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Understanding the Conditions for Protected Area Success in the Asia Pacific and Neotropical Regions

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Abstract

Tropical rainforests support a significant portion of the world’s total biodiversity. In addition, they provide a number of invaluable ecosystem services including climate regulation and mitigation, carbon sequestration, food, medicinal, and genetic resource provisioning, and cultural services. Today, an array of human land use decisions are the greatest driver of rainforest loss and degradation and are largely responsible for dramatic biodiversity losses globally, but especially in the Asia-Pacific and Neotropical regions where forest fragmentation has come to dominate landscapes. Protected area policies are among the oldest and most commonly employed tools for biological conservation and will be integral to the future of biological conservation. For this reason, many studies have sought to identify the conditions for protected area success with respect to biological conservation. This paper builds upon the existing literature to identify the conditions acting on two failing protected areas in the Asia-Pacific and Neotropical regions: Kerinci Seblat National Park and Río Plátano Biosphere Reserve. The evaluation of the two case studies provides support for a number of predominating arguments concerning the effects of size, structure, enforcement mechanisms, and multi-directional managerial accountability mechanisms on the health and success of protected areas. In addition, the evaluation demonstrates the unique ways by which these four factors interact with one another to produce unique challenges on reserve health that are unique to the social, political, and economic contexts of either case study. Based on these findings, the paper ultimately argues in favor of the need for a more systems-level approach to protected area research and policymaking.

Introduction

Tropical rainforests cover just seven percent of the Earth’s surface. Nonetheless, they contain anywhere from fifty to seventy-five percent of the world’s total biomass as well as a large variety of floral and faunal species (Sponsel et al. 1996; Bulte and Engel 2006). Tropical rainforests, and the biodiverse populations they support, provide a wide range of ecosystem services including climate regulation and carbon sequestration, provisioning services (such as the provisioning of food, water, medicine, and genetic resources), and cultural services. Each of these ecosystem services promotes the health and wellbeing of human populations around the globe and are especially integral to the lives of the roughly fifty million indigenous people who depend on rainforest stocks for survival (United Nations Forum on Forests 2005). Given the combined economic, social, and intrinsic value of rainforests, conservation is a matter of utmost importance. This is especially the case as human pressures on tropical rainforests mount.
In recent decades, human populations have placed unprecedented stress on global rainforest stocks. According to the 2018 Living Planet Index, global wildlife populations have declined by an average of 60% between 1970 and 2014 (Zoological Society of London and WWF 2014). In Asia-Pacific and the neotropics, wildlife populations have declined by an average of 64% and 89%, respectively. According to the Living Planet Index, these declines are largely the result of anthropogenically sourced habitat loss and degradation. There are a variety of human land use decisions that have sustained high rates of deforestation and degradation to the present day. In the Asia-Pacific and Neotropical regions, these include large-scale land conversion resulting from industrial agricultural demand, small scale land conversion resulting from smallholder demand, disruptive development projects such as the building of new roads, and extractive measures such as logging and mining (World Resources Institute 2018).

These land use decisions have a number of deleterious effects on habitat structure and function, particularly in tropical rainforest settings where ecosystems are vastly interdependent and where species are highly adapted to their natural environment and hence highly sensitive to change. Perhaps the greatest contemporary threat to rainforest ecosystems is that of forest fragmentation (Rogan and Lacher 2018). The Convention on Biological Diversity defines forest fragmentation as “any process that results in the conversion of formerly continuous forest into patches of forest separated by non-forested lands” (2000). Over time, human land use decisions have served to fragment a large number of once contiguous forests around the globe. This has had an outstanding and negative impact on the world’s stock of biodiversity as it has served to undermine the natural order of delicate ecosystems.

Although certain species are more vulnerable to the effects of fragmentation than are others, the abatement or extinction of one species often has dramatic effects on others (Sponsel et
al. 1996; Bulte and Engel 2006). This is because rainforest ecosystems are some of the most complex ecosystems in the world and are marked by heightened interdependence between species. Hence, although certain species have proven to be adaptable to fragmented landscapes, many species, particularly those with large home ranges and specialist species, are particularly susceptible to its effects. Because rainforest species tend to be interdependent, the decline of vulnerable species can pose serious challenges for biodiversity maintenance.

For this reason, policymakers have explored policies to address biodiversity losses resulting from human-induced habitat loss and forest fragmentation. Protected area policies are among the oldest and most commonly employed tools for biological conservation (Chape et al. 2005). The International Union for Conservation of Nature defines a protected area as a “clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long term conservation of nature with associated ecosystem services and cultural values” (IUCN Definition 2008). The consensus surrounding protected areas is that forest cover, as well as global biodiversity stocks, would be significantly lower in the absence of protected areas. In addition to maintaining forest cover, protected areas have proven to maintain biodiversity stocks within their specified bounds when established under the right conditions (Laurance et al. 2012; Barlow et al. 2007; Weiskopf et al. 2019).

This being said, as human-induced forest fragmentation continues to alter the structural makeup of rainforest landscapes, it is imperative to better understand the conditions for protected area success. Many studies have evaluated the conditions under which protected areas have been successful in terms of promoting landscape connectivity, ecosystem structure, and ecosystem function (Laurance et al. 2012; Sims 2014; Cabral, Saito, Pereira, and Laques 2018). This paper will build upon studies such as these to understand the conditions affecting protected area success,
namely by evaluating two failing protected area policies in the Asia-Pacific and Neotropical regions.

This paper will evaluate two case studies – Kerinci Seblat National Park and the Río Plátano Biosphere Reserve – according to four major considerations (size, structure, enforcement mechanisms, and managerial accountability mechanisms) identified in the literature review. In so doing, the paper will identify potential areas for improvement within the two protected areas. In addition to identifying the multiple factors driving deteriorating reserve health, this paper will attempt to identify potential gaps in the theoretical framework it employs as well as external factors outside of its scope that may play a significant role in deteriorating reserve health and which might be worthy of consideration by future researchers and policymakers.

