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Article Case

Establishing a Private Protected Area in Ecuador: Lessons learned in the management of Cerro Blanco Protected Forest in the city of Guayaquil

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Abstract

The Bosque Protector Cerro Blanco (Cerro Blanco Protected Forest) is a 6,078 ha reserve that protects a significant remnant of dry tropical forest in Ecuador. Under Ecuadorian law one of the principal ways to protect private lands is to declare them as protected forests and vegetation. These areas for the most part do not receive funding from the government but their designation does provide some legal support when the inevitable conflicts in land use arise. Cerro Blanco, which was designated a protected forest in 1989 via government decree, is one of the earliest and also most consolidated of the protected forests. With support from the private sector, principally Holcim, which has a cement-producing plant in the forest buffer zone, Fundación Pro Bosque has set up a broad-based management program that includes control and vigilance, dry forest restoration, environmental education and interpretation, scientific investigation, and community development. This article provides a perspective of establishing protected areas in biodiverse areas facing many challenges, including rapid urban expansion, poorly regulated land use, and encroachment. The article includes some lessons learned that may be of use in attempting to establish protected areas in other places with similar challenges.

KEY MESSAGE

This case study examines one of the first efforts in Ecuador to establish a private protected area under a governmental protection system called “protected forest and vegetation,” under the auspices of an Ecuadorian nonprofit organization. This case study details a 26-year sustained effort to establish the Cerro Blanco Protected Forest with both positive and negative outcomes, conservation highlights, and lessons learned that might be applicable to other efforts to establish protected areas in the tropics.

INTRODUCTION

Private efforts at land acquisition and conservation are neither new nor consistently private. In the United States, for example, private actors have played a vital role in acquisition and conservation efforts for more than 180 years [1]. The international literature on conservation on private lands is rich and varied and include the Australian experience [2], combining conservation and development on private lands in Costa Rica [3], a synthesis of early indicators of the drivers of predator conservation on private lands in South Africa [4], assessing significance for biodiversity conservation on private land in New Zealand [5] and the often neglected (by conservation interests) private lands of the United States [6], among many others. In Latin America, as in other regions, conservation strategies are becoming increasingly bioregional, operating on a scale of ecosystems and the wider landscape to conserve biological and cultural diversity. There is a growing recognition that protected areas can no longer be treated as islands, but must be seen in the context of overall land use with an emphasis on compatible management of surrounding lands and creating linkages among reserves. The region's experience with “paper parks”—protected areas in name only—has demonstrated forcefully that approaches that rely solely on regulation and enforcement are costly and too often meet with failure. Conservationists are finding they must adopt inclusive approaches that encourage local participation. These new directions in conservation will rely on engaging local residents and communities in protecting and managing areas, which increasingly, as countries in the region consider new types of land tenure mechanisms, are privately or communally owned [7].

In several countries of Latin America, NGOs advocating the use of protected landscapes are pushing for supportive legislation [8]. Ecuador, for example, includes private protected areas within the Constitution as part of the state patrimony of natural areas. The Ecuadorian National Protected Area System was initiated in 1959 with the declaration of Galapagos National Park and currently covers approximately 20% of the country including both continental areas and The Galapagos Islands [9]. While this is a commendable outcome of a sustained protection program that on the mainland began in the 1970s, some of the 43 ecosystems recognized in the country [10] are not adequately represented in the national system. The ability of the national protected

area system to conserve representative biodiversity is still limited, due to Ecuador's varied topography and accompanying diversity of microregions and life zones. Conservation of small natural areas is therefore an important conservation strategy in a country with Ecuador's unique ecological characteristics [7]. One of the tools used in the creation of private protected areas in Ecuador has been the *bosques y vegetacion protectores* (protected forest and vegetation). Beginning in the 1980s with the establishment of the National Forestry Law, a hybrid state and private protected area system was created, the protected forests. Currently, 241 protected forests have been declared by the Ecuadorian Government that nominally protects 2,386,957 ha of land or 11% of the country. A total of 60% of the protected forests are publicly owned, 32% a mix of public-private lands, 8% are privately owned and 7% are communal or local associations' lands [11]. However, many of these designations have not resulted in effective protection of the sites although some, including privately owned and managed by conservation NGOs, are being adequately conserved [12]. An analysis of the status of nine protected forests in Guayas Province including indicators such as percentage covered in forest, scientific studies carried out, boundary delineation in the field, management plans existing, funding and park guards on site found that while eight of the nine protected forests had organizations or private citizens involved in some aspect of their management, most were lacking in the aforementioned indicators [13]. One of the ecosystems not adequately represented in national protected area system is the Ecuadorian Coastal Dry Tropical Forest. Dry tropical forests are defined as dominated by at least 50% drought-tolerant deciduous trees growing in a climate where the mean annual temperature is greater than 25°C, total precipitation ranges between 700 and 2,000 mm, and three or more dry months occur every year [14].



