

OUT OF THE ASHES: EXAMINING FOREST
BIODIVERSITY CONSERVATION IN POST-CONFLICT
VIETNAM AND SIERRA LEONE

by

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When the word “paradise” comes to mind, words like “nature,” “prosperity,” and “peace” do as well. There is one phrase that most likely does not: “armed conflict”. However, over the past seventy years, most armed conflicts have occurred in biodiversity hotspots, areas that have both high species variety and high degradation. When armed conflict causes land-use changes, resource exploitation and pollution, there are direct damages to ecosystem health, ecosystem services and human health. Conservation in biodiversity hotspots seeks to protect natural ecosystems, but can also protect the people who are often ravaged by conflict. This thesis examines how countries in biodiversity hotspots have implemented strategies for forest biodiversity conservation in post-war periods and proposes a blueprint for conservation which any country could prospectively implement after armed conflict. I utilized the Most Different Systems Design, which seeks to identify similar factors between two extremely different case studies, to compare conservation efforts of the Vietnamese and Sierra Leonean governments. My time frame was sixteen years after their respective conflicts ended: between 1975 and 1991 after the Vietnam War, and between 2002 and

2018 after the Sierra Leone Civil War. Both countries sought to increase their conservation capacity after conflict, including expanding government capacity for conservation, creating new protected areas, incorporating communities in resource management, educating people about conservation issues, and developing alternative livelihood options. Protected areas, especially when combined with community-based management, can serve to fulfill the later four strategies. When there is an emphasis on communication, coordination, and collaboration between departments and between the government and local people, forest biodiversity conservation can be most successful after armed conflict.

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Introduction

When the word “paradise” comes to mind, words like “nature,” “prosperity,” and “peace” do as well. Life on earth, especially in places that are considered to be paradise, is beautiful, complex, unique, and diverse. The variety of life on earth is known as biodiversity, which encompasses differences at genetic, species, and ecosystem levels. The rate of endemism, or the ecological state of a species being only located in a certain area, is a good measuring stick for how biodiverse any given location is. While earth’s species are spread out over its surface, there are certain places, called biodiversity hotspots, where variety at the species level is more concentrated. The thirty-five biodiversity hotspots on earth only cover 2.3% of its surface, but contain over half of the planet’s endemic plant species and more than 43% of its endemic bird, mammal, reptile and amphibian species, which means they are only found in the hotspots (Conservation International, 2018) (Figure 1). In addition, the natural vegetation of hotspots is less than 30%, which means their biodiversity is threatened.

Biodiversity is facing innumerable threats, including development, pollution, and exploitation. Species are declining at a rate one hundred to one thousand times their normal background extinction rate (Pimm, 1995), which has led to some scientists to refer to this loss as the sixth mass extinction (Kolbert, 2014). Hotspots are critical areas of biodiversity loss because of their high levels of endemism: when rare hotspot species are lost, they are gone forever.

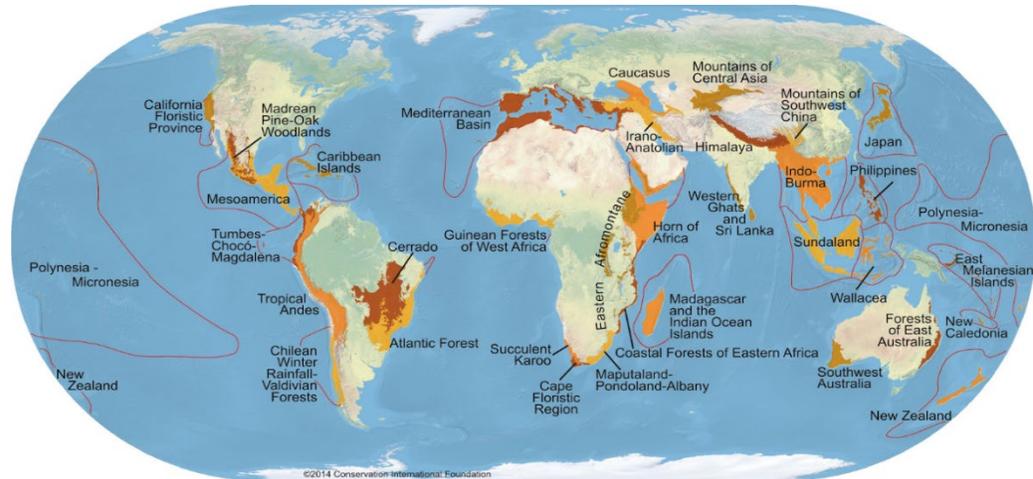


Figure 1: Biodiversity hotspots.

These are the locations and names of the thirty-five biodiversity hotspots throughout the world. Source: Conservation International, 2018.

Link between Natural Resources and Conflict

Paradise rarely brings to mind armed conflict. However, between 1950 and 2000, over 90% of the major armed conflicts involving over one thousand casualties occurred within countries containing biodiversity hotspots, and more than 80% took place directly within hotspot areas (Hanson, 2009). This trend is extremely concerning to conservationists. Armed conflict degrades the environment in a multitude of ways: through direct contact and violence, through side efforts (like logging or illicit crop growing) which can fuel and fund the conflict, and by changing the way in which people interact and relate to the environment (Hanson, 2009). Armed conflict and its side effects, like internal displacement of people, shifting agricultural systems and resource overexploitation, are some of the main threats to biodiversity in hotspots.

There is no clear consensus among researchers as to why the trend between natural resources and conflict occurs. Some point to a so-called ‘resource curse’ that occurs within weakly governed states and subsequently gives rise to various political

factions trying to dominate natural capital, as is the case with oil in the Middle East (Burgess, 2015). Others claim that when resource scarcity occurs, as in periods of drought, political tension can occur through a variety of channels (Burgess, 2015). Specifically, since 1945, tension over natural resources has instigated at least 40% of all intrastate conflicts (United Nations Environment Programme, 2009). When people rely on the land as their main source of livelihood, there is more at stake when other groups threaten it. In addition, use of natural resources can be exploitative and unsustainable during war times as populations rely on their environments to survive (United Nations Environment Programme, 2010). As climate change is expected to intensify existing problems around the world, like poverty, environmental degradation, and social tensions, the likelihood that conflict will occur because of natural resource conflict is strong (Department of Defense, 2015).

Harmful impact on natural resources can occur even after peace is established. Often, direct conflict occurs within protected areas. Once the violence leaves those areas, there is more access, and even incentive, for the general population to exploit those resources, as they are sometimes displaced from their normal source of income (United Nations Environment Programme, 2010). In a study examining threats to biodiversity in Sierra Leone, all threats significantly increased post-conflict (Conteh, 2017). Since the trend of violence in biodiversity hotspots is remarkably strong, violence is likely to continue in the immediate future. Therefore, the ways in which the environment is protected both during conflict and post-conflict is of utmost importance (Conteh, 2017).

Conservation

Conservation is the process through which people protect environmental resources. Through active management of the biosphere, humans have the ability to help restore healthy ecosystems and sustain biodiversity. This occurs through various institutions: governments create policies, programs, and protected natural areas; nongovernmental organizations (NGOs) implement privately-funded initiatives and influence governmental efforts; and communities work to change their own practices or educate children about environmental responsibility.

International conservation ideals have slowly been growing over the past century. In the 1980s, conservation saw a major boom as conservation biology became an official scientific field of study, the peer-review journal *Conservation Biology* was first published, and large-scale international conservation organizations like Conservation International and the Society for Conservation Biology were founded (Sodhi, 2010). In 1992, the United Nations held the Conference on Environment and Development and initiated the signing of the Convention on Biological Diversity. Over the period of one year, one hundred sixty-eight parties signed the agreement, which was “a dramatic step forward in the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising from the use of genetic resources” (Convention on Biological Diversity, 2018). As of 2018, one hundred ninety-six parties have ratified it. Conservationists and nations are working toward a sustainable and viable future; however, biodiversity conservation is a difficult process and requires active engagement and involvement.

Biodiversity conservation is vital for three main reasons: an intrinsic value in the variety of life and life itself, the extrinsic value of goods and services which ecosystems and species can provide, and the impact of biodiversity on human health. Ecosystem goods are tangible things like timber, food, water, or medicine, while ecosystem services are intangible, yet essential, processes like nutrient cycling, pollination, recreation, or water filtration. Conservation International reports that the “forests, wetlands and other ecosystems in hotspots account for 35% of the ecosystem services that vulnerable populations depend on” (Conservation International, 2018). These services, especially water filtration, are essential for human health. In addition, ecological communities, or groups of plants, animals and other organisms interacting together and with their environment, that are highly biodiverse are significantly more productive, in terms of plant biomass created over time, than communities with low biodiversity (Chase, 2002; Grace, 2016). When ecosystems are damaged through land-use changes, resource exploitation, pollution, or armed conflict, there are direct consequences to biodiversity and human health.

Biodiversity, Conflict, and Human Rights

Recently, major international organizations are recognizing the critical value that biodiversity plays in economic growth, human welfare, and even human rights. In 2017, the United Nations released a statement connecting biodiversity and human rights. The Special Rapporteur, Mr. John H. Knox, likened the loss of biodiversity as a loss of human rights, for if vulnerable populations are losing the healthy ecosystems they need for survival, then they are ultimately losing their ability to live. In addition, he

urges nations to consider the ramifications of biodiversity destruction for the sake of economic growth (Knox, 2017).

Russell A. Mittermeier, the president of Conservation International for twenty years and co-author on the study which linked armed conflict and biodiversity conservation, said in a statement about the study that “millions of the world’s poorest people live in hotspots and depend on healthy ecosystems for their survival, so there is a moral obligation—as well as political and social responsibility—to protect these places and all the resources and services they provide” (Conservation International, 2009). Conservation in biodiversity hotspots seeks to protect natural ecosystems, but can also serve to protect the people who are so often ravaged by armed conflict. People who live the hardships of armed conflict also experience human rights violations inflicted upon them, whether that be through forced militarization, needing to flee their homes, or even crimes against humanity. Hotspots are threatened and so are the people who rely on them.

