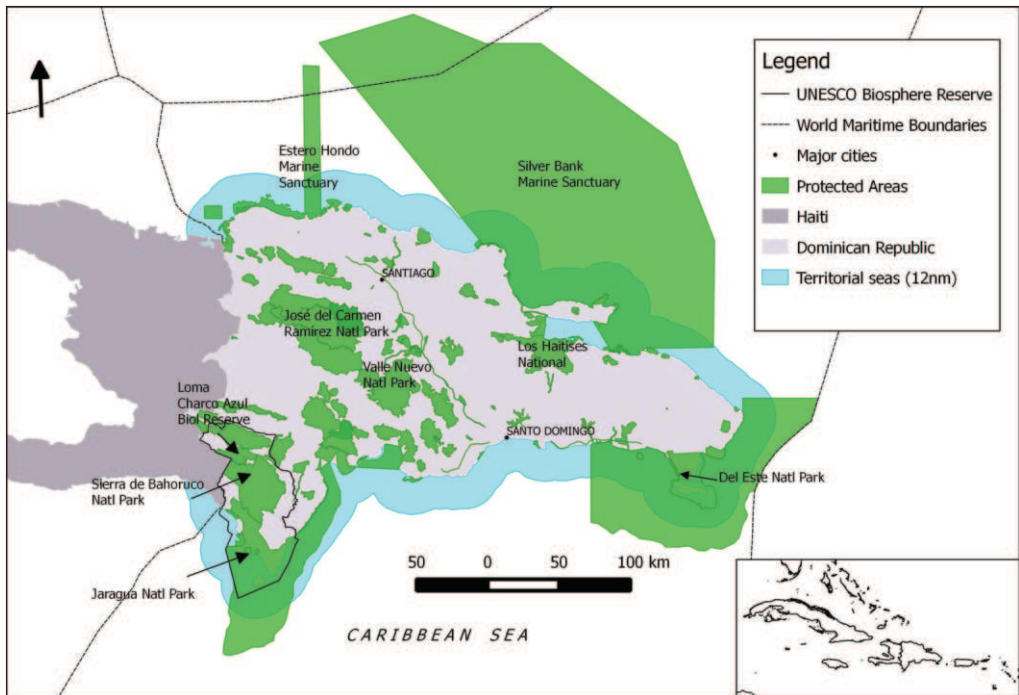


Figure 1. Map of the Dominican Republic depicting protected areas (light green), making up 24.8% of the terrestrial area of the country and covering 55.8% of its territorial sea. Sources: Protected areas shapefile obtained from the Ministry of the Environment (DR) in 2010, maritime boundaries from Global Maritime Boundaries Database (<http://www.gd-ais.com/>), and territorial seas created by applying a 12-nm (22.2-km) buffer from the coastline.

for the purposes of tourism (Arias 2014), and a more recent investigation discovered that this type of title scam had been used by the IAD previously to privatize state lands in coastal areas in other parts of the country (Y.M. León, pers. observ.; Ramirez Tejada 2002).

In addition to these types of political battles raging over protected beaches, mass tourism development within well-established National Parks is widespread in the DR. The eastern portion of the country exemplifies this in the coarsest way, as it has become the most popular tourist destination in the country. Large-scale resorts and golf courses, such as Barceló, Meliá, Punta Cana, and Cap Cana, are scattered across the landscape. The international airport in this area (Punta Cana) receives over 1 million foreign visitors annually (PCIA 2015), and nearly 6 million people venture into the adjacent Del Este National Park on day excursions every year, making it the most visited park in the country (Park Entrance Staff, Del Este National Park, Bayahibi, DR, pers. comm.). This is likely an underestimate of actual visitation, which is believed to exceed the carrying capacity of the park and is harming ecosystems (Guerrero and Rose 1998). The vast majority of visitors to this and other protected areas are foreigners (Holmes 2010). In fact, a survey of over 3000 residents throughout the DR indicated that less than 16% of the population has visited a nationally protected area (Berroa and Roth 1990). The high numbers of visitors are causing increased pollution, destruction of mangroves and other critical habitats (Guerrero and Rose 1998), and are placing additional pressure on fisheries in the area (Y.M. León and S.A. Pasachnik, pers. observ.). However, the government is not interested in limiting tourism because of the revenue provided (Guerrero and Rose 1998).