**Methodology**

**Plan of Action**

This study will investigate two deteriorating protected areas that have been inscribed on the list of World Heritage Sites. UNESCO World Heritage Sites are natural and man-made sites which the UNESCO World Heritage Centre has recognized to be of intrinsic and universal intellectual, cultural, environmental, and/or scientific value to the international community. As such, they are recognized as deserving of special protection under the auspices of the 1972 World Heritage Convention. This paper will evaluate two sites that UNESCO has identified as “in danger” due to persistent deterioration and human encroachment. The two case studies are: the Tropical Rainforest Heritage of Sumatra in Indonesia and the Río Plátano Biosphere Reserve in the Mosquitia region of Honduras.
Both case studies will include a background overview of the major features of the reserve and a brief summary of the major developments that have occurred within the reserve from inscription on the Heritage List to the present day. The case studies will also include an “Assessment” section that will investigate different factors contributing to deteriorating reserve health. In my assessment, I will focus on the four factors I have outlined in the literary review - size, structure, enforcement mechanisms, and multi-directional managerial accountability mechanisms - which I consider to be of great importance to reserve health. This being said, I will draw those considerations into conversation with additional factors I identify to be of significant importance to the health of either reserves in order to come to a more nuanced understanding of the multiple factors contributing to deteriorating reserve health in the two given contexts.

Limitations

The case study evaluations will draw primarily from the UNESCO Information System, an open-source database of Nominations, International Assistance, Missions, World Heritage Committee decisions, statutory documents, and so on. Although these sources provide immense insight into the design and health of each protected area, while also graphing prominent developments within both sites, the study would have benefitted from a more on-the-ground investigative research approach. However, due to financial and temporal constraints, such an approach was beyond the scope of this study.
Literary Review

The Human Dimension of Forest Conversion

The issue of rainforest fragmentation is very much a human-induced issue. That is to say, tropical deforestation and forest fragmentation are driven by an array of human actors ranging from rural smallholders to policymakers to global consumers and leaders of industry. The kinds of human land use decisions driving land conversion include small-scale land conversion and subsistence practices, industrial agricultural practices, and industrial logging practices. Various actors are responsible for each of these activities and are motivated by different factors relating to the political, economic, and social conditions of any given region.

On the local level, small-scale land conversion and subsistence practices are responsible for much of the land conversion in the global tropics, particularly in the neotropical region. These practices are largely driven by rural smallholders who partake in these activities due to perceived economic gain. The Food and Agricultural Organization of the United Nations defines smallholders as “farmers operating under structural constraints such as access to sub-optimal amounts of resources, technology and markets” (FAO 2017). Numerous studies have identified the potential underlying causes of smallholder demand. Insecure land tenure, land tenure regimes based on land conversion and forest clearing, and poverty traps resulting from market failures (such as poor initial land holdings and lack of access to outside markets) are the predominant causes of smallholder conversion (Angelsen, 1995, 1999; Malhi, Gardner, Goldsmith, Silman, and Zelazowski 2014; Coomes et al. 2011; Barbier 2010; Sherbinin et al. 2007). Many of these underlying drivers of smallholder conversion can be attributed to deficiencies in governance, lapses in public provisioning, or economic failure (Sherbinin et al. 2007). However, they can also arise as an inadvertent result, or spillover effect, of public policy. For example, a large portion of
smallholder-driven expansion occurs at forest frontiers that are within close proximity to roads (Curtis et al. 2018).

On a larger scale, industrial agricultural practices, which the western world introduced to developing countries throughout the 1960s, is another main driver of deforestation and fragmentation in the global tropics. Today, industrial agriculture is primarily driven by international demand. As Arild Angelsen (2010) writes, greater incidents of agricultural trade in the global age of neoliberalism have effectively “delinked domestic and local consumption from production and deforestation”. In this way, international demand has led to the institution of the beef and soy industries in Central America (Sponsel et al. 1996; Cabral, Saito, Pereira, and Laques 2018) as well as the proliferation of coffee, tea, and oil palm plantations throughout much of Southeast Asia (Malhi, Gardner, Goldsmith, Silman, and Zelazowski 2014; Global Forest Atlas 2019). Commercial agriculture industries such as these are responsible for a large portion of contemporary land conversion. Using satellite imagery, Curtis et al. concluded that as much as 27% of global tropical forest loss that occurred between 2001 and 2015 was the result of forest conversion for commercial agricultural production (2018).

Unsustainable logging practices are responsible for a large portion of converted forest (Curran et al. 2004). In recent decades, industrial logging has become a prominent force driving forest conversion, particularly in Southeast Asia where highly productive and commercially profitable dipterocarp trees dominate the landscape (Malhi, Gardner, Goldsmith, Silman, and Zelazowski 2014). Because commercial actors as well as rural smallholders perpetrate these practices, this particular driver is the result of a number of conditions. Commercial logging is predominantly motivated by international demand and private interest (Angelsen 2018; Sherbinin et al. 2007). By comparison, smallholder-driven conversion is largely the result of economic
conditions that make unsustainable logging more profitable than other forms of income. Moreover, there are a number of indirect factors driving unsustainable logging.

Generally, infrastructural development, technological advancements, and heightened international demand have resulted in increased logging throughout the global tropics. Road development has served to promote conversion and extraction in previously virginal swaths of forest by increasing accessibility and driving the transportation costs of land use down (Global Forest Atlas 2019; Boghean and Patel 1996). Technological advancements such as chainsaws and logging trucks have provided the conditions for heightened land conversion (Sponsel et al. 1996) as has international demand for forest products (Sherbinin et al. 2004). Moreover, concessions-based timber extraction has permitted unsustainable logging in a number of countries, particularly those in Southeast Asia, by inducing government corruption and evoking rent-seeking behaviors (Curran et al. 2004). In the Philippines and Malaysia, politicians often provide contracts in exchange for political support and other favors (Sponsel et al. 1996). In Kalimantan, this is one of the leading causes of illegal logging and forest fragmentation (Curran et al. 2004).

**The Ecological Effects of Habitat Fragmentation**

Although development and land conversion are necessary for furthering human welfare, understanding the ecological effects of certain human land use decisions can help to guide land use policies that preserve the overall integrity of endemic ecosystems. As Richard Bierregaard et al. argue, understanding the ecological implications of tropical fragmentation is essential for balancing human welfare and environmental concerns (Bierregaard et al. 1992). To this end, it is necessary to discuss the many ecological effects of rainforest fragmentation. Although the ecological effects of fragmentation can often take years or even decades to fully materialize
(Collins et al. 2009), there are a number of general outcomes of fragmentation which might occur independently, but which typically occur in conjunction with one another (Wilson, Chen, Corlett, et al. 2016). The amalgamation of these effects often produces dramatic effects on ecosystem function and community structure.