Purpose of this Study

Since biodiversity, armed conflict, and human rights are all connected, more examination is needed to understand how conservation efforts are implemented after conflict and what can be done to utilize conservation as a tool for peace-building. While researchers recognize that conservation programs must be built focusing on local context, there has been a recent call to action to make post-war conservation more easily applied (Conteh, 2017). Therefore, for this thesis, I compare what conservation strategies have been implemented after conflict in biodiversity hotspots in order to

identify a specific strategy that can be implemented after conflict to create the best impact on biodiversity. My research questions are:

1. How have countries in biodiversity hotspots implemented successful strategies for forest biodiversity conservation post-conflict?
2. What is a best practice strategy which any country can theoretically implement for forest biodiversity protection post-conflict?

While researchers warn about panaceas, or cure-all solutions, for conservation, they state that transferring lessons between different cases is possible if local context is taken into account (Berkes, 2007). Given the correlation between armed conflict and biodiversity hotspots between 1950 and 2000 and the increasing threats of conflict due to climate change pressures, this thesis serves to identify conservation strategies which can kick start conservation, and therefore, human well-being, after armed conflict.

Methods

Most Different Systems Design

To compare and contrast conservation in case-study countries after armed conflict, I utilized the Most Different Systems Design (MDSD) method. This research design was created by John Stuart Mill in 1843. It “identifies cases that are different on a wide range of explanatory variables but similar on the dependent variable” (Levy, 2008). Along with the Most Similar Systems Design, it is the most common strategy in comparative politics for analyzing and comparing a few detailed case studies. Because a large-scale statistical analysis of programs and policies was not possible due to the depth of research required for each case and the small number of cases, this process was the best way to cover countries in-depth and ensure a detailed analysis and comparison.

	Country A	Country B
Factor A	a	b
Factor B	c	d
Factor C	e	f
Factor D	x	x
Outcome	y	y

Table 1: Theoretical research design using the Most Different Systems Design.

By comparing two extremely different case studies that share a common outcome, a researcher can conclude that a common factor, in this case, Factor D, led to an outcome.

Table 1 describes how this design is implemented to find a similar factor that leads to a similar dependent variable (outcome). Factors A through C are different for

both countries, yet they both reach outcome “y,” so there must be some underlying factor that contributes to this. After significant research, factor D is found to be shared. Because no other factor is shared, factor D is determined to be the main reason why the two cases have the shared outcome. The relationship is correlation and not causation because the case study approach allows for in-depth analysis of qualitative factors. However, through the case study approach, one can infer generalizations and apply findings to other cases through the comparative method (Casey, 2012). Therefore, whatever factor, or conservation strategy, that two countries share that led to successful forest biodiversity conservation post-conflict could prospectively be implemented by any country post-conflict.

Government Conservation Strategies

For this study, I performed structured and controlled case studies of Vietnam and Sierra Leone. The reasons why they were chosen are explained later in this section. Given that both countries were coming out of armed conflict, they were poor and had low capacity to implement perfect or near-perfect conservation. Nevertheless, with low capacity, both countries were successful in implementing conservation as best they could. Since capacity for conservation is an important variable for how successful a country can be, I am including efforts they took to increase government and governance capacity for conservation as strategies. The scientific and conservation communities have identified a number of best-practice conservation strategies (Secretariat of the Convention on Biological Diversity, 2009). I utilized all of these strategies in my analysis. The full list of strategies is shown in Table 2. In order to apply these strategies in the Most Different Systems Design, I created a structured comparison of them similar

to that in Table 1. By determining whether Vietnam or Sierra Leone engaged in a particular strategy (in a yes/no binary comparison), I was able to determine which strategies they shared and which they did not. The ones they did share can be identified as the similar factors which ultimately drove success of forest biodiversity conservation.

	Strategy	Vietnam	Sierra Leone
Increasing governmental capacity	Creating new governmental organizations with authority over conservation and enforcement of policies	?	?
	Supplying organizations with greater financial capital	?	?
	Supplying organizations with greater human capital	?	?
	Reducing corruption	?	?
Conservation	Engaging in participatory and community-oriented natural resource management	?	?
	Education and community outreach	?	?
	Creating protected areas	?	?
	Providing alternative livelihood options	?	?
	Land reform	?	?
	Sustainable energy programs	?	?
	Timber bans	?	?
	Reforestation and afforestation	?	?
	Protection against forest diseases	?	?
Reduction slash-and-burn agriculture	?	?	

Table 2: Government conservation strategies.

There are various ways in which governments can engage in conservation, including expanding government capacity for conservation and implementing conservation programs.

Each of these subcategories have different effects on overall conservation. By creating governmental organizations and ministries with authority over conservation, governments focus the actual governance of conservation into focused groups. Therefore, the programs and enforcement of rules is clearly delineated. In addition, by expanding the financial and human capital allotted to those organizations, governments are more capable of enforcing rules and implementing programs. Finally, by reducing corruption, governments improve trust and cooperation with the people. Trust, cooperation, and participation in conservation can also be improved through community-oriented conservation programs, which allow communities to be in charge of natural resource management. In addition, by creating environmental education and community outreach programs, governments can teach people why conservation is important and develop better relationships between the government and the people.

Government ministries have the capability of creating protected and transboundary protected areas, which occur across international borders. These are established areas which receive protection because of their ecological, natural, or cultural significance. Therefore, the creation and management of these areas under federal law ultimately supports the overall goal of forest conservation and its subsequent benefits. By providing people with alternative livelihood options apart from deforesting and extracting natural resources from protected areas, governments safeguard protected areas even further.

Through land reform, governments can reallocate land to those in need, ultimately providing more alternative livelihood options and reducing issues that may occur from natural resource capital dominance. By developing sustainable energy

programs, governments help provide people with a means of energy production besides firewood or charcoal. Both of these energy sources rely on the destruction of forest habitats. Timber bans make cutting and exporting logs illegal, therefore, reducing destruction of forest habitats for species and improving ecosystem services for communities. Governments can also increase forest cover by reforestation and afforestation programs. Reforestation is the replanting of forests that have been destroyed due to deforestation while afforestation is the planting of forests where forests were previously nonexistent. Tree diseases threaten stand productivity, by either reducing tree growth or increasing tree mortality. By protecting against tree diseases, governments conserve forests and make them more healthy and self-sustaining. In addition, as countries grow and expand, more agricultural land is needed. Many farmers resort to slash-and-burn agriculture, which is the destruction of forests to create short-term soil fertility. When agricultural land is destroyed or abandoned from conflict, farmers might resort to this method more, if they desperately need food for their communities and their families. By reducing the impact of slash-and-burn agriculture, governments can reduce forests cut for agriculture, the number of forests affected by wildfire, and the soil instability that comes from land conversion.

Two Cases: Vietnam and Sierra Leone

The goal of my research was to find one conservation strategy that two countries located in biodiversity hotspots both implemented after armed conflict that ultimately led to successful forest biodiversity conservation. For this goal, I performed structured case studies of Vietnam and Sierra Leone, two countries fully located in biodiversity hotspots that experienced intense conflict. Vietnam is situated in the Indo-Burma

biodiversity hotspot and Sierra Leone is in Guinean Forests of West Africa hotspot (Figure 1). Both countries were successful in forest biodiversity conservation post-conflict. I define success as a clear and explicit focus from the governments in expanding government capacity for conservation, incorporation of environmental protection in development plans, and implementation of a variety of conservation programs after armed conflict. The success of these two countries will be more fully shown through the Findings section. The actual implementation of programs is critical for success. For example, no direct, positive effects come from a plan to reforest; the forest is healthier when the trees are actually grown and planted, and an increase in forest cover occurs.

I analyzed strategies to expand governmental capacity for forest biodiversity conservation and forest biodiversity conservation programs and policies applied after the Vietnam War, which occurred between 1955-1975, and after the Sierra Leone Civil War, which occurred between 1991-2002. Because I wanted to analyze the initial forest conservation steps taken, I limited the research timescale after the conflicts. Every time I refer to “timescale,” I am referring the amount of time after each conflict in which I included strategies in my analysis: since this study occurred in 2018 and the Sierra Leone Civil War ended in 2002, I made the timescale sixteen years in length. Therefore, I looked at conservation strategies between 1975 and 1991 for Vietnam and between 2002 and 2018 for Sierra Leone. My research draws from a variety of sources, including governmental programs, policies, journal articles, documentaries, and online sources.

While sixteen years may seem like an extensive period of time, there are distinct periods after conflict through which conservation can take place (United Nations

Environment Programme, 2010). Initially after conflict, states enter the recovery period and are focused on fixing immediate, short-term problems. Some of these include rebuilding critical infrastructure, assisting refugees, establishing a stable government, verifying human rights compliance, and kick starting economic growth (United States Institute of Peace, 2018). This transition into peace may last years. In addition, the safety of conservation workers may not be ensured immediately after conflict.

Once peace is established, conservation can take place. Conservation is focused on longer-term goals, so it requires a more stable structure to occur properly. However, conservation can be a “tough sell” to countries coming out of conflict, as natural resources are often key to initiating economic development by creating jobs, supporting livelihoods, and raising government revenues (Brown, 2012). However, since the link between human health and healthy ecosystems is strong (Conservation International, 2018; Knox, 2017; Conservation International, 2009), conservation should be a priority in the post-war recovery period. In a report about Sierra Leone, the United Nations Environment Programme highlights the importance of taking environmental destruction into consideration when planning post-war recovery: “When environmental impacts are not mitigated, crucial livelihoods and human health can be put at great risk, threatening recovery and stabilization” (United Nations Environment Programme, 2010). Therefore, conservation not only benefits the environment long-term—it can also promote peace post-conflict.

Why I Only Analyze Forests

While conservation can occur for a variety of ecosystems, I am specifically focusing on forest conservation for numerous reasons. First, forest cover is connected to

biodiversity: while forests cover only 30% of earth's surface area, 80% of the world's terrestrial biodiversity resides in them (Conservation International, 2011). Intact forests allow survival for humans and other species. Forests sustain the economic livelihoods of 1.6 billion people, over 20% of the world's population, by providing forestry products, including firewood and food that they can utilize and sell (FAO, 2015). In addition, over five thousand forest species are used as commercial products (Secretariat of the Convention on Biological Diversity, 2010). Forest ecosystems also provide clean water to two-thirds of all major cities in developing countries (Conservation International, 2011). If forests are broken up and degraded, the benefits which they offer diminish. In general, larger patches of forest can support a larger number of species (MacArthur, 1967). Therefore, a loss in forest cover results in a loss of forest species. Intact forest areas also result in fewer edge effects, like increased wind disturbance, elevated tree mortality, and reduced canopy height, which especially harm bird species (Primack, 2010). Biodiversity hotspots, which often contain forests, are also being threatened at an alarming rate. Therefore, by examining forest conservation in Sierra Leone and Vietnam after armed conflict, I hope to understand how forest ecosystems can be preserved and restored to benefit people and other species in their times of need. Finally, unlike marine biodiversity, forest biodiversity and cover are easy to estimate, whether that be through satellite imagery or field surveys.