More recently, many beaches in Del Este National Park, especially those on Isla Saona, have been leased for a fee (called a beach concession) so individuals and companies can have their own private beaches for day excursions (Y.M. León and S.A. Pasachnik, pers. observ.). These excursions usually involve deployment of beach furniture and construction of kitchen facilities, which are guarded at night by employees who effectively live within the park with little regulation. They are known to poach sea turtle eggs and even kill nesting females (Revueña et al. 2012; Y.M. León, pers. observ.). As of 2015, these beach concessions were being expanded into new areas of Isla Saona and divided to accommodate additional leases (Y.M. León and S.A. Pasachnik, pers. observ.). In addition, makeshift garbage-dumping sites are growing behind the beaches, most of the reefs are overfished by local and foreign fishermen, and horses, pigs, and donkeys continue to be brought to the island, where they roam freely and destroy many of the island's fragile forests (Y.M. León, pers. observ.).

Case Study II: Charcoal in the Loma Charco Azul Biosphere Reserve and Lake Enriquillo National Park

The use of charcoal has a well-established history on Hispaniola as the primary source of energy since early colonial times. Constant deforestation for charcoal production is evident throughout the DR, particularly in the areas that border

Haiti (Y.M. León, R.C. De León, and S.A. Pasachnik, pers. observ.). In the 1980s, the government began to subsidize propane gas; however, 10% of households in impoverished areas continue to use charcoal for cooking (Ovalles 2011). In Haiti, charcoal remains the primary cooking fuel, causing an ever-growing demand for charcoal produced in the DR as Haiti's forests are depleted (Ovalles 2011). Estimates suggest that 86% of the charcoal consumed in Haiti is provided by the DR (22,170 tons per year; Checo 2009). Given the financial scale of charcoal production and its illegal status (unauthorized tree cutting is considered illegal by the current Forestry Norm; Reglamento Forestal 2006), it is associated with much corruption by powerful Dominicans who control the business (Grupo Jaragua 2011). In addition, a recent investigation (Diario Libre 2015) exposed one of the largest Dominican charcoal producers, who had been issued at least 2 permits by the Ministry of the Environment. These authorized the cutting of over 200,000 trees per year from what was described as a managed tree farm. While the Forestry Norm does allow for such permits, 2 visits to the farm in question revealed that trees were cut from natural forests on the site, that no reforestation or propagation facilities exist, and that the area is within the boundaries of an UNESCO Biosphere Reserve (Y.M. León, 2014 and 2015 pers. observ.), which highlights the inadequacy of the government to properly evaluate such farms during its permitting process. The DR cannot sustain such large-scale harvesting of its remaining forests.

Decreasing the use of charcoal as a cooking fuel for many households on Hispaniola is a complicated process, as poverty, access to alternatives, and profits must be considered. Discussions of a subsidy similar to that for propane gas are underway in the DR and in Haiti; however, this may not be sufficient to reduce the charcoal demand and will take time to implement. In addition, a portion of the charcoal produced in the DR is being exported to the United States, Spain, Dubai, Puerto Rico, and other Caribbean islands for recreational barbecues (Díaz 2014). Although not all of this charcoal is coming from protected areas, a portion is, as charcoal kilns have often been detected inside these areas. To date, the origin of much of the exported product cannot be determined. At least 15 companies are listed as international charcoal exporters from the DR (see customs.alibaba.com).