FIGURE 1.

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Ecuadorian dry tropical forest.

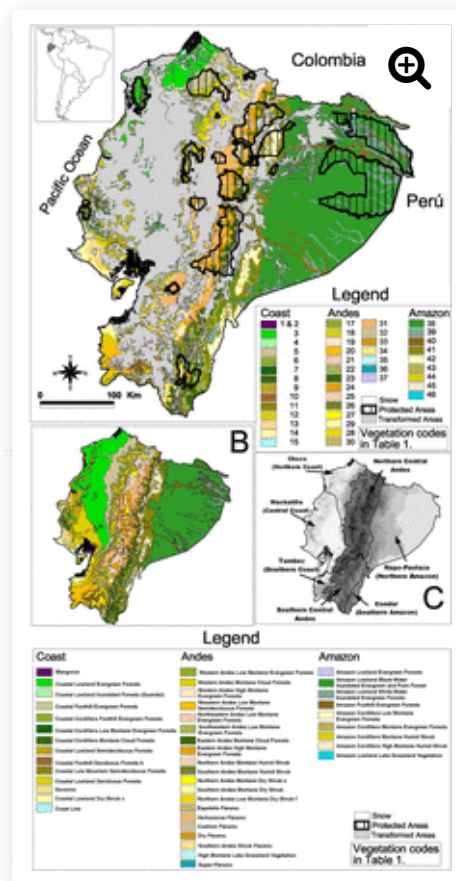


FIGURE 2.

[Download figure](#) | [Open in new tab](#) | [Download powerpoint](#)

Map of forest coverage in Ecuador.

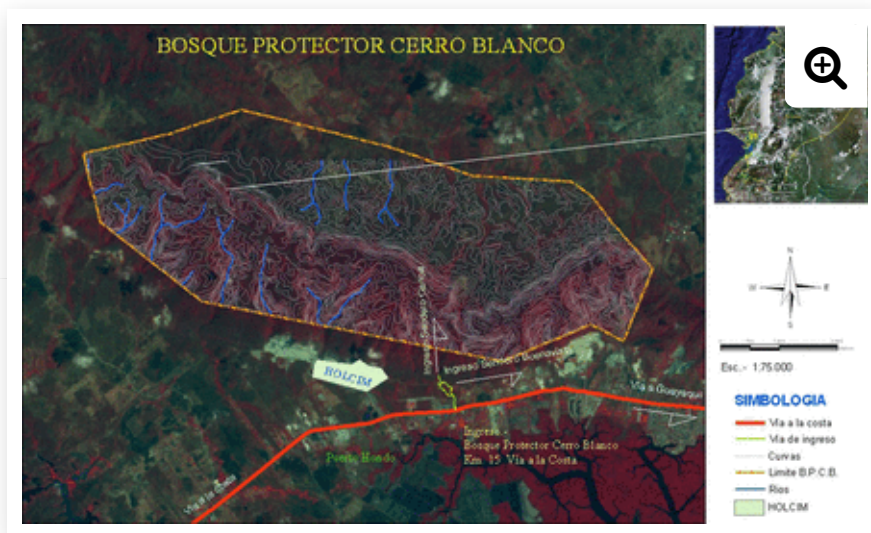


FIGURE 3.

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Map of Cerro Blanco Protected Forest.

CASE EXAMINATION

History

Beginning in the 1960s, La Cemento Nacional (National Cement Company) bought up land in Cerro Blanco to establish a limestone mine quarry on part of the land. The remaining extension of approximately 1,820 ha was nominally protected by the head of security of the adjacent cement plant with a group of 10 workers who periodically maintained boundary fences, planted trees, etc.