Why I Only Analyze Governments

Conservation can also be implemented through a variety of networks, including governments, nongovernmental organizations, international organizations, and communities. I specifically am comparing only governments because they produce

quantifiable and documented efforts, which are necessary for a study like this. By comparing only governments, this project is structured because they hold similar levels of authority. However, there are multiple opportunities for further research in the areas I will not cover, like the nonprofit sector or the conservation of different ecosystems. Community initiatives are often undocumented, while government actions are usually well-documented, so they were easily accessible for this study.

In addition, “improved governance of natural resources and the environment is a key feature of government stability and relevance” (United Nations Environment Programme, 2010). Therefore, by examining how governments handled conservation coming out of conflict, I can recommend conservation methods which other governments can utilize to promote peace and create greater stability in their countries. After conflict, people often prioritize short-term economic incentives to recover from economic losses which can degrade the environment. Thus, government intervention is necessary as a market economy would prioritize economic gains at the expense of the environment.

The two comparison timescales also put limitations on the conservation action that would have been taken in each country. Since the war in Vietnam ended before international conservation became widespread in the late 1980s, the impact of international organizations in Vietnam was limited. In the 1990s, after Vietnam’s timescale, international conservation efforts grew. On the other hand, international assistance dominated, and still continues to dominate, in Sierra Leone (Abdullah, 2004). Finally, community initiatives are often undocumented, while government actions are well-documented, so they were easily accessible for this study.

Background of Cases

For this thesis, I compare Vietnam and Sierra Leone. The location and size of each country is shown in Figure 2.

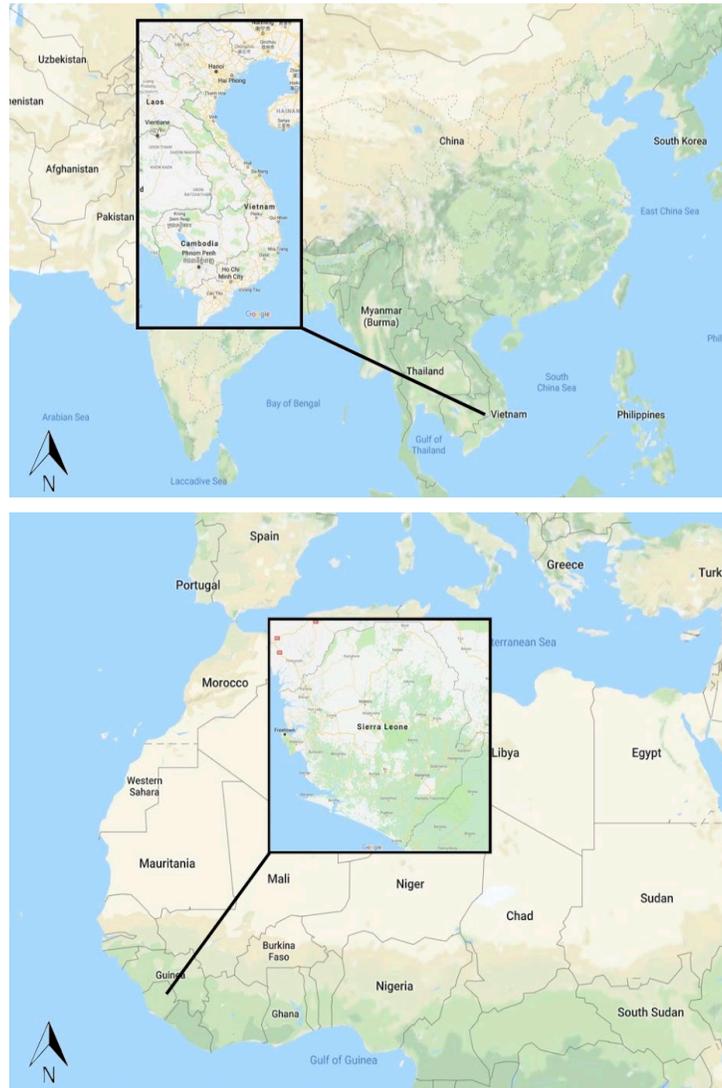


Figure 2. Locations of Vietnam and Sierra Leone.

Vietnam and Sierra Leone are drastically different countries in nearly all aspects (Table 2). Vietnam is a fairly large country in both physical area and population. Sierra Leone, on the other hand, is small in both areas. Because they are both situated close to

the equator and by the ocean, the ecosystems of Sierra Leone and Vietnam are relatively similar. The chiefdom structure of Sierra Leone is rooted in tradition and Vietnam experiences more social stratification, partially due to tradition and partially due to wider economic livelihood differences. For Sierra Leone, more than 70% of people are below the poverty line (United Nations Environment Program, 2010). Likewise, immediately after the Vietnam War, the country was in an economic crisis. Political leaders implemented the economic philosophy of ‘doi moi,’ meaning renovation, in 1986, over ten years after the Vietnam War ended, which implemented a decentralized market economy and created a rate of economic growth and poverty reduction that has been “unsurpassed” by any other developing country (Vandemoortele, 2011). Vietnam, therefore, had much more capital and physical resources to implement conservation after conflict than Sierra Leone. The major economic industry in both countries was agriculture, especially before the implementation of ‘doi moi’ in Vietnam.

	Vietnam	Sierra Leone
Population after Conflict	48.03 million (1975)	4.957 million (2002)
Area Size	331,210 km ²	71,740 km ²
Ecosystem Types	Rainforests Mangrove wetlands Deltas Highlands	Rainforests Mountain forests Savannah woodlands Wetlands
Social Structure	Traditional social stratification	Chiefdoms
Religion	None (81.8%) Buddhist (7.9%) Catholic (6.6%) Other (3.7%)	Muslim (78.6%) Christian (20.8%) Other (0.6%)
Political System	Communist State	Presidential Republic
Types of Industries	Services (41.3%) Industrial manufacturing (32.7%) Agriculture (15.9%)	Agriculture (61.3%) Mining (4.5%) Forestry (2.3%)
GDP after Conflict (in 2002 USD)	\$12.847 billion	\$1.239 billion

Table 3. Comparison of Vietnam and Sierra Leone.

Vietnam was much larger, in terms of population and area size, and prosperous than Sierra Leone after their respective conflicts. In addition to population and wealth, social structure and political structure would play key roles in conservation efforts after conflict. Sources: The World Bank; Google; Central Intelligence Agency; United Nations; United Nations Statistics Division.

Background of Conflicts

This next section contains brief backgrounds of each conflict, focusing on the impacts on the people and environment of Vietnam and Sierra Leone.

Vietnam War

Vietnam, in addition to Cambodia and Laos, was a colony of France in the 1800s. The French exploited the vast resources of Vietnam, ultimately leaving many Vietnamese poor and without land. When World War II broke out, the French were unable to defend Vietnam and the Japanese invaded and seized control. Once it ended, the Japanese withdrew from Vietnam, ultimately leaving the control of the government nearly open. This led to a clash between the French and Viet Minh, a communist group led by Ho Chi Minh. In 1954, the French and Viet Minh signed a treaty which divided Vietnam into the communist North and the anti-communist South. Some people in the South, however, still sided with the views of the communist North. These supporters, the Viet Cong, were assisted by the North, who sent soldiers and supplies to them through the Ho Chi Minh trail.

Fearful of communist uprisings, the United States supported the South with money, troops and advisors. Because the United States did not have an understanding of the Vietnamese jungles, they were often bombarded by the Viet Cong through guerilla warfare. Therefore, in 1962, Operation Ranch Hand was implemented. Over the course of nine years, the United States sprayed defoliants, including the infamous Agent Orange, over 19,943 km² of forest (Ives, 2010). This was roughly 14% of South Vietnam's total land area (Milner, 1988). An estimate of forest destruction by defoliants performed by researchers at the University of Wageningen is shown in Table 3. After just one spraying, tree species lost their leaves in two-three weeks (Williamson, 1990). Forests were not the only land area sprayed; agricultural areas were also sprayed, which destroyed crops, so forests were felled to create new agricultural land for feeding the

growing population (Collins, 1991). In addition, forests were also bulldozed over. In the documentary *After the Fire*, American soldiers are shown plowing down the Boi Loi forest while some Vietnamese citizens looked on in sadness (Milner, 1988).

Number of Sprayings	% of Total Sprayed Area	% of Trees Killed Outright
One	66	10
Two	22	25
Three	8	50
Four or More	4	85-100

Table 4. Herbicide spraying effects on dense forest.

After one spraying with herbicide, tree species lost their leaves in about two-three weeks. The more times an area was sprayed, the greater tree mortality occurred. Source: Williamson, 1990.

Americans were told that the spraying and destruction of Vietnamese jungles would save American lives. One reporter even went so far as to say that “what [the United States’ military is] doing amounts to a pretty important form of conservation in itself--the saving of American lives” (The New York Times, 2014). Clearly, Agent Orange had the opposite effect on the Vietnamese landscapes and people, but also harmed American soldiers, as many developed cancer and their children developed birth defects (The New York Times, 2014).

Professor Egbert Pfeiffer, one of the first scientists to raise concern of environmental damage in Vietnam, described the aftermath as “one of the most shocking experiences of [his] life. [He] virtually saw no green living plant life anywhere. It was just a solid gray scene of death.” (Milner, 1988). Mangrove forests

near the coastline, which are vital for protecting the coastline from typhoons and erosion (Milner, 1988), took the biggest hit: 41% of true mangrove forests, which are the forward portion of mangrove swamps and which experience tidal inundation, and 23% of back mangrove forests, which reside in a second layer behind true mangroves, were sprayed with herbicides during Operation Ranch Hand (Westing, 1984). The differences between before and after herbicide spraying are stark (Figure 3).