One of the areas that has been most affected by charcoal production is the southern shore of Enriquillo Lake in the southwestern portion of the country (Fig. 2). This area, specifically the town of Baitoa, has been known as one of the most active charcoal production sites since 1981 (Ducoudray 2006) and continues to operate to this day with little to no governmental interference (Y.M. León, R.C. De León, and S.A. Pasachnik, pers. observ.). Given the difficult socio-economic situation in this region, which is one of the poorest in the country, illegal charcoal production is an ever-increasing source of income. The main effect of this industry has been a reduction of plant species diversity combined with the simultaneous introduction of aggressive species like *Prosopis juliflora* (Sw.) DC. (Mesquite) and an over-abundance of native cacti, the only plants not targeted by charcoal makers (Rupp et al. 2007). These plant population shifts in turn affect a variety of other species that depend on these ecosystems, such as the two endemic

Rock Iguanas (Rhinceros Rock Iguana and *Cyclura ricordii* Duméril & Bibron [Ricord's Rock Iguana]). Grupo Jaragua, a local NGO that has been monitoring the area for the past 10 years, filed a legal complaint to the Environmental Attorney's office about the aggressive charcoal production in the area, but no response has been received as of the end of 2015 (Y.M. León, unpubl. data.). This openly visible charcoal-production site directly affects Loma Charco Azul



Figure 2. A section of land south of Enriquillo Lake, Dominican Republic, in 2011 (A) and 2013 (B). The destruction depicted here was for agricultural projects; however, charcoal production commenced following the initial clearing. Photos by Rosanna Carreras De León.

Biological Reserve and Lake Enriquillo National Park, both within the Jaragua-Bahoruco-Enriquillo Biosphere Reserve (Fig. 1) and thus recognized under the previously listed international conservation classifications.

In 2011, a Dominican university (INTEC) examined the distribution of the 2 aforementioned endemic and threatened rock iguana species as well as the presence of charcoal production. A total of 82 transects were randomly placed across the region, covering ~164 km² (Fig. 3). A total of 96 charcoal kilns were documented (1.2 kilns/transect). Just 2 years later, the same transects yielded 173 charcoal kilns (2.7 kilns/transect). In addition, the areas encompassing 12 transects had been completely clearcut for agricultural projects and charcoal production was underway (Fig. 4; R.C. De León et al., unpubl. data). In just 2 years, charcoal production had doubled, leaving huge tracks of barren land in the Loma Charco Azul Biological Reserve and Enriquillo Lake National Park buffer zones. Charcoal production persists in this area (into 2015) with no signs of being curtailed. As in Haiti (Y.M. León, R.C. De León, and S.A. Pasachnik, pers. observ.), charcoal production may persist until nothing is left to burn.

Case Study III: Agriculture in the Loma Charco Azul Biosphere Reserve and Sierra de Bahoruco National Park

Government-sponsored agricultural projects have been created to reduce poverty in rural areas since the time of Trujillo (1930–1961). Agricultural practices have been shown to have a negative affect on a variety of lizard species in both protected