One of the greatest implications of forest fragmentation is the drastic increase of forest edges. In rainforests, forest edges (i.e. transitions from areas of forests to fields or clearings) rarely occur naturally. Hence, the introduction of new edges can have dramatic consequences on the structure and function of affected ecosystems (Laurance and Heraldo 2004). For one, new edges can produce changes in microclimate that can have devastating effects on community structure. Changes in microclimate occur as warm, dry air rises over clearings, creating pockets of low air pressure that draw the moist air out of neighboring fragments, resulting in changes in humidity, temperature, and soil moisture (Bierregaard et al. 1992; Laurance and Heraldo 2004). On a similar note, increased wind shear along new forest edges often leads to heightened tree mortality and leaf abscission. These effects often increase the likelihood of forest fires, a well-documented phenomenon in both the Amazon and Kalimantan (Laurance and Heraldo 2004; Curran et al. 2004). Changes in faunal composition and increased incidents of forest fires can also affect community structure as they result in the loss of specialist species \(^1\) and the addition of opportunistic pioneer species (Laurance et al. 2012).

Certain taxa are more vulnerable to fragmentation effects than are others. Species that require smaller spatial requirements and are more adaptive to matrix habitats are generally more resilient to fragmentation effects. Meanwhile, species requiring large home ranges that are

\(^1\) The Encyclopedia Britannica defines specialists species as: “… those [species] adapted to narrow habitats, limited food resources, or other specific environmental conditions… [specialists] are often the most vulnerable to dramatic population declines and extinction when conditions change” (2019).
simultaneously resistant to traversing non-primary forests are more vulnerable to local extinction (Mavatur, Divya, and Shankar 2010). According to a study produced by Laurance et al., sensitive guilds include apex predators, large non-predatory vertebrates, bats, large-seeded old-growth trees, epiphytes, and ecological specialists (2012). Although these species are the most vulnerable to fragmentation, because of the ecological interdependence of rainforest ecosystems, the loss of any one of these guilds, or any one of the species that comprise them, can have cascading effects. For example, the loss of an apex predator species can promote the proliferation of mesopredators that can result in heightened predation of frugivore species necessary for large seed dispersal (Laurance and Heraldo 2004). In addition to producing cascading effects, reduced seed dispersal can have an irreversible effect on forest structure as it limits the potential for plant colonization and regrowth in previously cleared land (Moran, Catterall, and Kanowski et al. 2009).

**Conditions for Protected Area Success**

Numerous studies support the notion that protected areas (PAs) have, in general, helped to mitigate the aforementioned effects of forest fragmentation on biodiversity by preserving large strips of contiguous forest, increasing average forest patch size, and promoting connectivity between patches (Barlow et al. 2007; Sims 2014). Although some PAs have deteriorated over the decades, mainly due to encroachment, the general consensus is that forests would be far more fragmented in the absence of protected area policies (Cabral, Saito, Pereira, and Laques 2018). For this reason, it is likely that protected area policies will remain one of the flagship conservation strategies in decades to come, especially in the midst of growing concerns over increasing rates of forest fragmentation (Malhi, Gardner, Goldsmith, Silman, and Zelazowski 2014).
This being said, a study conducted by Laurance et al., which observed data sets measuring biodiversity levels across sixty protected areas around the globe, found that only about half of all protected areas have been effective over the past 20 to 30 years compared to the other half which have experienced heavy losses in biodiversity (2012). The findings of this study beg the question - what factors might explain variations in efficacy? This is an important policy question that many researchers have sought to address. Some have evaluated the size, structure, and design of protected areas to draw varying conclusions. Others have focused on the governance mechanisms and cultural, social, and political contexts surrounding different protected area policies to understand variations in performance. It is important to consider each of these factors to explain variations in efficacy.

**Size**

The general consensus concerning the size of protected areas is that larger PAs will more effectively conserve ecosystem structure and function. This is due to a number of reasons. For one, smaller fragments are more susceptible to edge effects and likewise provide a smaller area of interior “refuge” for vulnerable species (Malhi, Gardner, Goldsmith, Silman, and Zelazowski 2014; Laurance and Heraldo 2004; Askins 2002). As a result, they produce higher rates of biodiversity loss than do larger protected areas (Bierregaard and Lovejoy 1988; Stouffer et al., 2008). Likewise, smaller protected areas can increase the occurrence of inbreeding and genetic drift, both of which can reduce the longevity of local populations and lead to local extinction. Finally, small fragments generally support a relatively smaller range of habitats and species compared to larger fragments. If important habitats are missing within fragments, many dependent species will most likely decline or else disappear (Laurance and Heraldo 2004).
In contrast, larger protected areas ensure greater landscape continuity, something that mitigates many of the issues arising from smaller protected areas. Because they tend to produce greater occurrences of critical habitats and keystone species that tend to be patchily distributed, larger protected areas more effectively conserve ecosystem structure and function. Moreover, they provide the conditions necessary for conserving species that are particularly sensitive to fragmentation effects including species with large home ranges, those sensitive to edge effects, and those incapable of inhabiting or traversing modified, non-primary, or cleared forests (Barlow et al. Laurance and Heraldo 2004).

**Structure**

Though the size of protected areas increases the chances of maintaining ecosystem integrity, the structure of protected areas is arguably just as important. As Sims argues, effective conservation policies must consider not only the “total amounts of habitat conserved, but also the spatial configuration of that habitat” (Sims 2014). This requires knowledge of local ecosystems. While scientifically informed planning and design ensures a more effective application of the ecosystem approach, it does not entirely suffice in conserving species within the protected area. Knowledge of the susceptibility of local species to spillover effects of neighboring environments is also an important determinant of protected area success (Laurance et al. 2012). In their comprehensive study, Laurance et al. measured environmental drivers within and outside of sixty-one protected areas and found that environmental changes occurring within protected areas often mirrored those occurring in neighboring land. Similar studies have found the effects of surrounding environments on reserve health are particularly apparent within the Zone of Influence (Oberosler et al. 2019). In highly fragmented forests with high rates of human activity, disturbances within the Zone of Influence can pose a serious challenge for protected areas aimed at counteracting
fragmentation effects, especially in the absence of a buffer zone. Hence, the structure of the PA, as well as the structure of the surrounding environment, are said to be determinant factors in PA health.