Figure 3. Mangrove forest before (top) and after (bottom) defoliation from herbicide spraying.

After herbicide spraying in Vietnam, the difference in forest cover was drastic. Tree mortality was widespread, resulting in a loss of forest cover. This loss of forest cover severely altered ecosystems. Source: The New York Times, 2014.

Early scientific research in Vietnam found that when forests are sprayed, wildlife also suffers. A study by Professor Vo Qúy from Hanoi University compared

unsprayed and sprayed sites: two unsprayed forests held one hundred forty-five and one hundred seventy birds species, while a sprayed forest only had twenty-four; and the unsprayed forests had thirty and fifty-five mammal species, while the sprayed site only had five (Westing, 1984). These drastic differences are mostly linked to loss of habitat and resources, as trees died off and forests became grasslands which were more susceptible to fires, which ultimately continued the cycle of loss. When the wet season came, all the soil nutrients were washed away, which was why forest regeneration was difficult naturally (Milner, 1988). Vietnam needed established conservation efforts to get their forests back.

Once the Vietnam War ended, the Vietnamese were left with the task of recovery and rebuilding, which put the forests under even more strain, as firewood and lumber was needed for postwar reconstruction. The destruction was so overwhelming that “no one knew how much natural habitat was affected.” But, that did not mean “no one cared,” as one government official said in an interview (Milner, 1988).

Sierra Leone Civil War

Sierra Leone was also a European colony. During their control of Sierra Leone, the British extracted commercial timber products and other forest products, like ivory and rubber, for trade (United Nations Environment Programme, 2010; Munro, 2016). These activities greatly reduced forest cover. The amount of extraction is largely unknown but thought to have been exaggerated to a certain extent. Antiquated European colonial environmental philosophies and narratives depicting local people with no control of natural resources dominated written accounts in the early 1900s, rather than actual data (Munro, 2016). However, there was a rapid enough rate of deforestation that

ultimately prompted early conservation efforts, like protected area establishment (Squire, 2001). Since Sierra Leone gained independence in 1961, strong and stable government structure has been rare: many leaders have been authoritarian, five coup d'états have occurred, and fighting has been a regular occurrence, with the 1991-2002 civil war being the most notable (United Nations Environment Programme, 2010). This instability led to dramatic damages to the economy, governance, society, and environment.

The Sierra Leone Civil War began in 1991 when the Revolutionary Armed Front (RUF) began its rebellion. The RUF was made up of predominantly disaffected or unemployed young men who were frustrated by the corruption and mismanagement of the government (United Nations Environment Programme, 2010). The inequality created through decades of instability ultimately placed greater value on tangible natural resources and the control of them. When inequality occurs, tensions rise; “inequitable benefits-sharing of natural resource wealth,” most notably diamonds, was a driver of the Sierra Leone Civil War (United Nations Environment Programme, 2010). Men in the RUF felt government corruption and the wealthy’s control of natural resources were why they could not have stable or life-supporting incomes. The RUF seized diamond mines in eastern Sierra Leone early on in the war and held them until 1995. As a democratically-elected government structure was established and United Nations support improved, the RUF presence began to dwindle. Peace in Sierra Leone was gradual and the war was finally announced to be over in 2002.

While there is no significant link between RUF base placement and forest cover, total forest cover in Sierra Leone chiefdoms declined from 67.5% covered to 57.9%

covered, a difference of 9.6 percentage points, between 1991 and 2002 (Figure 4) (Burgess, 2015). This change was entirely in secondary forests, which are forests that have regrown after a timber harvest (Burgess, 2015). Secondary forests are common in Sierra Leone because of earlier exploitation. These forests also do not require strongly-networked infrastructure for access, which is why they were affected more (Burgess, 2015). Most deforestation occurred because of illegal timber harvests and land clearing for agriculture. Through direct interviews with communities in Sierra Leone, researchers found that nearly all displaced people from the war engaged in deforestation activities as a means of survival specifically in the Western Area Forest Reserve, yet also considered the forest to be unsafe during the peak-war period (Conteh, 2017). Since people were uncertain of when they could enter the forest to engage in deforestation activities, they participated in rapid, high-impact extraction of natural resources, specifically timber, in unsustainable fashions (United Nations Environment Programme, 2010). In protected areas, mammal fauna remained relatively intact, but a large loss of the elephant population was noted in Gola Rainforest National Park (Lindsell, 2011). Some sections of protected forest were extracted, especially near the Guinea border, as the border was not secured (United Nations Environment Programme, 2010).

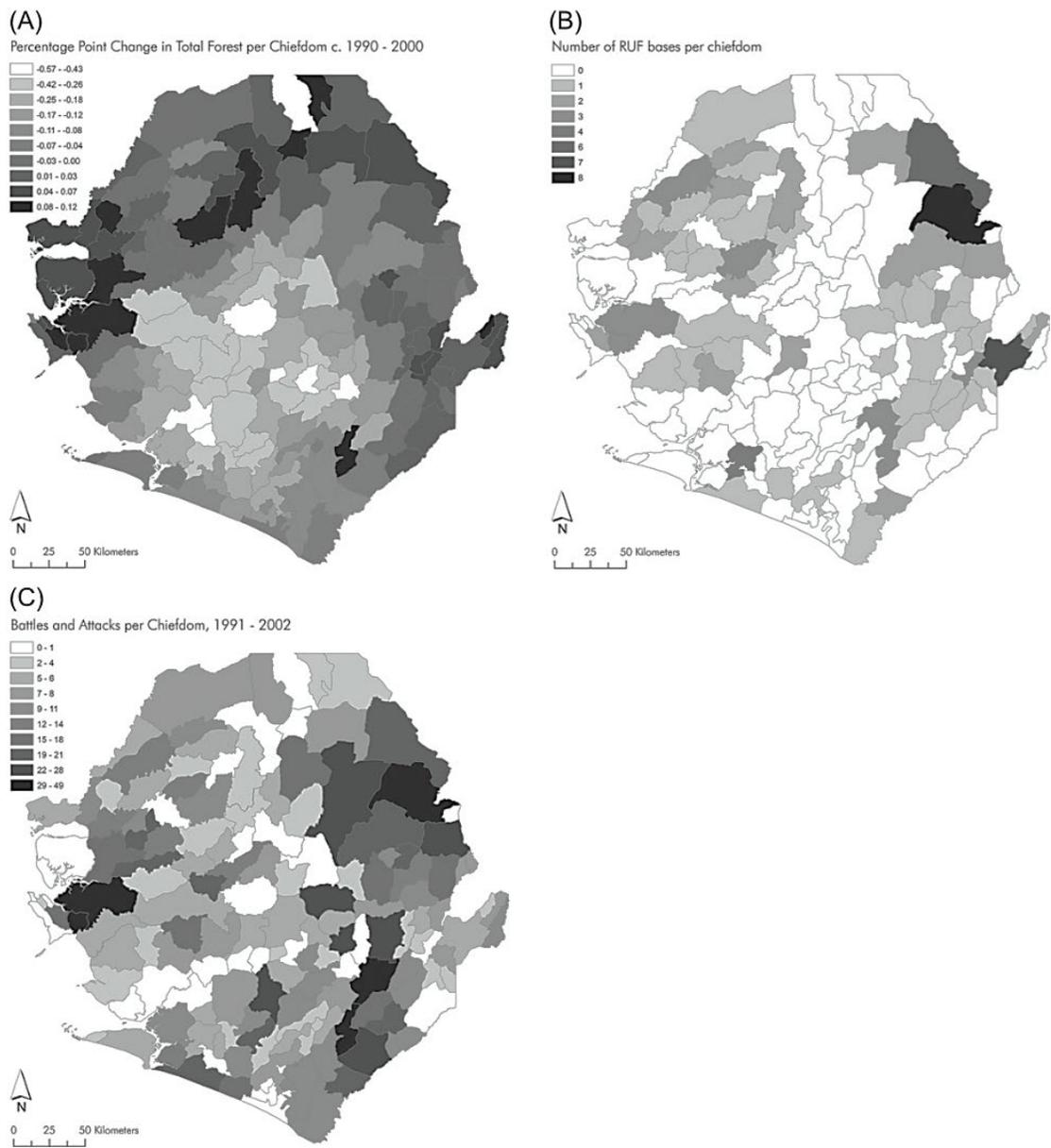


Figure 4. Geographic variation in total forest cover change, in percentage points/100 (panel A), location of RUF bases (panel B), and intensity of battles of attacks (panel C) by chiefdom.

Forest cover change was damaging especially in the middle of Sierra Leone. No statistical correlation was found between RUF base location and forest cover loss; however, forest damage was widespread. Source: Burgess, 2015.

Once conflict subsided, over half of the displaced people remained in the communities adjacent to protected areas (Conteh, 2017). In addition, threats to biodiversity increased after the end of the war (Conteh, 2017). This was probably because large portions of the population returned to their shifting-agricultural lifestyle, which requires the conversion of forest land, and because the RUF no longer presented a threat to those entering the forest (United Nations Environment Programme, 2010). Understandably, during the conflict and after, during the recovery period, short-term economic gains were more sought after than long-term resource management.

Summary

The Vietnam War and the Sierra Leone Civil War caused significantly harmful effects on both the people and environment. Over one million, four hundred thousand military personnel died while fighting in the Vietnam War and over two million civilians were killed (Spencer, 2018). The Sierra Leone Civil War resulted in the death of over seventy thousand Sierra Leoneans and the forced amputation of more than ten thousand people (Abdullah, 2004). Both wars resulted in large-scale displacement of people: three million in the Vietnam War (Zampano, 2015) and more than three million in the Sierra Leone Civil War, which was over half of their population (Abdullah, 2004). While both countries experienced reduction in forest cover, more previously untouched forest was affected in the Vietnam War. After the conflicts were over, rebuilding began.