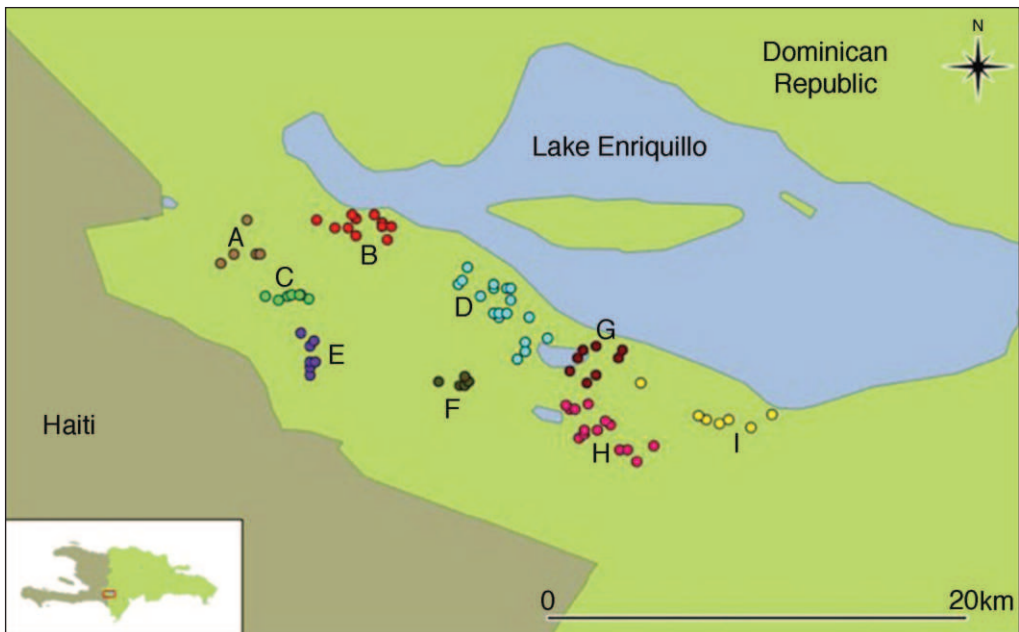


Figure 3. Map of transects used to evaluate the number of charcoal kilns on the southern shore of Lake Enriquillo, Dominican Republic. Dots represent each transect, color coded by lettered zone.

and unprotected areas in the DR (Glor et al. 2001). The current president, Danilo Medina, is focused on a poverty-relief plan in which tourism, commerce, and agriculture play leading roles. In 2013, the government's IAD instated an aggressive plan to create new agrarian projects on state lands for local farmers (under agrarian reform principles). This proposal called for vast land clearing and irrigation infrastructural projects (González 2014), some in protected areas.

A well-documented case is that of the Enriquillo Lake region. This lake experiences periodic flooding that at times causes lakeshore farms to be inundated and thus not suitable for farming (Archibold 2014). The economic impact of these events has prompted the government to attempt to compensate these communities by developing new agrarian projects. Although some projects fell within the Loma Charco Azul Biological Reserve, they were nevertheless authorized by the Ministry of the Environment (Figs. 1, 4; Martínez Batlle 2013). Tragically, agriculture is nearly impossible in this incredibly arid habitat without substantial irrigation. The unique dry forest habitat of the reserve harbors various endangered species, most notably the critically endangered Ricord's Rock Iguana, the vulnerable Rhinoceros Rock Iguana, the endangered *Guaiacum officinale* L. (Lignum Vitae Tree), and the rare *Haitiophis anomalus* (Peters) (Hispaniolan Brown Racer) (Landestoy et al. 2013). Given the high biodiversity value of the area, a local NGO (Grupo Jaragua) exposed the development of these projects in protected areas through conven-



Figure 4. Forest clearing by the Dominican Agrarian Institute (IAD) in the Loma Charco Azul Biological Reserve, Dominican Republic. Photo by Yolanda M. León.

tional and social media, which triggered a letter of concern from the IUCN Species Survival Commission (ISG 2013). These actions generated considerable public outcry and are believed to have prompted the IAD director to negotiate with Grupo Jaragua and reconsider the location of one of the planned project sites within the Reserve, agreeing instead to allocate land from some of the other projects to the farmers in the area (Y.M. León, pers. observ.).

Agriculture plays a major role in destroying many other protected areas. The situation in Sierra de Bahoruco National Park has been particularly well documented. Besides being the largest terrestrial protected area in the DR, Sierra de Bahoruco is also within the Jaragua-Bahoruco-Enriquillo Biosphere Reserve (Fig. 1). In addition to the aforementioned international conservation classifications, Bahoruco also is an Alliance for Zero Extinction site in light of the degree of endemism and occurrence of range-restricted species within its boundaries. In fact, Latta (2005) found Sierra de Bahoruco National Park to be the most important area on Hispaniola for avian biodiversity. In 2013 and 2014, the destruction of 69 km² of broadleaf and cloud forest was documented in Sierra de Bahoruco National Park, equivalent to more than 30% of the original extent of the southern slope broadleaf forests of the park (Fig. 5; León et al. 2013).