In 1989, at the request of La Cemento Nacional, the Ecuadorian Ministry of Agriculture and Livestock was asked to protect approximately 2,000 ha of Cerro Blanco as a protected forest. While no government funding was forthcoming as a result, the designation did provide a legal basis for protecting Cerro Blanco especially against later attempts to take over by force parts of the area by land traffickers wanting to convert the protected forest into urbanized areas.

The first attempt to write a management plan for Cerro Blanco failed. Instead of focusing on the principal objective of *protecting* native dry forest, the plan called for exploiting the remaining tropical hardwoods in Cerro Blanco and was rejected by La Cemento Nacional.

In 1990, La Cemento Nacional in conjunction with Fundación Natura, the principal Ecuadorian nonprofit conservation organization at the time, requested assistance from the Peace Corps for a volunteer to assist in carrying out the initial planning for the protected forest and assist in setting up some of its management programs. The author of this article was sent to work initially for three months to research and prepare management guidelines for Cerro Blanco. The first month consisted in walking the internal and external boundaries of the area, which ranges from approximately 15 to 500 m above sea level in a series of hills intersected by ravines with permanent springs. The vegetation was a mosaic, reflecting past management for cattle production and ranged from near pure areas of *Panicum maximum* grass to good quality dry tropical forest.

The management guidelines included a preliminary land use zoning ranging from intensive use areas to strict scientific areas [15]. In between the two was a recuperation zone where the natural processes of forest regeneration would continue, to a restoration zone focusing on the exotic pasture grasses. The principal management programs in the guidelines were also outlined including an environmental education and interpretation program recognizing the close proximity of Cerro Blanco to the city of Guayaquil and its easy access from the coastal highway linking the city to nearby beaches. The existence of a tree nursery on site that produced some

native tree species utilized mainly in urban green space programs was also incorporated with a new focus on producing native dry forest trees for the Cerro Blanco restoration program. The globally endangered Great Green Macaw *Ara ambiguus guayaquilensis* was also identified as the conservation symbol of the Cerro Blanco Protected Forest.

Fundación Natura initially signed a 25-year agreement with La Cemento Nacional to administer Cerro Blanco. Owing to disagreements in the focus of the management program, this agreement was annulled in 1993 and Fundación Pro Bosque whose founding members included both representatives of La Cemento Nacional and Fundación Natura, began work to implement the conservation programs in Cerro Blanco.

In the three-year period from 1990 to 1993 that Fundación Natura worked in Cerro Blanco, progress was made in developing the interpretative infrastructure of the reserve including the construction of a visitor center with an amphitheater, interpretative sign boards, and a trail system. The first guides were trained and began to lead interpretative walks in the forest principally school students and family groups from Guayaquil, with some international visitors.

A core group of five park guards were also formed and work began to restore forest in tree plantings along internal access roads within the reserve. The visit of several important Neotropical scientists under the auspices of the Rapid Areas Assessment Program of Conservation International and their subsequent recommendation to protect and expand the reserve provided a needed boost [16].

Beginning in 1993 the author with the support of the CEO of La Cemento Nacional worked to consolidate the conservation gains made, including the construction and manning of the first backcountry guard station, the construction and staffing of an on-site office and the expansion of the dry forest restoration program through the establishment of enrichment parcels in both abandoned pasture lands as well as secondary scrub vegetation. A botanical inventory under the auspices of the National Herbarium was carried out [17] and the first known Great Green Macaw nest was protected with 24 hours a day vigilance leading to the successful fledging of two chicks.

Serious threats also appeared that unchecked would have led to the destruction of the area. In 1993, a large forest fire started outside of the protected forest threatened to expand into it. Firefighting equipment was purchased and park guards trained to build fire lines and techniques on how to control and extinguish fires in dry tropical forest. Encounters with illegal hunters began to escalate and crucial support was provided by the Ecuadorian Army initially and later by the Environmental Unit of the National Police to shore up law enforcement capability.

**FIGURE 4.**[Download figure](#) | [Open in new tab](#) | [Download powerpoint](#)

Cutting fire lines.

**FIGURE 5.**[Download figure](#) | [Open in new tab](#) | [Download powerpoint](#)

Forest fire near protected forest boundary.