Findings

Conservation is a difficult and demanding process, especially for countries coming out of conflict. As seen through the cases of Vietnam and Sierra Leone, governments who want to engage in conservation can even when capacity is low. Each country recognized the need to protect the environment, especially the use of natural resources, during the reconstruction period: Vietnam decided in 1985 that any development which occurs should take environmental protection into consideration (Ortmann, 2017); and Sierra Leone recognized the impact of natural resource usage in every major development strategy in the country, including the National Biodiversity Strategy and Action Plans of 2004-2010 and 2017-2026, the Poverty Reduction Strategy Paper in 2005, the Agenda for Change in 2007, and the Agenda for Prosperity in 2012. In addition, the governments each engaged in a variety of conservation programs, which I will explain further in this section. Following the MDSD method, I will compare how forest biodiversity conservation was implemented in Vietnam and Sierra Leone after conflict using both a yes/no binary comparison and narrative analysis.

Creating new governmental organizations with authority over conservation and enforcement of policies

	Vietnam	Sierra Leone
Yes/No?	Yes	Yes
What:	1976: Ministry of Forestry 1988: Vietnam Association for Conservation of Nature and Environment (VACNE)	2008: Environmental Protection Agency 2008: Ministry of Agriculture, Forestry and Food Security 2012: National Protected Area Authority (NPAA)

Table 5. Government environmental departments.

Vietnam created two government environmental departments between 1975 and 1991 and Sierra Leone created three between 2002 and 2018.

To rebuild and engage in conservation, Vietnam and Sierra Leone needed to expand their capacity to implement conservation. They did this by creating and restructuring government organizations who played a role in conservation (Table 4).

In 1976, the General Department of Forestry transformed into the Ministry of Forestry, which oversaw forestry policy, planning and research, and held direct responsibility for 17,000 km² of forest land, of which 14,000 km² was actual forest (Ministry of Agriculture and Rural Development, 2018; Collins, 1991). In addition, the creation of the Vietnam Association for Conservation of Nature and Environment (VACNE) by the government in 1988 put forest conservation as a priority in development. VACNE’s role was to assist in public environmental education, conservation law compliance, and to help in the development of policies and programs relating to conservation.

Sierra Leone added multiple government organizations in charge of various aspects of conservation post-conflict. The Environmental Protection Agency was established with the goal of creating and enforcing environmental regulations. In addition, it manages all programs related to the environment. The Forestry Division in the Ministry of Agriculture, Forestry and Food Security is in charge of the management of forest resources and of the preservation of forests for biodiversity research, education and conservation (Ministry of Agriculture Forestry and Food Security, 2018). In order to more effectively manage protected areas, the National Protected Area Authority (NPAA) was created in 2012 and overtook management of national protected areas to concentrate this authority in one sector and allow the Ministry of Forestry to focus on other goals (The REDD Desk, 2018). During their post-conflict timescale, Sierra Leonean government organizations have worked to strengthen their cooperation and communication, and sought to limit the conflict of interests between governments (Government of Sierra Leone, 2017).

Supplying organizations with greater financial capital

	Vietnam	Sierra Leone
Yes/No?	Yes	Yes

Table 6. Government conservation funding.

Vietnam and Sierra Leone increased the investments in conservation organizations after conflict, but it made marginal impact.

While I was unable to find exact numbers, Vietnam increased the budget of environmental organizations (Ortmann, 2017). They were more able to obtain highly

trained staff and updated equipment, ultimately improving the quality of data with which to make decisions. Some of this funding was from international donors, while some was from the government itself (Milner, 1988).

Funding for conservation in Sierra Leone mostly came from international donors, as there was a consistent deficit in the government’s budget (United Nations Environment Programme, 2010; Brown, 2012; Government of Sierra Leone, 2017). During their timescale, the country received at least \$6.8 USD to support conservation in protected areas (Government of Sierra Leone, 2017). To reduce dependency on outside donors, Sierra Leone also created the Conservation Trust Fund in 2012, which has a goal of raising \$20 million USD (Brown, 2012).

However, while they increased funding, there was always a consistent lack of financial resources to implement both countries’ conservation goals (Collins, 1991; United Nations Environment Programme, 2010). The lack of funding ultimately resulted in a lack of staff to implement conservation programs. While funding is essential for implementing conservation, the marginal impact of increases in funding means this strategy is less important than others analyzed in this thesis.

Supplying organizations with greater human capital

	Vietnam	Sierra Leone
Yes/No?	Yes	Yes

Table 7. Government conservation human capital.

Vietnam and Sierra Leone increased the number of people working on conservation in government organizations, but it was a marginal impact.

Since both countries created new government organizations in charge of conservation, they needed to employ more people. Some of these new people came from university programs designed to train more people in conservation practices (Milner, 1988; Convention on Biological Diversity, 2014). In addition, some community members, in either the Local People’s Committees in Vietnam or the Local Councils in Sierra Leone, overtook responsibility for natural resource management at the local level through community-oriented management programs. However, there was always a consistent lack of staff and management experience, due to lack of financial resources that hindered conservation goals.

Reducing corruption

	Vietnam	Sierra Leone
Yes/No?	No	Yes
What:		2008: Anti-Corruption Act

Table 8. Reducing government corruption.

Vietnam did not reduce corruption, while Sierra Leone did and they passed the Anti-Corruption Act in 2008.

Vietnam did not reduce government corruption after the Vietnam War. That is not to say that Vietnam did not have corruption, but rather that the political system in place did not try to reduce any that may have been present. On the other hand, the Sierra Leone government did. The Anti-Corruption Act of 2008 sought to stop illegal harvesting of natural resources by government officials, which added to the inequitable sharing of natural resource wealth, and to help the people trust in governmental

processes and decisions more (United Nations Environment Programme, 2010; Abdullah, 2004).

Engaging in participatory and community-oriented natural resource management

	Vietnam	Sierra Leone
Yes/No?	Yes	Yes
What:	1986: ‘Doi Moi’ Policy 1988: Land Law Local People’s Committees Reforestation	2004: Local Government Act

Table 9. Community-oriented natural resource management.

Vietnam did not have a reason to reduce corruption, so they did not attempt to, while Sierra Leone did and they passed the Anti-Corruption Act in 2008.

Both Vietnam and Sierra Leone attempted to provide citizens with more say and more ownership in conservation by passing laws. In Vietnam, the economic concept of ‘doi moi’, the philosophy which placed emphasis on a decentralized market economy, spurred the involvement of local people in forestry on their own terms. From ‘doi moi’, the 1988 Land Law was passed which gave people opportunities to own and benefit from production forests (Ahlbäck, 1995; Howard, 1998). This led to an increase in tree cover, mostly from plantation farming, but much of this was in small scales (Ahlbäck, 1995). Farmers would receive plots of land which they could utilize for forest production and protection (Howard, 1998). The government emboldened these farmers, with one farmer saying the Ministry of Forestry “encouraged and praised” him since he was turning barren land green again (Howard, 1998). The government of Vietnam also included local people in the planning and management of forests. All the forest outside

the control of the Ministry of Forestry, including some protected areas, was under the control of Local People's Committees (Collins, 1991). By including local people, the decisions made by the Vietnamese government were more accepted and the attitude towards conservation was more positive and widespread. The biggest impact for community-based conservation came through the reforestation programs which restored forested areas. Reforestation will be explained further on in this section.

The Sierra Leonean government passed the Local Government Act in 2004, which brought more power to local people by creating the structure for district and city councils. The councils were financed by the central government (United Nations Environment Programme, 2010). This improved cooperation with local communities and provided them a voice in natural resource management. By decentralizing the government, leaders wanted to reduce corruption and empower the next generation of leaders (United Nations Environment Programme, 2010). In addition, the establishment of any protected area required the input of the local community (Brown, 2012). Near the end of its timescale, the government specifically recognized the importance of community-based management: it set aside \$10,420,000 USD for community-based natural resource management in its Second National Biodiversity Strategy and Action Plan 2017-2026, which was 20.92% of the plan's total budget (Government of Sierra Leone, 2017).

Education and community outreach

	Vietnam	Sierra Leone
Yes/No?	Yes	Yes

Table 10. Education and community outreach.

The incorporation of conservation into education programs was especially important for both Vietnam and Sierra Leone after conflict. Both countries implemented community education programs and expanded conservation training in university systems (Milner, 1988; Convention on Biological Diversity, 2014).

VACNE, the Vietnam Association for Conservation of Nature and Environment, was the main government organization in charge of public education. For those in the countryside, Vietnam implemented education programs in which every child was taught about problems with deforestation and “how to plant trees and look after them” (Milner, 1988). The reforestation programs were mainly carried out by children, ultimately providing hands-on conservation training and educational experience for the next generation. In addition, for those in the city, some museums showcased the “scars” on the land by displaying photos of the herbicide damage (Milner, 1988).

For Sierra Leone, education was one of their biggest conservation accomplishments (Government of Sierra Leone, 2017). Education was implemented through a variety of means, including radio programs, newspaper articles, community meetings, and workshops (Convention on Biological Diversity, 2014). All of these educational and awareness-raising tools had a two central themes: the importance of biodiversity in general to human survival and the establishment of protected areas

(Government of Sierra Leone, 2017). For their next biodiversity action plan, the government hopes to raise \$2,720,000 USD specifically for community-oriented education programs on conservation (Government of Sierra Leone, 2017).

Creating protected areas

	Vietnam	Sierra Leone
Yes/No?	Yes	Yes

Table 11. Creating protected areas.

Vietnam and Sierra Leone developed a similar amount of protected areas as a percentage of their country size (Table 12). However, Vietnam created more nature/forest reserves than national parks, while Sierra Leone created more national parks than nature/forest reserves (Figure 5). The list of protected areas formed in both Vietnam and Sierra Leone is found in Appendix 1.