Through interviews, León et al. (2013) documented well-established agricultural systems involving protected-area land-grabs by Dominicans. One of these



Figure 5. Clearing for bean production in Bahoruco National Park, Dominican Republic. Note the forest fragment in the background. Photo by Yolanda M. León.

involves hiring migrant Haitian workers as inexpensive field hands in extensive avocado plantations with produce destined for the export market (shipping primarily to the USA and Spain). Another system consists of leasing cleared park lands to Haitian farmers in exchange for 20% of their crop, usually consisting of short-cycle food staples such as beans, corn, pumpkins, sweet potatoes, and pigeon peas (León et al., unpubl. data). Meanwhile, the Dominicans responsible remain out of sight and free from accusations of forest destruction.

Furthermore, in late 2014, the Pedernales Provincial Director of the Ministry of the Environment issued a permit for the deforestation of over 25 acres for a private agrarian project in Jaragua National Park near its northern connection with Sierra de Bahoruco National Park. Only after a local citizen (Nicolás Corona) filed a formal complaint to the Provincial Environmental Attorney's office and a major newspaper picked up the story, did the Ministry of the Environment decide to investigate the affair. The result was to transfer the director to another Ministry position in the same region, where he was granted the same salary (Y.M. León, pers. observ.).

Conclusions

Protecting habitat can be quite complicated, particularly in developing nations with limited land such as those of many Caribbean island nations. Overpopulation, poverty, greed, and corruption will always be drivers of destruction. However, mismanagement and a lack of enforcement of protected-areas legislation allow destruction to proceed in areas that should be conservation strongholds for the future. Each destructive force feeds off the next in a synergistic fashion, creating a downward spiral (Wilson 2002). Constructing roads into protected areas paves the way for charcoal cartels to access new timber and farmers to encroach on new territory. In turn, clearing habitat for agricultural projects further opens the door for charcoal production and might even encourage it. To support ever-growing populations, development will proceed, this is a given. However, such activity should be focused outside protected areas, such that a balance can be reached between development and conservation of natural resources.

As is evident from the selected case studies, a lack of sustainable, well-informed management plagues the protected areas of the DR. Charcoal cartels destroy the landscape in the open for all to see, tourism continues to increase without concern for visitation capacity, and damaging agrarian and charcoal projects are permitted. Further, this all happens within protected areas and with the knowledge if not the blatant support of the Ministry of the Environment. In an extreme case, the government's IAD has been implicated in corrupt plans to create false land titles to distribute among friends. In general, recent governments have shown an overarching lack of interest in protecting the land and respecting Environmental Law. Greed and corruption is becoming more and more prevalent, and the land is paying the price.

We attribute this situation in part to the lack of continuity of government plans and key decision makers following national elections. With each presidential election (every 4 years), bureaucrats at all levels are frequently replaced, particularly if a different political party prevails in the election. This turnover results in

institutional myopia, as new appointees lack job experience and the knowledge gained from training programs at the national and international levels (which are not repeated with every election). Turnover also causes many conservation plans and initiatives to be lost in transition, resulting in them being completely rewritten, revised, or simply ignored. In addition, a spoils system reigns, and many governmental employees are rewarded with positions based on political connections instead of expertise (Jorge 1997; Y.M. León, pers. observ.).

These factors result in many areas being protected only on paper that even the Ministry of the Environment only sporadically recognizes and will not consistently enforce. Part of the problem is that very few protected areas have clear boundaries, management plans, or staff (Holmes 2010)—but the main issue is a lack of initiative and desire to put the necessary effort into active protection. This is not to say that all parks function in this manner or that creating parks on paper is not a positive step. It is the proper first step and can buy valuable time, but additional work is needed to reach appropriate levels of protection. Further action must be taken after drawing lines on a map. The DR has legislated protection of extensive land and marine areas through the Sectorial Law of Protected Areas of 2004, Law 202-04, and later Presidential Decrees, and should thus be a powerful biodiversity stronghold. In 2010, the National Protected Area System (SINAP) was even included in the national constitution (art. 16; Constitución de la República Dominicana 2010). However, this designation is meaningless unless the nation takes the next step and enforces its laws.