The construction of a water canal along the reserve boundary facilitated access into formerly farms and subsistence agriculture areas intermixed with dry forest and led to the rapid

establishment of squatter settlements. The “leaders” of the settlements have political ties in government and despite the illegality of taking over by force land with legal land titles through coercion and violence, land traffickers have contributed to the destruction of large tracts of both dry tropical forest and mangroves in the city of Guayaquil.

Attempts to take control of land by force in Cerro Blanco by land traffickers has been thwarted so far with appeals made via initially the news media and later via social media to defend Cerro Blanco. In both cases, pressure has been placed on authorities by some of the more than 50,000 people who have so far visited Cerro Blanco and orders issued to evict the squatters in three separate incidents from 1996 to 2013.

Conservation Highlights

Some of the main advances in the conservation and restoration of the Cerro Blanco Protected Forest include the following:

- Approximately 50% of dry forest in Ecuador has been cut down mainly for the expansion of the agricultural frontier that reflects a growing population [18]. Restoration of 637 ha of abandoned pasture lands and secondary scrub vegetation was carried out within Cerro Blanco, with the over-arching management objective to prevent the continued degradation of natural resources and restore forest cover. The original forest cover in Cerro Blanco had begun to be cleared in the 1960s and converted to cattle pasture. The African grass *Panicum maximum* was introduced in limited areas and the seed distributed on a wider scale by birds. Tropical hardwoods especially *Handroanthus chrysantha* were cut and used for furniture or to make charcoal. As part of its efforts to consolidate the protected forest's conservation, La Cemento Nacional purchased several inholdings for a total of 750 ha and deeded them to Fundación Pro Bosque. On these lands and others owned by Fundación Pro Bosque in Cerro Blanco, between 900 and 1,000 trees were planted per hectare in enrichment parcels around existing trees and shrubs. Mixed native tree species were used in the program and planted in parallel lines simulating natural forest gaps, holes were excavated with digging bars to a depth of 30 cm along the lines at a spacing of between 3 and 4 m. Existing trees and shrubs, mainly *Cecropia littoralis*, as well as stump sprouts of primary forest trees especially *Cynometra bauhiniifolia* were incorporated into the planting program. International funding by SEE through the World Land Trust permitted the program to expand quickly from an average of 9,000 trees planted per year to a high of 90,000. A total of 35 native dry tropical tree species were used, propagated in the on-site nursery. Despite the increasingly erratic rains possibly because of climate change, an overall survival rate of between 65% and 70% has been achieved in the 637,000 trees planted. A key factor is maintenance, for up to three years after planting, weeds and other vegetation is cleared around planted trees. Low

funding at the beginning of the program did not permit adequate maintenance of planted trees, which led to higher mortality rates or stunted growth in trees outcompeted by surrounding weeds and vines. Tree species selection was also experimental when the project began, there was little available literature on the propagation of several native dry tropical forest tree species and consequently, much trial and error occurred. Beginning in 2016, a million dry forest tree seeds have been planted through a project funded by The Body Shop in conjunction with the World Land Trust. Heavy seasonal rains in the second year of seed planting has sparked good germination and tree growth rates and if successful may be used in the future where budget limitations rule out using trees and site and climatic conditions permit direct seeding.

TABLE 1.[Collapse inline](#) | [View popup](#)

Number of trees planted in the Cerro Blanco Protected Forest restoration program registered since 2006 including area and estimated survival rates

Year of planting	Surface (ha)	Planted trees	Estimated survival (%)
2006–2007	18	17,800	75
2007–2008	90	90,000	65
2008–2009	99	96,000	70
2009–2010	90	90,000	70
2010–2011	55	55,000	75
2011–2012	35	35,000	70
2012–2013	15	15,000	70
2013–2014	10	10,000	70
2014–2015	15	15,000	70
Total	427	423,800	70.5 (average)

Note: Prior to these work periods, a program was maintained that began in 1992 and lasted until 2002, where approximately 200 ha were reforested; these sites currently show a wide recovery rate.

**FIGURE 6.**
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Fernán Sánchez (*Triplaris cumingiana*) tree planted in January 2007 and evaluated in June 2011.