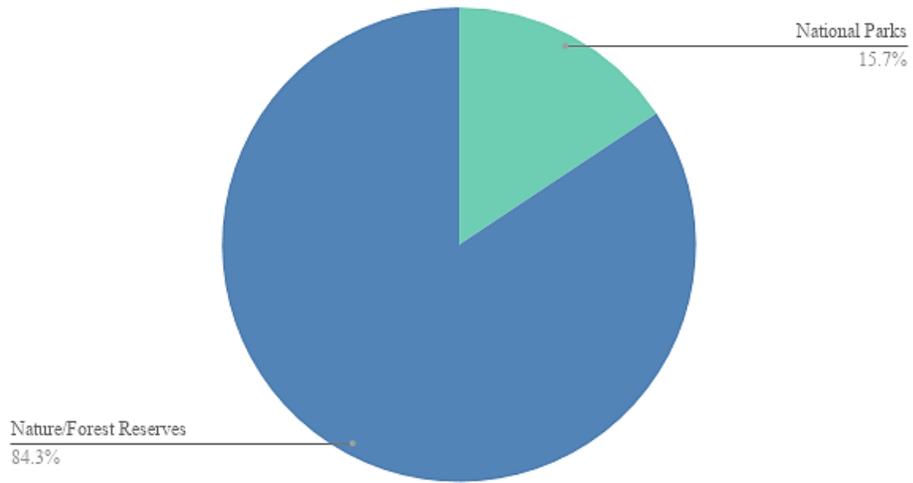
	Vietnam	Sierra Leone
National Parks Total Area (km²)	1152	1216.08
National Parks (% of Total Country Area)	0.348	1.70
Nature/Forest Reserves Total Area (km²)	6202	212.1
Nature/Forest Reserves (% of Total Country Area)	1.87	0.296
Total Area (km²), Parks and Reserves	7354	1428.18
Total Area as Percentage of National Area	2.22	1.99

Table 12. Protected areas.

Vietnam and Sierra Leone created a similar amount of protected areas based on country area size. Data Sources: Collins, 1991 (Vietnam), and Protected Planet: Sierra Leone (Sierra Leone).

Vietnam and Sierra Leone invested in nearly opposite percentages of national parks and nature/forest reserves (Figure 5). The difference in which kind of protected area was established depended on the individual needs of each country. Nature and forest reserves were often smaller areas of land, while national parks were larger.

Vietnam New Protected Areas



Sierra Leone New Protected Areas

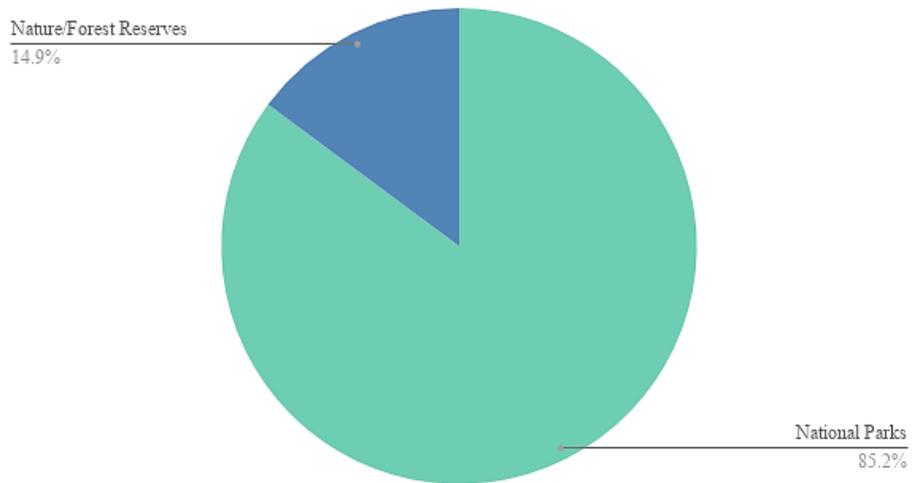


Figure 5. Creating protected areas.

Vietnam and Sierra Leone established nearly opposite percentages of protected areas, considering national parks and nature/forest reserves. Data Sources: Collins, 1991 (Vietnam), and Protected Planet: Sierra Leone, 2018 (Sierra Leone).

Of all new protected areas established within their timescales, 15.7% were national parks in Vietnam and 85.2% were national parks in Sierra Leone, while 84.3%

were nature/forest reserves in Vietnam and 14.9% were nature/forest reserves in Sierra Leone (Figure 5).

Before the war, Vietnam only had one national park. After the war, Vietnam developed a large system of national parks and nature reserves. Most of the newly established protected areas were nature reserves, which tended to cover smaller areas and have looser conservation goals than parks (Stolton, 2004). A lot of these areas were created in chunks through governmental decisions by the Ministry of Forestry (Rambaldi, 2001). In 1986, the same year that Vietnam switched to the 'doi moi' economic system in which production forest land use was delegated to the people, a majority of the protected areas were established (Stolton, 2004). By protecting forested areas, researchers noticed increases in tree cover, which ultimately led to increases in species population, especially with birds (Milner, 1988). As mentioned previously, Local People's Committees were in charge of the management of protected areas, which provided citizens with opportunities to become involved in conservation (Protected Planet: Vietnam, 2018).

While the government in Vietnam could establish protected areas at their whim, the Sierra Leonean government required community support to create protected areas (Brown, 2012). The first protected area created after the end of conflict was the Gola Transboundary Peace Park in 2010. As a Peace Park, this protected area conserves 2,000 km² of the Upper Guinea Rainforest across the border between Sierra Leone and Liberia (United Nations Environment Programme, 2010). Through coordination and cooperation between countries, the governments reduced the complications of forest management across borders. In 2011, the government of Sierra Leone also proposed an

additional 363 km² for conservation, increasing the total area under protection to 4.5% of the country’s land area (Brown, 2012). Although this goal was under the global and Sub-Saharan averages, it was still a significant improvement for Sierra Leone. The government has since surpassed the Sub-Saharan average and now has 9.39% land coverage (Protected Planet: Sierra Leone, 2018).

Providing alternative livelihood options

	Vietnam	Sierra Leone
Yes/No?	Yes	Yes

Table 13. Providing alternative livelihood options.

In efforts to clarify and develop the rules on production forestry, Vietnam implemented the Forestry Protection and Development Law in 1991 and Sierra Leone modified the Forestry Act of 1988 in 2010 (de Jong, 2006; Government of Sierra Leone, 2010). Both laws supported production forests as means of safeguarding protected forests from harm, as they could provide livelihoods for people, alternative sources of firewood and charcoal for energy, and expand the forestry product market (de Jong, 2006; Government of Sierra Leone, 2010). In addition, the land reforms which Vietnam implemented gave people opportunities to engage in production forest for economic incomes. In Sierra Leone, a few small-scale buffer zones were established around protected areas as fuel wood lots to reduce the impact of deforestation inside protected areas (Leach, 2015).

Land reform

	Vietnam	Sierra Leone
Yes/No?	Yes	No

Table 14. Land reform.

The ‘doi moi’ policy of 1986 and the 1988 Land Law in Vietnam were major land reform measures that improved conservation. By providing people with land and supporting them in forestry efforts, the government reduced inequality from previous land ownership systems (Ahlbäck, 1995; Howard, 1998).

In Sierra Leone, however, land reform did not occur because of the traditional land ownership system of chiefdoms. These chiefs are the “custodians of the land,” so they have the most authority over who owns land and how the land is utilized. In addition, the government was unable to allocate land to small-holders, mostly because the strategic investment in economic growth was geared more towards education and basic services for the poor, who overwhelmingly resided in rural agricultural areas, as opposed to significant economic opportunities like production forestry (Government of Sierra Leone, 2005).

Sustainable energy programs

	Vietnam	Sierra Leone
Yes/No?	No	No

Table 15. Sustainable energy programs.

Sustainable energy had little to no impact in forest conservation in each country after conflict. A vast majority of people in Vietnam and Sierra Leone relied on biomass,

or wood, for their energy needs: 80% in Vietnam (England, 1993) and 93% in Sierra Leone (Government of Sierra Leone, 2016). Because of the limited budgets for both countries, long-term, sustainable energy programs were simply not possibilities (England, 1993; An, 1997; United Nations Environment Program, 2010). In addition, small-scale renewable projects were too costly.

Both countries made statements on their energy uses near the end of their timescale. In Vietnam, an official position on reducing environmental impact from energy production was made in 1991, with the government taking the side of environmental protection (England, 1993). In 2016, the government of Sierra Leone released renewable energy and energy efficient strategies to reduce reliance on fuelwood and charcoal (Government of Sierra Leone, 2016). The main idea of the strategies are to develop legislation for renewable energy and energy efficiency, then work with stakeholders to fund energy projects, and finally promote renewable energy among the people. In addition, the government included tax incentives for individuals and companies who acquire renewable energy equipment.

Timber bans

	Vietnam	Sierra Leone
Yes/No?	Yes	Yes
What:	1990: Timber ban	Multiple timber bans

Table 16. Timber bans.

Vietnam and Sierra Leone implemented timber bans post-conflict. Vietnam, in addition to its neighbor Laos, initiated a ban on the export of raw logs in 1990 (Kemf,

1990). Sierra Leone issued multiple timber bans to reduce the extent of illegal and unsustainable timber trade across borders (The REDD Desk, 2018).

Reforestation and afforestation

	Vietnam	Sierra Leone
Yes/No?	Yes	No

Table 17. Reforestation and afforestation.

After the war ended, Vietnam launched country-wide reforestation initiatives. The government wanted to reforest the land to reduce the impact of all the herbicide damage from the war, but also wanted to reduce the impact from ongoing firewood and timber exploitation (Milner, 1988). This work was performed by a variety of actors, but predominantly students (Kemf, 1990; Milner, 1988). As a “special project to make the countryside green again,” children were taught about forestry techniques and planted seeds that were then distributed to local villages (Milner, 1988). They even were taught which seeds to sow in barren land and how to look after the schools’ plantations (Milner, 1988). In higher education forestry schools, students planted fast-growing trees in massive plantations first to reduce wind problems and then added more delicate trees to increase forest diversity (Milner, 1988). The mangrove forests, which were more delicate and more affected by the herbicide damage, were reforested through trial-and-error techniques by the national army (Milner, 1988). One project even sought to reforest an entire rainforest that was lost. Once the seedlings were established, the workers planted other plants to increase biodiversity among both plants and in other species, like birds. By 1987, 450 million trees were planted across Vietnam, with the

target rising each year (Milner, 1988). Figure 6 shows the rapid increase in tree plantation establishment. Between 1975 and 1991, the number of hectares planted increased nearly seven times (de Jong, 2006).