**Enforcement Mechanisms**

Many studies have made the case that enforcement type plays a key role in mitigating the influence of external environments and promoting reserve health. By comparing reserve health indicators from two protected areas in Tanzania, Mwanihana and Udzungwa Scarp, Oberosler et al. concluded that adequate legal protection complemented by on-the-ground enforcement played a determinant role in reducing illegal hunting and maintaining faunal diversity (2019). This study, though not explicitly related to the issue of rainforest fragmentation, shows the potential role enforcement plays in staving off human encroachment in protected areas. On a more directly related note, looking at datasets from over sixty protected areas around the global tropics, Laurance et al. concluded that the implementation of greater on-the-ground enforcement had a uniformly positive effect on counteracting encroachment. Both of these studies suggest on-the-ground enforcement is necessary for mitigating the threat of encroachment. Similarly, a micro-landscapes study conducted by Sims suggests the spatial configuration of enforcement might also have an effect on reserve health. By comparing forest cover loss in national parks and wildlife sanctuaries in Thailand, Sims concluded that the uniform, core-focused enforcement approach that is characteristic of wildlife sanctuaries produced greater reserve health than the boundary-focused enforcement approach of national parks (2014). This study stresses the importance of considering the spatial configuration of enforcement in preventing encroachment.
Multi-Directional Managerial Accountability Mechanisms

On the subject of enforcement and policy implementation, public accountability is another possible determinant of reserve health. Most rainforests are owned and managed by national governments, though the control and management of these forests is largely devolved to local bureaucrats and politicians (Burgess et al. 2011). Government control of natural resources can induce corruption and incidents of illegal rent capture in states with weak governance structures (Zhan 2017; Burgess et al. 2011). In Indonesia, Burgess et al. observed changes in the rate of deforestation resulting from logging practices in the midst of a redistricting process that nearly doubled the number of governmental districts (2011). Their findings suggest that decentralization and governance fragmentation induce heightened corruption, bribery, and illegal rent capture by undermining central monitoring systems meant to prevent unsustainable leasing practices within protected areas (2011). Hence, in the absence of public accountability to the aims of protected areas, fragmentation can occur within reserves. Because of the growing trend toward national devolution of forest management to local governments, these findings highlight a potential key challenge to the role protected areas can play in conserving ecosystem structure and biodiversity levels in the absence of public accountability.

In another sense, public accountability is an integral prerequisite for the efficacy of protected area policies in that it determines the political feasibility of implementation. Public acceptance and involvement in protected area initiatives is often integral to policy success. As Walde et al. posit, conservation efforts produce numerous challenges, “especially when done against the preferences of local communities” (2019). The establishment of protected areas against the preferences of local communities is not only unethical, but also unproductive as it undermines the long-term feasibility of implementation and increases risks of encroachment. Hence, external
factors such as the degree of local reliance on ecosystem services as well as local perceptions of the potential economic benefits of protected areas are key determinants of protected area success (Walde, Tran, Tappeiner, and Tappeiner 2019). With this in mind, ensuring that local communities share in the economic benefits of protected areas (such as profits from ecotourism) and providing alternative economic opportunities are integral to public acceptance and the successful implementation of protected areas.

Case Study: Kerinci Seblat National Park

**Background**

The Tropical Rainforest Heritage of Sumatra (TRHS) was inscribed as a UNESCO world heritage site in 2004 after having satisfied criteria vii, ix, and x. Today, TRHS is one of the largest conservation areas in all of Southeast Asia (Tropical Rainforest Heritage of Sumatra 2019). The site comprises three national parks - Gunung Leuser National Park, Kerinci Seblat National Park, and Bukit Barisan Selatan National Park - that together encompass 2.5 million hectares of land. The three parks are located along the Bukit Barisan Mountain Range - commonly referred to as the “Andes of Sumatra” - which spans from Aceh in the north-west to Bandar Lampung in the southeast. Due to variations in elevation, TRHS is characterized by a diversity of land types including lowland rainforest, montane forest, subalpine low forest, scrub thickets, and shrub thickets (Tropical Rainforest Heritage of Sumatra 2019). As a result, the site supports a diversity of floral and faunal species including an estimated 10,000 plant species, 200 mammal species, and

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2 (vii) to contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance;

(ix) to be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals;

(x) to contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation (The Criteria for Selection 2019).
580 bird species. This includes 17 genera of plant species and 22 mammal species endemic in Asia as well as 15 mammal species and 21 bird species endemic in Indonesia. Because of the size, location, and geobiological diversity of TRHS, UNESCO considers the site to pose the greatest potential for long-term conservation in Sumatra (Tropical Rainforest Heritage of Sumatra 2019). The three parks contained within TRHS represent some of the most significant remnant islands of the once-continuous Sumatran forests.

Following nearly fifty years of widespread deforestation and forest fragmentation, TRHS stands as one of the last remaining swaths of continuous land in Sumatra (Tropical Rainforest Heritage of Sumatra 2019).

Since the year of its inscription, a number of human pressures have threatened the integrity of the TRHS. These pressures include road construction, mining activities, illegal logging, and agricultural encroachment. Due to significant rates of land conversion, degradation, and
fragmentation at the time of inscription, the IUCN recommended that TRHS be immediately inscribed on the List of World Heritage in Danger. However, because of protests by the State Party of Indonesia that such a classification would undermine the reserve’s credibility and discourage foreign investment in the park, the World Heritage Committee instead requested the State Party submit an emergency action plan outlining a strategy to mitigate pressures on the park. The property was eventually added to the List In Danger in 2011 against the State Party’s wishes. Two years later, UNESCO representatives visited TRHS and developed the conditions, called the Desired State of Conservation, for removal of the property from the List of World Heritage in Danger (Decision 38 COM 7A.28). Although the State Party of Indonesia has made significant progress to improve conditions within the park since inscription on the List In Danger, the site has not yet satisfied the DSOC and thus remains “endangered” (List of World Heritage in Danger 2019)

Kerinci Seblat National Park (KSNP) has remained under threat of extensive road development, illegal logging, poaching, and agricultural encroachment since inscription to the World Heritage List. Each of these factors has negatively impacted forest cover, landscape connectivity, and ecosystem function. According to a report by the State Party in 2011, many of the roads that have been developed in KSNP have intersected primary forests and served to fragment the home ranges of large mammals such as the Sumatran Tiger and the Sumatran Elephant. A UNESCO mission to the site identified similar threats resulting from road construction such as a decrease in landscape connectivity along highly trafficked roads as well as a relative increase in illegal logging, poaching, and encroachment (2009/10). Encroachment is considered the most serious challenge to the park’s integrity, especially along its boundaries (2008). In 2010, IUCN received reports that monitoring by park staff, NGOs, and satellite imagery identified a loss
of forest cover in 60% of the KSNP’s buffer zone. This dramatic reduction in forest cover is mainly
the result of industrial expansion, namely the expansion of commercial oil palm plantations,
although the subsistence practices of local communities account for a portion of the loss in forest
cover along the park’s peripheral.