TABLE 2.
[Collapse inline](#) | [View popup](#)

Forest seeds planted directly in the field (Project Seeds)

Year of planting	Surface (ha)	Seeds planted directly in field	Estimated survival (%)
2015–2016	40	350,000	45
2016–2017	70	650,000	
Total	110	1,000,000	

Note: The project is still running.

**FIGURE 7.**[Download figure](#) | [Open in new tab](#) | [Download powerpoint](#)

Organization of field staff to start a day of direct sowing of native tree seeds in the field.

**FIGURE 8.**[Download figure](#) | [Open in new tab](#) | [Download powerpoint](#)

Direct planting of forest seeds in enrichment area for restoration of forest cover in Cerro Blanco Protected Forest.

**FIGURE 9.**[Download figure](#) | [Open in new tab](#) | [Download powerpoint](#)

Germination and first stages of growth of plants obtained by direct planting of dry forest seeds

**FIGURE 10.**[Download figure](#) | [Open in new tab](#) | [Download powerpoint](#)

Plant obtained by direct sowing of forest seeds, evaluated eight months after planting.

- The Great Green Macaw, which is listed as critically endangered in the Ecuadorian Bird Red Data Book [19] has been the object of an extensive conservation program that has included protection of nest sites against poachers that sells chicks in the illegal pet trade and habitat restoration using known food sources such as *Centrolobium ochroxylum* and *Cynometra bauhiniifolia*. Captive bred birds have been released back into the wild to bolster the local

population (five macaws have been released to date) as well as the construction and installation of artificial nest boxes and a community environmental education program that led the Municipality of Guayaquil to declare the Great Green Macaw the natural symbol of the city in 2005. Fundación Pro Bosque also spearheaded the preparation of a national conservation strategy for the Great Green Macaw in Ecuador with the input of national experts in various areas [20]. The Strategy, which has been implemented both within a working group and individual institutional level, includes both *in situ* and *ex situ* programs focusing on bolstering and extending habitat protection through different conservation strategies including the implementation of agroforestry programs to diminish deforestation, and declare bans on the exploitation of key nesting tree species and food sources such as *Cavanillesia platanifolia* and *Cynometra bauhiniifolia*. With the support of the Jambeli Rescue Foundation, captive bred macaws will continue to be released back into the wild to bolster the local population.



FIGURE 11.

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Great Green Macaws in the Cerro Blanco Protected Forest.

**FIGURE 12.**
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Adaptation of macaws born in captivity prior to release.

• The location of the Cerro Blanco Protected Forest about 15–20 minutes from the center of the city of Guayaquil and right off the main coastal highway is a double-edged sword. Easy access increases pressure on the protected forest but at the same time it permits easy visitor access. While visits to the Cerro Blanco Protected Forest have remained constant at an average of between 3,500 and 5,000 visitors a year who take guided walks with guides (mainly students from local schools) and camp out or picnic, special events have been a key to bolster attendance. In 2013, an Eco Festival was carried in one day and featured food and crafts, music, puppet theatre, yoga, talks and presentations on various topics such as bird watching. In one day, 3,500 visitors came to Cerro Blanco, almost the same number the reserve receives in a year. A special effort was made to reduce impacts, such as parking cars outside the main gate and walking in or better yet using public transport or bicycles. No plastic water bottles were allowed with water jugs strategically placed in different areas and visitors encouraged to bring their own canteen or cup. No leaflets or other paper was allowed and the number of visitors allowed to enter the trails was set at 85, which is the established daily carrying capacity.

TABLE 3.
[Collapse inline](#) | [View popup](#)

Statistics of visitors of the last 10 years (2007–2016)

Type of visitors	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Students	0	0	1,295	1,417	1,068	1,620	1,478	838	2,431	1,224
Children	1,839	1,976	279	262	347	249	1,923	534	283	248

Type of visitors	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Adults	2,946	2,325	1,203	1,487	1,212	1,244	4,181	2,086	1,512	1,718
Elderly and disabled	0	0	0	0	49	70	160	83	75	112
Payment exemption	0	0	0	0	189	159	539	370	1,020	809
Foreign	666	817	656	750	518	477	467	349	348	257
Campers	523	531	420	233	128	333	625	422	367	508
Total	5,974	5,649	3,853	4,149	3,511	4,152	9,373	4,682	6,036	4,876
Total visitors 2007-2016						52,255				
Annual average						5,225.5				



FIGURE 13.