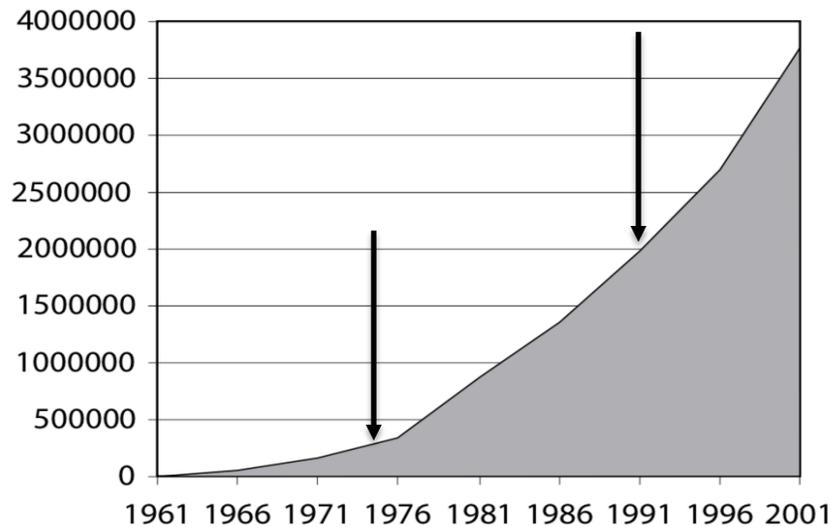


Figure 6. Accumulative plantation establishment 1961-2000 [hectares].

Between 1975 and 1991, forest plantations in hectares increased nearly seven times.

Source: de Jong, 2006.

In Sierra Leone, reforestation activities did not occur after the civil war.

However, in the Agenda for Prosperity, the government designated a National Reforestation Plan as a strategy for forest resource management (Government of Sierra Leone, 2012), and in the National Biodiversity Strategy and Action Plan for 2017-2026, the government set aside \$1,000,000 USD for reforestation programs at community and grassroots levels (Government of Sierra Leone, 2017).

Protection against forest disease

	Vietnam	Sierra Leone
Yes/No?	Yes	Yes

Table 18. Protection against forest disease.

Both Vietnam and Sierra Leone invested in small-scale efforts to protect against forest disease.

To protect against forest diseases in tree plantations, the Vietnamese government tried to plant a mixture of species (Poole, 1989). When mixtures of trees were used, much less defoliation, and subsequently, tree mortality, occurred compared to monoculture stands. Sierra Leone sought to increase education in plant disease and insect infections. In 2008, the government allotted \$80,000 USD to create plant health clinics in each administrative district in the country. The students in the clinics, usually people with authority in the Ministry of Agriculture, Forestry and Food Security, were able to support local farmers and foresters because of their training (Harling, 2008).

Reduction of slash-and-burn agriculture

	Vietnam	Sierra Leone
Yes/No?	No	No

Table 19. Reduction of slash-and-burn agriculture.

Slash-and-burn agriculture, a form of shifting cultivation in which trees are cut and burned to increase short-term soil nutrition, was still prevalent in Vietnam and Sierra Leone after the conflicts (Collins, 1991; Bass, 1994; Brown, 2012). While some rural populations were starting to change their agricultural methods (Bass, 1994), slash-

and-burn agriculture increased throughout the post-war period in Vietnam because of the pressure to rebuild Vietnam and the agriculture needs of the increasing population (Collins, 1991). In Sierra Leone, slash-and-burn agriculture as a form of subsistence agriculture, which feeds over 60% of the population (United Nations Environment Programme, 2010), was extensive and, as in Vietnam, contributed to substantial deforestation, bushfires, and erosion (Brown, 2012).

Discussion

Vietnam and Sierra Leone engaged in a variety of conservation strategies after conflict (Table 20). In general, they both implemented strategies related to community development and involvement, protected areas, and expansion of government capacity. Neither country implemented strategies for sustainable energy or reduction of slash-and-burn agriculture.

Table 20. Summary of conservation strategies.

	Strategy	Vietnam	Sierra Leone
Increasing governmental capacity	Creating new governmental organizations with authority over conservation and enforcement of policies	Yes	Yes
	Supplying organizations with greater financial capital	Yes	Yes
	Supplying organizations with greater human capital	Yes	Yes
	Reducing corruption	No	Yes
Conservation	Engaging in participatory and community-oriented natural resource management	Yes	Yes
	Education and community outreach	Yes	Yes
	Creating protected areas	Yes	Yes
	Providing alternative livelihood options	Yes	Yes
	Land reform	Yes	No
	Sustainable energy programs	No	No
	Timber bans	Yes	Yes
	Reforestation and afforestation	Yes	No
	Protection against forest diseases	Yes	Yes
	Reduction slash-and-burn agriculture	No	No

The most important strategies, based on investment in them and focus on them, for the two countries were: 1) creating new government organizations in charge of conservation; 2) creating protected areas; 3) engaging in participatory and community-oriented natural resource management; 4) educating and reaching out to communities; and 5) creating alternative livelihood opportunities. For a majority of these strategies (2-5), there is a main theme—community involvement and development. Protected areas, when incorporated with development strategies, have the ability to accomplish strategies 2-5 in post-conflict countries.

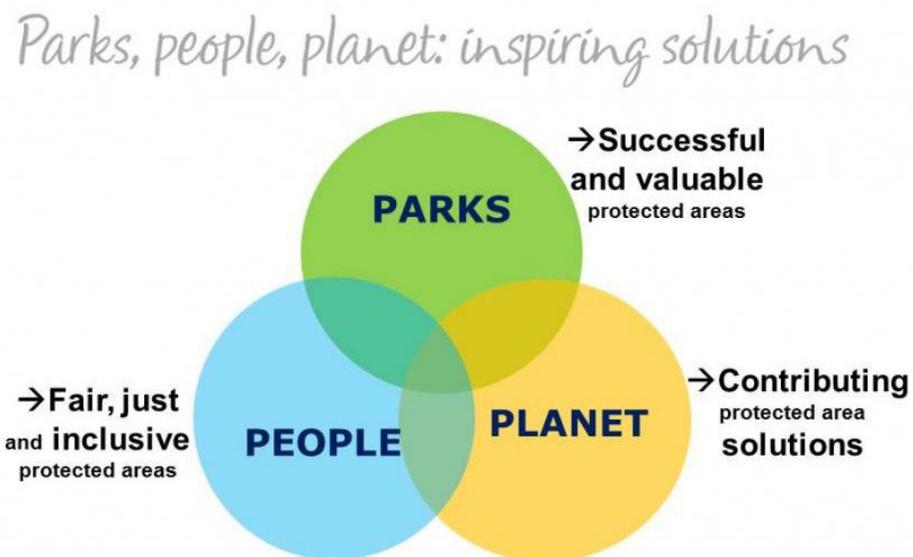


Figure 7. Global protected areas ideology.

The ideal protected area uses tested and globally-minded solutions to support biodiversity, people, and the planet. Source: International Union for Conservation of Nature, 2018.

Recently, there has been a shifting attitude towards protected areas: they are now supposed to do far more than just protect biodiversity (Figure 7). Protected areas are expected to "directly contribute to national development and poverty reduction" (Naughton-Treves, 2005). According to the Convention on Biological Diversity, protected areas should: 1) conserve biodiversity; 2) sustainably use biodiversity; and 3) allow fair and equitable sharing of the benefits that come from the use of biodiversity. As seen through the cases of Vietnam and Sierra Leone, clear establishment of protected areas and production forests can reduce people's need to harvest firewood, charcoal, and timber in protected areas by providing them with alternative livelihood options. From the case study of Sierra Leone, the inequitable sharing of natural resource wealth was a main driver of the civil war. Therefore, by promoting equitable sharing of resources through production forests next to protected areas, countries can take preventative steps to reduce conflict. In addition, after conflict when national development is especially important for kick starting economic growth, the incorporation of protected areas into development strategies promotes sustainable economic growth and more economic incentives for local people to participate in conservation. There are tangible economic benefits from protected areas. One study in Madagascar, another biodiversity hotspot, found that the rate of return for protected areas was 54% (Naughton-Treves, 2005).

While Vietnam and Sierra Leone often did not have sufficient financial or human resources to fully manage protected areas, that did not necessarily mean they were ineffective at reducing harmful environmental impacts and protecting biodiversity (Naughton-Treves, 2005). In a study that examined ninety-three protected areas in

twenty-two tropical countries, researchers found most protected areas to slow land conversion, logging, hunting, fire, and grazing inside of these areas, even with ineffective management (Bruner, 2001). Therefore, with even small funding increases for important management tactics like enforcement, boundary demarcation, and direct compensation for communities, park effectiveness at protecting biodiversity directly increases (Bruner, 2001). In addition, when government departments communicate, coordinate, and collaborate regarding protected area management, conservation will be more effective. Departments will understand who oversees conservation plans to ensure enforcement and roles. When Vietnam and Sierra Leone clearly established who was in charge of certain aspects of conservation, like when Vietnam focused the Ministry of Forestry more and when Sierra Leone created the National Protected Area Authority, they took steps to reduce miscommunication and consolidate the management of protected areas into one department. In addition, opportunities for cross-collaboration can also extend to bordering countries by creating peace parks, as in Sierra Leone.

Equally as important as collaboration between government departments is coordination between the government and the local communities that rely on and surround protected areas. By incorporating them into the planning and management of protected areas, governments promote trust, participation, and engagement. This occurs through the establishment of two forms of accountability: vertical and horizontal. Vertical accountability occurs between the government and the people and horizontal accountability is among the people. Transparency is the most fundamental aspect of both kinds of accountability because it requires open and honest communication from both parties (Nuesiri, 2016). It is also a key principle of good governance, especially

regarding natural resources, because it seeks to prevent negative social and environmental impacts from natural resource exploitation and abuses of power from natural resource use (Nuesiri, 2016). When governments communicate with local people about natural resource use and local people share input about what is occurring in and near protected areas, better management is possible: local people are not surprised by government decisions and the government has more information about the protected area and its potential problems, which can inform management decisions (Figure 8). Every actor involved in natural resource management understands how the other will be affected with decisions they make. When given the opportunity, local people can successfully manage forest resources because they have extensive knowledge about them (Hayes, 2006). Therefore, government authorities who make final decisions about and provide funding for conservation programs should invest time in learning about local concerns and knowledge.

Information: a one-way relation in which government produces and delivers information for use by citizens. It covers both “passive” access to information upon demand by citizens and “active” measures by government to disseminate information to citizens.



Consultation: a two-way relation in which citizens provide feedback to government. It is based on the prior definition by government of the issue on which citizens’ views are being sought and requires the provision of information.