Although much is known about the types of human pressures driving land conversion in
KSNP, less is known about the impacts of these influences on biodiversity levels. According to
UNESCO, the population data provided by the State Party provides a cumulative assessment of
species recorded within the park but does not include yearly trends necessary for calculating year-
to-year variations in population size. In addition, current population data is lacking for many
species depending on the year. In the past, UNESCO has strongly encouraged the State Party to
strengthen its property-wide monitoring, especially with respect to key endemic species such as
the Sumatran Tiger, Sumatran Rhino, Sumatran Elephant, and Sumatran Orangutan (2017). In an
attempt to remove KSNP from the List In Danger, the State Party has recently published
guidebooks on best monitoring practices in order to improve data on biodiversity levels within the
park (2019). Because biodiversity indicators are not yet available, concerns for the integrity of the
park are predominantly informed by the recorded rate of forest cover loss, on-the-ground reports
concerning degradation and fragmentation within the park’s core and buffer zones, and the
negative consequences these processes are known to have on ecosystem function and biodiversity
levels.

Assessment

KSNP is over 1.3 million ha large and encapsulates the entire Kerinci Valley. According
to UNESCO, “Biological and ecological processes are preserved within the property because it
contains a sufficiently large number of ecosystems, forest types, ranges of altitudes and topographies” (The Rainforest Heritage of Sumatra 2019).

Forest classification in KSNP and surrounding areas (Linkie 2001)

Biodiversity indicators seemingly support this claim. Due to its size and structure, the park contains the full diversity of interdependent ecosystems found within the valley including lowland rainforests, montane forests, and subalpine forests. Moreover, the park supports a large portion of Sumatra’s species including more than 4,000 different plant species and 73% of all mammal species native to Sumatra (World Bank 1996). This data indicates that KSNP is large enough to promote greater occurrences of critical habitats and keystone species that tend to be patchily distributed in forest landscapes. Moreover, the park’s size has ensured large tracts of contiguous land that, based on limited monitoring records, has promoted the movement of several endemic species with large home ranges that are especially vulnerable to land conversion and fragmentation including the Sumatran tiger, orangutan, elephant, rhino, and ground cuckoo (Tropical Rainforest Heritage of Sumatra 2019).
Despite the ecological benefits of the size of KSNP, the park’s size has produced some unforeseen consequences with respect to enforcement. The State Party and the Committee have both cited the park’s size as one of the greatest challenges to enforcement. This is because the large size of the property demands greater financial and human resources than would a much smaller park. In the absence of sustained public funding, this poses serious implications for enforcement. For at least a decade after inscription to the List in Danger, a large portion of KSNP’s vast borders were totally absent of demarcation, patrols, encroachment monitoring systems, and other enforcement mechanisms due to lack of funding and public investment in park management.

These lapses in enforcement were compounded by local resistance resulting from a negative perception many local communities had concerning the park’s impact on local economic development. As the Committee wrote in their 2006 Report on the State of Conservation:

The capacity of management [in KSNP] to effectively respond to and resolve critical situations has failed to keep pace with the mounting threats due to a range of institutional constraints, including funding constraints; inadequate cooperation and support from local, provincial and central government agencies, including in some cases law enforcement agencies; confusion over the rights of local government within national parks; and bureaucratic procedural constraints and inefficiencies. In addition, local communities and local government remain largely uninformed about the importance of and threats to World Heritage property, and are therefore often antagonistic (2006).

In the years following this report, the Committee appealed to the State Party to invest in improved enforcement. Due to increased records of encroachment from 2006 to 2009, the Indonesian government began to express agreement with the Committee’s calls for heightened investment in enforcement. KSNP park authorities benefitted from heightened resources which enabled them to improve law enforcement in the property namely by instituting more regular patrols, building park staff’s law enforcement capacity, and developing literature and training programs for park rangers (2011). Around the same time, park authorities initiated a number of outreach programs in coordination with environmental education and awareness programs such as Rhino Protection
Unit, WWF Elephant Patrol, FFI Tiger Protection and Conservation, Zoological Society of London. The goal of these preventative programs was to educate the public about the importance of the site both locally and globally to prevent local antagonism and reduce human pressures along the park’s borders (2011). Despite these advances in funding, enforcement, and prevention, local opposition remained a persistent threat to the park’s integrity.

Several annual reports reference instances of local resistance and encroachment, especially along the park’s boundaries and in the Lembah Masurai District, where encroachers recurrently remove boundary markers. Attempts to address the root cause of the opposition have been lackluster. For example, in 2012, park rangers responded to local resistance by planting fruit trees along 60 kilometers of the border with the intention that locals would harvest the fruit rather than illegally harvest within the park (2012). This did very little to curb encroachment and public dissent as the welfare benefits were disproportionate to the perceived gains of illegally harvesting within the park. This opposition is indicative of a design flaw in park management. The strict restrictions surrounding resource use within KSNP, characteristic of a fences and fines protected area approach, combined with the lack of alternative sources of income provided by relevant authorities, make the park’s restrictions unsavory even to those sworn to protect it. Government officials in the state of Indonesia have often expressed their concern that the enforcement of KSNP’s borders, as well as the prosecution of encroachers, is hindered by the shared concerns of park rangers regarding human rights (2017).

In the same vein, the highly fragmented governance structure of Indonesia has served to further complicate park management and enforcement. Indonesia is a decentralized democratic republic. Most governmental services are provided by governments and, although the management of forests theoretically lies at the national level, Indonesia’s system of regional autonomy has
resulted in the production of more than 1,000 authorities with the power to make laws concerning forest resources at both the provincial and district levels. Governance structures on the island of Sumatra mirror those of mainland Indonesia. KSNP spans four provinces that together contain dozens of districts. Governmental decentralization in the region has led to a highly fragmented legal framework of often-conflicting laws that govern forest conservation and resource use in Indonesia and complicate the government’s chain of command.

Likewise, it has allowed for a number of authorities with conflicting interests to clear development projects that would otherwise not be approved. When the Indonesian government created fourteen new districts along and within the borders of KSNP in 2011, conflicting interests among district directors posed significant threats to the integrity of KSNP. In the absence of upward accountability mechanisms, a number of them granted permits for development within the park including permits for road development, mining, and plantation expansion. The emission of these permits served to undermine national conservation directives. For example, despite a ministerial decree issued in 2010 urging protected area authorities to block road construction permits filed within their jurisdiction, local governments continued to entertain proposals for the development of at least four roads that would intersect the park’s core zones.