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Foreign visitors, bird watchers in Cerro Blanco Protected Forest.

**FIGURE 14.**[Download figure](#) | [Open in new tab](#) | [Download powerpoint](#)

Students visiting Cerro Blanco Protected Forest as part of the environmental education program.

**FIGURE 15.**[Download figure](#) | [Open in new tab](#) | [Download powerpoint](#)

Eco festival Cerro Blanco.

- Through agreements with more than ten Ecuadorian universities, students carry out internships as well as thesis projects and have significantly contributed to the overall conservation effort in Cerro Blanco. Although sporadic, research projects over the years have focused on among other things, an ongoing study in conjunction with the Chester Zoo that led to the Ecuadorian Amazon *Amazona lillacina* being elevated from a subspecies to full species status, an inventory of the bat species in Cerro Blanco (35 to date) which led to its designation as Ecuador's first Important Bat Conservation Area and an ongoing study of the parasitic *Philornis downsi* fly continues. This species of fly is found naturally in Cerro Blanco but introduced to the

Galapagos Islands where it had a devastating impact on the breeding success of the native Darwin's Finches and other land birds [21].



FIGURE 16.

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Chester Zoo team carrying out field work on the Ecuadorian Amazon Parrot.

The Future

To insure the survival of many species still found in Cerro Blanco especially Jaguar *Panthera onca* and Great Green Macaw *Ara ambiguus*, biological corridors need to be urgently established to link adjacent remnant forests with Cerro Blanco. Restoration of dry tropical forest habitat is also important and the experiences in restoration in Cerro Blanco are serving as guidelines for similar initiatives on a regional basis. Squatter settlements have moved up to the northern boundary of the protected forest and hunting, wood cutting, and forest fires continues to be a constant threat especially during the dry season. The Ecuadorian Government has taken a stand against the expansion of squatter settlements which has helped to decrease potential pressures to expand into Cerro Blanco. Budget constraints on the Fundación Pro Bosque's conservation programs has led to key programs such as the honorary wardens in surrounding communities to be suspended. Greater coordination with other stakeholders through initiatives such as the National Conservation Strategy for the Great Green Macaw needs to happen to insure that conservation is extended on a regional basis. A major challenge looming on the horizon is the construction of a road accessing the future Guayaquil Airport. The Guayaquil Airport Authority has decided to construct the road on the Northwest boundary miles of the Northwest boundary of the Cerro Blanco Protected Forest. Although the Airport Authority claims that impacts will be diminished by the construction of a tunnel through a hill instead of routing the road over it, unless actions are taken by the authorities to protect adjacent lands, speculators will move in

quickly to sell and develop land along the road, effectively cutting off access by Jaguars and other wildlife species and eventually leading to the biological diminishment of Cerro Blanco. In general, Cerro Blanco has shown that private conservation initiatives with the proper funding can succeed in Ecuador. A challenge facing protected areas managed by the national government is free entry in all mainland parks (except the Galapagos National Park). This may cause future funding problems due to decreased revenues with cut backs that could affect staffing and field programs. While the gate fees that the Cerro Blanco Protected Forest charge for visitor entry and guide's fees is not enough to cover even basic maintenance costs, the fees along with donor support especially from Holcim provide most of the yearly budget. As previously mentioned, some important field programs have been suspended in part to funding restrictions that reflect the general state of the economy in Ecuador. On a national scale, legislation has recently passed that recognizes protected forests and vegetation and efforts are underway to integrate them fully within the national protected area system.

CASE STUDY QUESTIONS

1. What are the pros and cons of private versus public protected area establishment and management?
2. How can protected areas in general be sustainable in the long term taking into account shifting political interests and donor fatigue?
3. What are some ways that local communities can become involved in protected area management?
4. Are there differences in the challenges facing protected area establishment and management in developing countries as opposed to developed countries?
5. Is forest restoration a viable option in dry tropical forest taking into account global climate change?

AUTHOR CONTRIBUTIONS

Eric Horstman carried out the initial protected area management planning and was tasked with implementing it and wrote this case study paper.

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COMPETING INTERESTS

The author has declared that no competing interests exist.

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