Historically, civil groups have had to compel the government to properly manage protected areas (Jorge 1997). In the case of the land-grabbing scam in the Bahía de las Águilas beach of Jaragua National Park, the outrage of civil society at large, a committed NGO, and a few individuals inside the justice system seem to have averted the threat at least temporarily. In the case of Loma Charco Azul, a very persistent NGO exposed the situation to the media and halted the bulldozers, ultimately negotiating a solution with the responsible government entity. Thus, civil society has proven to be a very important player in the preservation of protected areas in the DR, but its effectiveness varies. As is evident in the success of the charcoal cartels, no magic recipe or simple formula exists. A local NGO has attempted to halt the destruction, but the cartels appear to be untouchable. Civil society should not have to fight these battles alone (Jorge 1997) and should not be forced to oppose the very governmental entities that should be enforcing protective actions (Powell and Inchaústegui 2011).

Small, biologically diverse countries, such as the DR, must urgently develop and implement nation-wide and spatially explicit land-use plans if their remaining biodiversity is to survive. In the DR, a call for this plan has existed since the General Environmental Law of 2000; however, technical complexities, a lack of spatial databases, and disagreement among stakeholders have precluded any progress (Y.M. León, pers. observ.).

Similar situations haunt many protected areas around the world. Well-documented examples include the Mesoamerican Biodiversity Corridor and the Indio Maiz

and Bosawas Biosphere Reserves of Nicaragua (Meyer and Huete-Perez 2014), the Wolong Reserve of China (Liu et al. 2001), and the Goat Islands and the Portland Bight Protected Area of Jamaica (Edwards 2015). In each instance, conservation, politics, and socioeconomics are at odds with each another. The IUCN has highlighted the fact that despite the apparent increase in protected areas throughout the world since the 1970s, the rate at which biodiversity is being lost continues to grow (e.g., IUCN 2014). Leverington et al. (2010) indicated that only 24% of the world's protected areas have "sound management". Of the remainder, 35% have only "basic management", 27% have "major management deficiencies", and the management in 13% is "clearly inadequate". Watson et al. (2014) explicitly identified corruption and poor law enforcement as a major threat to protected areas throughout the world. Consequently, the inadequate management of protected areas in the DR is not unique—but it is something that can be addressed through increased awareness in both private and public sectors along with strengthening management skills and applying additional resources to the building blocks (i.e., the designated protected areas) that are already in place.

To address these deficiencies in the DR, the Ministry of the Environment should actively collaborate with local and international academic institutions and NGOs, so that tangible conservation actions may be achieved in one of the most corrupt nations in the world (Noticias SIN 2010, Transparency International 2014). Unfortunately, civil entities that expose and denounce weak management or corrupt practices are facing increasing hostility from and exclusion by government authorities. As a result, the degree of participation granted to them on internationally funded projects aimed at improving protected area management in the DR (e.g., GEF projects) is very limited. This lack of collaboration greatly limits the design and effectiveness of many projects, which precludes any effective conservation efforts. Universities and NGOs with proven records of protected area advocacy and research should be given more prominent roles in decision-making, implementation, and monitoring of protected areas. Most importantly, these groups are vital in adopting objective measures for such projects, such as those outlined in the Open Standards for the Practice of Conservation (CMP 2013).

Edward O. Wilson (2002) postulated that the future of life is in the hands of developing nations. Much of the world's biodiversity occurs only in developing nations, many of which are struggling to protect their natural heritage despite obstacles such as those presented herein. Caribbean islands such as the DR harbor some of the highest levels of biodiversity in the world and stand as important reservoirs for many of the world's unique species and ecosystems—if they can maintain protected areas. With very little remaining intact Caribbean habitat, these island nations must strive to prevent their protected areas from being fragmented and diminished by agriculture, charcoal, and tourism, or simply sold to the highest bidder.

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