Case Study: Río Plátano Biosphere Reserve

Background

The Río Plátano Biosphere Reserve was inscribed as a UNESCO world heritage site in 1982. The reserve encompasses some of the last remaining rainforest in Honduras (UNESCO 2019). The property consists of two distinct geomorphological areas: a steep mountain range and a flat and at times undulating expanse of coastal plains. The Río Plátano spans 45 kilometers from
its headwaters in the mountainous region to its river mouth in the coastal lowlands and supports a diversity of ecosystems throughout the reserve. These ecosystems include estuarine and marine systems, sandy beaches, coastal lagoons, mangrove swamps, pine savannah, and temperate forest. However, the majority of the reserve consists of dense tropical rainforests in the mountainous region (UNESCO 2019). Together, the ecosystems of the Río Plátano Biosphere Reserve support a diversity of species including 586 vascular species, 721 species of vertebrates, and 411 documented species of birds. With respect to each of these three taxonomic groups, the reserve supports a significant proportion of all fauna occurring in Honduras. For example, the 721 species of vertebrates occurring in the reserve represent more than half of all mammalian species known to Honduras. This includes a number of endangered species, including the Mexican Spider Monkey and Central American Tapir, vulnerable species such as the White-lipped Peccary and the West Indian Manatee, and near-threatened species such as the Jaguar. The reserve also harbors a number of charismatic species such as the Puma, the Ocelot, the Neotropical Otter, the Great Green Macaw, and the White-throated Capuchin Monkey that have attracted a number of international conservation organizations to the region.

Because the Río Plátano supports over 2,000 indigenous people, including the Pech, Tawahka, Miskito, and Garifuna people, each of whom have preserved their traditional way of life, the reserve was selected for its cultural as well as natural significance. According to the IUCN, Río Plátano was selected for both “nature conservation objectives and social and economic development objectives. It meets natural criteria… as well as cultural criteria for inclusion on the World Heritage List” (World Heritage Nomination 1982). For this reason, the reserve consists of three zones that permit varying degrees of land use and habitation. The core zone legally prohibits human presence and activities, with the exception of pre-approved research activities (Desired
State of Conservation Report 2015). In 1996, the reserve was restructured to include a cultural zone roughly 450,000 ha large. The cultural zone encompasses the ancestral territories of the Miskito, Pech, and Garifuna people. Both the cultural zone and the buffer zone allow for habitation and sustainable use of forest resources.

Although parts of the reserve allow for sustainable use, the reserve is under immense human pressure. This is because the property is surrounded by a largely poor and resource-dependent local population (Report on the Monitoring Mission to Rio Plátano Biosphere Reserve 2011). Much of the region’s population consists of subsistence farmers and temporary workers, many of whom are landless. The lack of access to outside markets incentivizes inhabitants to adopt unsustainable subsistence practice that impede conservation efforts within the reserve and hinder the long-term economic development of the region, effectively creating a positive feedback loop between environmental degradation and poverty. As a result, the reserve has historically high rates of deforestation, particularly within the southern and western regions of the site, resulting from smallholder encroachment and frontier land conversion. Illegal logging is another principal threat,
particularly in the southern and western zones and along either side of the Río Plátano; these zones are rich in highly profitable Swietenia macrophylla, one of just three tree species that produce genuine mahogany (Environmental Investigation Agency 2005). In recent years, these pressures have been compounded by security risks such as drug trafficking and increased violence in the region, both of which have complicated monitoring and enforcement within the reserve (19 BUR VI.20; State of Conservation 2003; Report on the Monitoring Mission to Río Plátano Biosphere Reserve 2011).

This has resulted in rapid deforestation and degradation in the years since the reserve’s inscription. According to a time series of satellite images conducted by the State of Honduras, more than 28,000 ha of broad-leaf forest was cleared in just three years (between 2010 and 2013). This equates to a staggering 17% loss of forest cover in three years. This being said, the extent of forest cover loss varies across zones. For example, the core zone remains largely untouched aside from 300 ha of degraded lands that are expected to naturally recuperate within ten years of degradation (State of Conservation 2015). This is because the rate of encroachment in the core zone is relatively low given its remote location. The same cannot be said for the cultural and buffer zones. According to the 2008 State of Conservation Report, as much as 80% of the reserve’s buffer zone has been impacted by unsustainable agricultural activities and illegal conversion to pasture for cattle ranching. Such a high rate of deforestation poses serious threats to the long-term conservation value of Río Plátano Biosphere Reserve and the many ecological systems and biological species it encapsulates. It is for this reason that the state of Honduras requested the World Heritage Committee place the property on the List in Danger in 2011.

**Assessment**
The Río Plátano Biosphere Reserve is the largest protected area in Honduras with 350,000 ha of land. In terms of structure and demarcation, the reserve encapsulates the entire watershed of the Río Plátano. The Río Plátano acts as a landscape corridor and connects a variety of ecosystems throughout the watershed. Protecting the full scope of the Río Plátano watershed is a sensical conservation strategy that ensures maximum connectivity between the various interdependent ecosystems along the river (UNESCO 2019). The reserve is also a part of a much larger conservation complex that includes Tawahka Asangni Biosphere Reserve and Patuca National Park and that extends to Bosawas Biosphere Reserve in Nicaragua. In sum, the complex constitutes the largest swath of contiguous forest in Latin America north of the Amazon (UNESCO 2019). As such, the mosaic of reserves works to ensure maximum landscape connectivity. According to UNESCO reports, the complex has ensured that important interdependencies between ecosystems and the species they support are maintained at the landscape level (2019).

*Honduran Conservation Complex (Esselman and Opperman 2010)*
With respect to the Río Plátano Biosphere Reserve, the greatest structural challenge to the reserve’s integrity has resulted from discrepancies between the demarcation of the Río Plátano Biosphere Reserve and the inscribed boundaries of the Heritage Site. For several decades following inscription in 1982, the inscribed UNESCO site contained most but not all of the Río Plátano Biosphere Reserve. A UNESCO mission to the site in 2007 determined that there existed widespread confusion among reserve managers about the actual boundaries of the World Heritage property within the confines of the Biosphere Reserve due to insufficiencies in the maps produced at the time of inscription. Discrepancies between the two demarcations were compounded by the fact that the Honduran government had modified the reserve boundaries and zone demarcations in 1997 to create the cultural and buffer zones.

According to UNESCO, the cultural and buffer zones, which remain today, encroach on the core zone and threatens the universal values for which the site was inscribed on the Heritage List. For this reason, UNESCO and the Honduran government have agreed to consider ways of restructuring the demarcation of the reserve and its three zones in order to “consolidate the management and
conservation of the property, taking into account the current status and socioeconomic reality” (UNESCO 2011). However, this process will likely take several years as it would serve to modify boundaries, rights, and governance arrangements that have been defined over several years of negotiation between the State and its constituents. The human dimension of this process will be discussed shortly as it is of vital importance. For the purpose of this case study, the inscribed Heritage Site, which is the subject of this analysis, will be hereafter referred to as the Río Plátano Biosphere Reserve.