Active participation: a relation based on partnership with government, in which citizens actively engage in the policy-making process. It acknowledges a role for citizens in proposing policy options and shaping the policy dialogue—although the responsibility for the final decision or policy formulation rests with government.



Figure 8. Social Accountability and the Government-Citizen Relationship.

Social accountability depends on the government-citizen relationship. Protected area management, especially post-conflict, should utilize the active participation method. This promotes engagement in conservation efforts for the community and assists governments in the development of management plans for what best suits the community. Source: Nuesiri, 2016.

For the active participation relationship to work, however, effort is required on both sides. There are multiple ways and places it can occur, like environmental education workshops, forums, town halls, councils, and anonymous surveys. All of these should seek to address local concerns and provide more information to local people about the natural resource plans (Fiallo, 1995).

When people are a part of decision making and deciding rules, the management system is more sustainable. The people decided the rules and, therefore, they are accountable to them. The horizontal accountability that occurs between citizens regarding the rules and regulations not only makes the active participation relationship with the government stronger, but also is in the community’s best interest, as they rely

on their environment to support themselves (Nuesiri, 2016). Those who cheat the system by attempting to exploit resources will not be supporting the community and will receive negative social consequences because of it, much like animals that attempt to cheat a system of altruism. Forests with community management styles have less deforestation rates than protected areas with top-down management style (Porter-Bolland, 2012). This is because of the horizontal accountability that occurs.

Integrated Conservation and Development Projects (ICDPs) serve as an ideal model for community-based protected areas. The model establishes core protected areas with restricted uses and outlying buffer zones, essentially production forests, that seek to promote socioeconomic development and income generation that aligns with park management values (Naughton-Treves, 2005). Development mainly occurs through sustainable resource extraction and use in buffer zones. However, some ICDPs have been criticized for not being truly participatory or being too focused on development, rather than conservation (Naughton-Treves, 2005). Therefore, the early inclusion of community knowledge and decision-making in protected area and buffer zone management is essential. The government needs to be there for guidance, oversight, final decisions, and funding. In addition, by providing education and community-outreach, governments are mostly to engage people in the conservation mission of the park and be supportive of ICDPs in general (Fiallo, 1995). When communities have higher education levels, knowledge about conservation issues, perceived benefits from a protected area, or friendships with park staff, they are more likely to have positive feelings about the park and the its purpose (Fiallo, 1995). Therefore, to ensure community support, park staff should engage in outreach and education opportunities.

Also, if possible, providing local people with employment opportunities within the park would increase support. In addition, emphasizing the impact that resource use now will have on future generations can garner support and engagement with protected areas (Fiallo, 1995). After conflict, the Vietnamese people had an attitude of contributing to their country to support future generations that aided in the wide scale implementation and acceptance of conservation efforts. Their attitudes could serve as an example for the encouragement of conservation after conflict in other countries.

ICDPs fail when the community is charged with not only managing natural resources, but also with providing funding for programs they desire (Naughton-Treves, 2005). In Sierra Leone, local leaders often disappointed their constituents when they were unable to implement conservation programs because they did not have the funding. Similarly, in Vietnam, the Local People's Committees did not often have the necessary funding either. As seen through the cases of Vietnam and Sierra Leone, the governments did not often have the money or human capital to support conservation projects. In order to increase the effectiveness of conservation programs, both of those strategies are essential. Therefore, if governments are struggling with funding after conflict, then there are opportunities for international organizations and nongovernment organizations to step in and provide funding for these opportunities. Therefore, communication, collaboration, and coordination does not have to fall simply on the government or the people—it can be cross-functional, including actors and participants from multiple organizations. In addition, for organizations that are already interested in providing support and relief after conflict, a solution like protected area management offers people more long-term economic and resource stability. If those organizations

choose to withdraw funding after a certain time, then management plans will have already been established with long-term stability in mind. By having clear and results-oriented management plans, governments and communities are more able to secure funding. A results-oriented approach can also promote conservation among the local people as they are able to see the outcomes and benefits from conservation programs. Because threats to biodiversity in protected areas are highest after armed conflict (Conteh, 2017), fast and targeted funding is essential for early and successful conservation. In addition, by supporting community-based conservation programs early, donors can reduce people's need to rely on unsustainable deforestation activities for economic livelihood and promote long-term conservation since local populations have a stake in conservation success.

Nongovernmental Organizations (NGOs)

There are a multitude of opportunities for NGOs to help with forest biodiversity conservation after armed conflict. International NGOs, who often have greater capacity to create change, can support governmental efforts to create and initiate Integrated Conservation and Development Projects by providing consulting expertise to assist governments in planning where ICDPs would be most effective, financial capital to employ park staff, and developing conservation education programs for locals to promote sustainable and long-term changes. Local NGOs could be more involved in promoting conservation to local people since they know and understand cultural differences. In addition, they would be necessary for the implementation of conservation education on the ground. Local NGOs can also serve to ensure ICDP

effectiveness by measuring progress and ensuring compliance and accountability among local people.

Limitations

The limitations of this study are based mostly around results of my research method, Most Different Systems Design. While the method allows for detailed comparison between two cases, MDSD has been criticized because it is difficult, if not nearly impossible, to find two cases that are different in every factor except for one (Lauth, 2009). In addition, most of my research was done by searching and scavenging for endless biodiversity conservation strategies on the internet, which was extensive work. There is a chance I did not find all the biodiversity conservation strategies that were implemented in Vietnam and Sierra Leone because of my limited time frame. While this project may not be perfect, I believe this is a start to examining how forest conservation can be implemented after armed conflict in any country, especially those in biodiversity hotspots. In addition, the data for natural resource management after conflict was often limited for the countries, which limited Vietnam and Sierra Leone's conservation efforts. The quality of data on protected areas between the countries is quite different. For example, databases list Sierra Leone as having many small designated forest reserves, but with no date of establishment listed. In addition, there are proposed forest reserves and national parks, but the status of these is unknown. Therefore, these areas cannot be included in analysis because of the uncertainty on whether they fit into the time period or not. This emphasizes a need for environmental data collection to occur throughout conflict. However, protected area staff should never be required to put themselves in harm's way for data collection.

Areas for Future Study

This analysis could be performed for international organizations, nonprofits, or community groups, as they all utilize different strategies to enact conservation. In addition, different ecosystems, like marine ecosystems or wetlands, could be studied to determine the best way to protect them post-conflict. Both of those ecosystems can contribute to national development after conflict, but more investigation is needed.

Summary

While conflict is never desirable, there are a variety of ways to support people and the environment during and after it occurs. Through ICDPs, governments can successfully engage in both forest conservation and socioeconomic development. By incorporating local communities in the planning and management of them, governments can establish systems of trust, accountability, engagement, and participation—four values especially needed after armed conflict. Funding for community-oriented protected areas can come from the governments themselves, international organizations, or nongovernmental organizations.

Epilogue

Between 1976 and 2010, Vietnam's total forest cover increased by 23.5% (de Jong, 2006; Mongabay, 2011). A majority of this increase was from plantations, which increased by 379.3%, while natural forest decreased by 7.9% (de Jong, 2006; Mongabay, 2011). Plantations were managed by local people and reduced their need to rely on protected forests for their livelihoods. The vast increase in plantation size was due to significant legislation passed in the 1990s by Vietnam, including Program 327 in 1993 and the Five Million Hectare Reforestation Program (5MHRP) in 1998. While originally intended to promote the productive utilization of barren land and hills, Program 327 shifted its focus in 1994 to protecting critical forest areas and reducing slash-and-burn agriculture techniques and again in 1996 to protecting forests in protected areas by allowing natural regeneration and implementing plantation projects (Sam, 2003). Overall, Vietnam invested over \$62.5 million USD (2018 USD) in Program 327 (Sam, 2003). The 5MHRP that occurred between 1998 and 2010 sought to continue this work and ultimately increase total forest coverage to 43% of Vietnam's land area (Sam, 2003). Vietnam succeeded, having 44.5% of land cover forested by 2010 (Mongabay, 2011). On 5MHRP, Vietnam spent nearly \$124 million USD (2018 USD) (Sam, 2003). These projects were funded mainly by the government but included collaboration with international partners (Sam, 2003). Now, Vietnam is focusing more on creating biodiversity within tree plantations to promote native tree growth (Millett, 2013). In addition, Vietnam has significantly increased its protected area network since its time period ended: in 1991, terrestrial protected areas accounted for 3.3% of total

land area (Collins, 1991); now, it is 7.58% of total land area (Protected Planet: Vietnam, 2018).

If Sierra Leone invested in reforestation efforts, forest cover would increase, and tree plantations could be used as a source of sustainable energy. This would reduce the need for people to rely on protected areas for energy needs. These plantations could also be part of buffer zones in ICDPs. In addition, Sierra Leone also has a large opportunity to expand their protected area network, ultimately protecting forest biodiversity and creating sustainable socioeconomic development programs.

Appendix 1: Detailed Protected Area List

	Sierra Leone	Area (km ²)
National Parks	Gola Rainforest National Park (Transboundary)	710.7
	Loma Mountains National Park	322.01
	Western Area Peninsula Forest National Park	183.37
	Total:	1216.08
Forest Reserves	Kangari Hills Forest Reserve	212.1
	Total:	212.1
Source: Protected Planet: Sierra Leone, 2018.		

	Vietnam	Area (km ²)
National Parks	Ba Be	50
	Bach Ma Hai Van	400
	Cat Ba	277
	Con Dao	60
	Nam Bai Cat Tien	365
	Total:	1152
Forest Reserves	Bana-Nui Chua	52
	Ben En	120
	Binh Chan Phuoc Buu	55
	Bu Gia Map	160
	Bu Huong	50
	Chu Yang Sinh	200
	Dao Phu Quoc	50
	Kon Kai Kinh	280

Kong Cha Rang	160
Lo Go Sa Mat	100
Mom Ray	450
Muong Cha	1820
Nam Dun	180
Nam Lung	200
Ngoc Linh	200
Nui Ba	60
Nui Dai Binh	50
Nui Hoang Lien	50
Nui Pia Hoac	100
Nui Yen Tu	50
Sop Cop	50
Suoi Trai	190
Tay Bai Cat Tien	100
Thanh Thuy	70
Thuong Da Nhim	70
Vu Quang	160
Xuan Nha	600
Yok Don	575
Total:	6202

Source: Collins, 1991.

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