In terms of enforcement, a number of social, economic, and geographic features serve to hinder effective enforcement of the reserve’s rules and regulations. As the 2011 mission report states,

A climate of insecurity and lawlessness in Honduras' remote north-east region along with a procedural vacuum and institutional weakness provide a difficult framework for addressing the multiple threats. The more recent increase of major drug-trafficking has become an overarching part of the socio-economic reality of the Mosquitia, as this region of Honduras is nationally and locally referred to. Clearly, the challenges in Río Plátano are beyond the scope of a protected area agency as they are related to the poverty, security and political stability of an entire region. (Report on the Monitoring Mission to Río Plátano Biosphere Reserve 2011)

With respect to on-the-ground enforcement, the presence of a drug cartel in the reserve has made monitoring of illegal activities and enforcement of regulations difficult and dangerous. The establishment of an illegal land trading market has served to expand the cartel’s influence in the reserve (while also producing large scale land conversion, particularly in the buffer and cultural zones). Heightened security risks in the region, combined with the remote location of the reserve, have hindered efforts to attract rangers to the mission. Underfunding on the part of the Honduran government has served to reduce the enforcement staff’s size and efficacy. Although funding from non-governmental organizations and foreign government agencies has helped to supplement the
reserve’s enforcement budget, for several years enforcement was lapse, and oftentimes nonexistent, in many regions of the reserve (State of Conservation 2011).

These security risks are compounded further by legal constraints that undermine enforcement efforts and deterrence. Because of the reserve’s remote location, there is a marked absence of prosecutors and legal expertise at the local level. Hence, individuals arrested for illegal activities must be sent to the capital for trial. The costs associated with transportation to the capital deter authorities from pursuing persecution. As is written in the 2010 State of Conservation Report, “IUCN has received reports that there is insufficient follow-up on violations of existing laws, including illegal logging, despite recognized enforcement efforts on the ground.” For this reason, UNESCO has recommended in a series of reports that the State invest in implementing the full cycle of the law either by subsidizing transportation costs or promoting legal infrastructure at the local level (State of Conservation 2010; Report on the Monitoring Mission to Río Plátano Biosphere Reserve 2011; State of Conservation 2011).

Moreover, the seemingly discriminant application of enforcement has served to undermine public confidence in the local police and discourage cooperation in police efforts and monitoring (Report on the Monitoring Mission to Río Plátano Biosphere Reserve 2011; Mission Report 2007). This is largely due to an apparent propensity for law enforcement “to focus on powerless actors while avoiding politically or otherwise more powerful and often armed actors” which has led many local communities to view reserve enforcement as “arbitrary and unfair.” This has produced tension between local communities and police in many areas of the reserve (Report on the Monitoring Mission to Río Plátano Biosphere Reserve 2011).

Over the years and through the combined efforts of the Honduran government, foreign aids, and UNESCO, the management of the reserve has evolved to better reflect the importance of
natural resources to local livelihoods. One of the more successful of these efforts has been the introduction of an agroforestry scheme in the reserve’s buffer zone which has served to engage local communities in efforts to forestall land degradation and conversion while also producing income opportunities for participating members. Led by GTZ and KDW, two state-owned German development agencies, the scheme generated around 13 million USD to Río Plátano and its surrounding areas. By 2007, about 100,000 ha of land in the buffer zone was managed through agroforestry (State of Conservation 2007). Meanwhile, a UNF-funded initiative has helped to promote the rise of the sustainable ecotourism in the region (State of Conservation 2003).

In addition to foreign-led efforts to engage community members in agroforestry and sustainable tourism, state-led efforts have helped to promote local access to resources by granting non-commercial extraction permits and community forest management contracts in recognition of the importance of forest benefit streams to local lives (State of Conservation 2012; State of Conservation 2013). To this end, the Honduran government, in partnership with the GTZ-KDW German development cooperative, has worked for over a decade to organize land tenure in the region. Historically, the lack of clear title to lands has promoted land grabbing and the expansion of the agricultural frontier while also disincentivizing investments in land stewardship. By 2011, “most long standing settlers” had obtained clear titles, with the exception of many indigenous groups (Report on the Monitoring Mission to Río Plátano Biosphere Reserve 2011). In 2012, the Forest Conservation Institute, under the direct supervision of the President, was granted the legal responsibility to grant land tenure to the ancestral lands of indigenous groups provided those lands fell within the cultural zone (State of Conservation 2012). After the imperative was published in the Honduran Gazette in 2012, several indigenous communities sought and obtained land titles.
(State of Conservation 2013). By 2018, 400,000 ha of land had been granted to the Miskito and Pech people.

With the rise of these programs, encroachment has steadily decreased. This suggests that each of these endeavors - the promotion of sustainable resource use and sustainable ecotourism, the institution of co-management regimes, and the cadastral process - will be integral to the integrity of the reserve as each of them serves to disincentivize illegal and unsustainable land use. This much is evident in the recurring trends surrounding smallholder encroachment into the core zone. In 2001, the Honduran government gave 3.7 million lempiras ($150,585.94) to 152 families who voluntarily relocated from the core zone (State of Conservation 2001). In 2010, the IUCN received reports of large scale illegal settlement within the property. Many of the families were those that had been relocated and compensated nine years prior. As the annual conservation report states, this suggests that “relocation alone is insufficient to address the larger issue of illegal settlement within the property” (2010). Mitigating encroachment will require further engaging local communities in the reserve’s mission and promoting sustainable economic opportunities in the appropriate zones.

**Discussion and Conclusion**

**Identifying the Conditions Impacting Reserve Health**

There is compelling evidence from both Kerinci Seblat National Park and the Río Plátano Biosphere Reserve to support the importance of the four factors - size, structure, enforcement mechanisms, and managerial accountability mechanisms - identified in Section II of the literary review. Based on data produced at the time of inscription on the World Heritage List, the large size of the two parks has served to enhance the diversity of interdependent ecosystems occurring
within the park while also increasing landscape contiguity. This is in line with the arguments set forth by Barlow et al. (2007) and Laurance and Heraldo (2004). In terms of structure, both parks presented illegal land use patterns that mirrored those occurring in neighboring territories. The size of the parks, and the use of buffer zones, helped to stave off the progression of these land uses into the core zones while also preventing implosion. Again, this provides evidence to support arguments by Laurance and Heraldo (2004) concerning the importance of landscape structure on reserve structure and function. Consistent with Sim’s (2014) central argument concerning the importance of the spatial configuration of enforcement, the inconsistent, sporadic, and regionally-varied application of enforcement along KSNP’s borders undermined the long term efficacy of enforcement and deterrence in the park. Similarly, as Oberosler et al. (2019) and Laurance et al. (2012) posit, heightened on-the-ground enforcement reduced the rate of encroachment in KSNP and RPBR.

With respect to managerial accountability mechanisms, public commitment to human welfare considerations varied between the two parks to produce differing outcomes in line with the argument presented by Walde et al. (2019) concerning the importance of local support for maintaining the integrity of reserves. In KSNP, a lack of investment in local and sustainable development resulting in the absence of downward accountability mechanisms increased tensions between enforcement staff and local communities. By comparison, efforts to integrate human welfare and environmental concerns in RPBR have reduced hostilities and effectively engaged local communities in the conservation aims of the park. This disparity supports popular arguments against the “fences and fines approach” and provides compelling support for a shift to a more participatory approach to conservation. With respect to upward managerial accountability mechanisms, the KSNP example supports the arguments set forth by Zhan (2017) and Burgess et
al. (2011) that governmental fragmentation can undermine central monitoring systems and induce local authorities to emit unsustainable land use permits. In the absence of upward accountability mechanisms, government fragmentation in Sumatra produced a complex and often times contradictory legal framework and induced local leaders to promote development projects that conflicted with national directives.

Understanding How Conditions Affect Reserve Health

My research provides ample support for many, if not most, of the arguments outlined in the literary review. For this reason, it helps to identify and exemplify several relevant factors affecting reserve health. This being said, my research provides more than just support for existing arguments concerning the factors affecting reserve health. It also serves to demonstrate the unique ways in which these factors exert their influence synergistically dependent upon the context in which they are acting upon reserve health. To understand this point, it is useful to revisit the evidence of both case studies. Whereas KSNP is an excellent example of the ways in which different factors interact to pose unique challenges to reserve health, RPBR exemplifies the importance of context to shaping the ways in which various factors interact to affect reserve health.

In the case of KSNP, the size of the park is ecologically advantageous in that it encapsulates the diversity of interdependent ecosystems endemic to the region, promotes landscape contiguity, and staves off encroachment to the core zone. However, in the absence of consistent and adequate funding, the size of KSNP poses unique challenges to enforcement, especially along park boundaries, mainly because park management has not had the funding to develop the monitoring infrastructure and technical staff necessary for enforcing the boundaries. The strain on enforcement along the boundaries has been further compounded by opposition from local communities. Many
local communities oppose KSNP because the park authorities have failed to integrate local
development concerns into their park management plan. This is in part due to the lack of sustained
funding from the national government, but has also arisen in the absence of appropriate downward
accountability mechanisms. Hence, in the absence of consistent funding and appropriate
accountability mechanisms, heightened local dissent undermines effective enforcement, which is
likewise impaired by inadequate funding and park size. The different factors affecting the health
of KSNP exert their influence collectively to produce unique and multifaceted challenges to park
management, enforcement, regional development, and conservation.

Figure 1: Different factors often act synergistically on reserve health.

In comparison, the RPBR example demonstrates the influential role of regional social,
political, and economic contexts play in shaping the ways in which different factors interact.
In the example of RPBR, a number of coordinating factors produced a positive feedback loop
between encroachment, on-the-ground enforcement, and public dissent. In RPBR, encroachment
induced heightened on-the-ground enforcement. Because of the establishment of a violent drug
cartel in the park, enforcement was disproportionately applied to weaker, unarmed actors (i.e. “low
hanging fruit” such as non-violent and unarmed rural smallholders and indigenous persons)
compared to more violent or politically powerful encroachers. This disproportionate application
of enforcement produced local dissent. At the same time, in the absence of adequate legal
infrastructure at the local level, and due to high transportation costs associated with transferring persecutors to the capital for trial, persecutors were only sporadically prosecuted. This, again, undermined public confidence in enforcement measures. Lack of public confidence in enforcement measures, combined with a general lack of access to alternative income opportunities, induced heightened encroachment, all within the context of regional underdevelopment and regional conflict.

As is evident in the case of RPBR, regional social, political, and economic contexts can be deterministic conditions for the ways in which different factors interact to affect reserve health. Although continued public and private investment in generating alternative income opportunities for local communities reduced illegal activity in the reserve, poor enforcement mechanisms resulting from regional underdevelopment counteracted some of these positive results. This is just one of the many examples provided in my research to support the claims that 1) factors affecting reserve health often act synergistically and 2) regional context is a determinant factor of reserve health.
health, especially as they affect the unique challenges that arise in protected areas. These findings are important not only to researchers, but also to policymakers.

**Arguing for a Systems-Level Approach to Research and Policymaking**

The findings of both case studies suggest the need for a more systems-level approach to studying the various factors acting on reserve health. With respect to the existing literature, studies of the factors affecting reserve health have a tendency to consider various factors as acting independently of one another when, as is evident in both case studies, this is not always the case. Even when studies do consider the various factors impacting reserve health, (e.g. there exist a number of studies that investigate the effects of size on reserve health, specifically in the absence of sustained funding), very rarely do they consider the regional contexts in which these factors are operating. This is largely the result of an academic push for easily generalizable theories and solutions to conservation challenges. However, as is evident in both case studies, a more systems-level understanding of the factors affecting reserve health is often necessary to identify how and why factors affect reserve health. If more studies assume a systems-level approach in the future, this could help to establish trends in the ways in which various factors interact to affect reserve health across different contexts, which would in turn produce more accurately generalizable theories.

In the meantime, my research provides ample evidence to support the need for a more systems-level approach to policymaking by demonstrating the importance of regional context to reserve health. As is evident in both examples, the unique challenges that arose in both parks were indicative of the regional contexts in which they were situated and vice versa. This suggests that policies external to protected areas, as they are responsible for shaping regional social, political,
and economic contexts, can be a determinant factor of reserve health. Following this line of reasoning, policies that undermine regional social, political, and economic stability will have detrimental effects on reserve health. Meanwhile, policies external to protected areas that promote favorable social, political, and economic conditions at the regional level will have a positive effect on reserve health. In other words, regional social, political, and economic stability, and the external policies that shape them, are integral to optimizing the positive gains of policy measures internal to protected area design and management.

In conclusion, in the future, both researchers and policymakers should expand their perspective to account for the importance of regional contexts and the wider policies that shape them while also considering the various ways in which different conditions may interact to produce unique challenges to protected area policies. Adopting a systems-level approach is one effective means of doing so. Assuming a more systems-level approach to understanding the factors affecting reserve health would enable researchers and policymakers to better anticipate the challenges and relative advantages of different approaches to protected area design and management. Moreover, it would empower policymakers to better anticipate the outcomes of policies external to protected areas and the challenges they may pose to conservation efforts. In this way, policymakers could make more informed policy choices to better optimize positive conservation outcomes.

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