The Political Ecology of Conservation amidst Violent Conflict

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List of Acronyms

ADF	Forces Démocratiques Alliées, Allied Democratic Forces
CBD	Convention on Biological Diversity
CNDP	Congrès National pour la Défense du Peuple, National Congress for the Defense of the People
DRC	Democratic Republic of the Congo
EC	European Commission
FARDC	Forces Armées de la République Démocratique du Congo, Armed Forces of the Democratic Republic of the Congo
FDLR	Forces Démocratiques de Libération du Rwanda, Democratic Liberation Forces of Rwanda
GDP	Gross Domestic Product
ICCN	Institut Congolais pour la Conservation de la Nature (Eng. Congolese Institute for Nature Conservation)
ISIS/IS	Islamic State
IUCN	International Union for Conservation of Nature
KST	Kivu Security Tracker
M23	Mouvement du 23-Mars, March 23 Movement
MONUSCO	Mission de l'Organisation des Nations Unies pour la Stabilisation en République Démocratique du Congo, United Nations Organization Stabilization Mission in the Democratic Republic of the Congo
NGO	Non-governmental organization
NP	National Park
NYU	New York University
OSESG	Office of the Special Envoy for the Great Lakes
PPP	Public-Private Partnership
UCDP	Uppsala Conflict Data Programme
UK	United Kingdom
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNHCR	United Nations High Commissioner for Refugees
UNSC	United Nations Security Council
WB	The World Bank
WCMC	World Conservation Monitoring Centre
WDPA	World Database for Protected Areas

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Abstract

Nature conservation can often be contested and it is even more so in the settings of ongoing violent conflicts. While studies have long recognized the importance of conservation areas as key drivers of conflicts and transformation in rural livelihoods, evidence on the dynamics, nature and extent of their linkages, especially in the context of recent increased interest in neoliberal conservation involving varied actors in the era of climate change, remains limited. The purpose of this thesis is to introduce a quantitative perspective on this topic and better understand the dynamics and linkages between conservation and conflict. Conflict and conservation data are collected and analyzed in order to identify conflict-affected conservation hotspots, possible patterns and specific indicators that might explain the different violence levels found in affected protected areas, specifically National Parks. The study shows that there are conservation areas that suffer from ongoing violent conflicts which however have no direct connection to the fact that the territory is designated as a protected area. Due to the impacts of armed conflict on nature, neoliberal conservation measures are nowadays often implemented to counter the damages but run the risk of further increasing or even starting new conflicts. As it is not yet possible to identify exact causes for each individual violent conflict within National Park territory from the currently available data, the need for qualitative research was deemed necessary, and as a result, the case of the Virunga National Park has been explored based on a review of literature to illustrate and nuance the dynamics and insights captured from analyzing existing databases on National Parks and conflicts.

Relevance to Development Studies

Although conflicts over natural resources and environmental issues have extensively been studied from a political ecology approach, an increased engagement of political ecology with the field of peace and conflict studies could provide opportunities for a more nuanced understanding and analysis of such conflicts. As a contribution to the existing but slowly growing number of research projects that combine political ecology and conflict studies, this research project applies a mixed approach to combine both fields and analyze and discuss the contemporary dynamics of violent conflicts in and around National Parks. Environmental issues and violent conflicts play a big role in the development field, as both often occur in less developed countries and hinder positive developments in affected regions. In addition, conservation/protected areas, like National Parks, are proven to play an important role in trying to manage our global climate crisis, meaning that the predominantly destructive effects of violent conflicts on such areas negatively impact not only these regions but the entire world. Research on these two fields, especially in a combined way, is therefore of high relevance to the development context worldwide. The insights of this study could be important inputs for policy making and practice around National Parks and other protected areas that are affected by violent conflicts.

Including a small "case study" on the Virunga National Park will show how a protected area, which should be a source of well-being, natural biodiversity and wealth for its people, animals and the global community, can be affected by violent conflicts.

Keywords

National Park, Conservation, Violent Conflict, Protected Areas, Classification Model, Virunga National Park, Political Ecology, Conflict Studies

Chapter 1
Introduction

Conservation areas can be found worldwide in many different forms, from reserves, forests, and various types of parks (e.g., National Parks (NP), State Parks, Natural Parks, etc.), to Wildlife Habitats or even World Heritage Sites (Protected Planet 2021). As defined by Dudley (2008: 8) for the International Union for Conservation of Nature (IUCN), a protected area is: "A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values". Although nature conservation is not a new phenomenon, there is an increase in recent years in the intensity and variety of forms of conservation and the diversity of actors involved (Arsel & Büscher 2012). This is mainly associated with the increasing threats of environmental and climate change and biodiversity loss. As a result, protected areas of various kinds and different scales have proliferated across the world and have become increasingly important, especially as a mitigation measure against the changing natural environments and our climate (Atiqul Haq 2016: 2-3; Alemu 2015; CBD 2006: 1-7). Apart from conserving and protecting natural environments, conservation areas can create additional benefits such as "regional economic development, rational use of resources, generating income and creating jobs, research and monitoring, conservation education and, recreation and tourism" (Atiqul Haq 2016: 1). However, such conservation measures, which are often top-down implementations, can also be opposed, especially by people who are in close proximity to the protected areas and usually depend on forest resources for their livelihoods (e.g., wood, hunting grounds, natural medicine, etc.) (Alemu 2015: 2).

Nature conservation has become even more contested in the light of "the current alliances between capitalism and conservation", which are "characterized by an aggressive faith in market solutions to environmental problems" (Brockington & Duffy 2010: 470). These alliances are "actively remaking economies, landscapes, livelihoods and conservation policy and practice" (Brockington & Duffy 2010: 470) across the globe, particularly in the developing world. The imagery, rhetoric, policies and practices of neoliberal conservation focus on how capitalism can help conserve biodiversity and address climate change while expanding the conditions under which capitalist production and accumulation can continue unabated (see Arsel & Büscher 2012; Kelly 2011; Brockington & Duffy 2010). The creation/demarcation and maintenance of protected areas and other conservation territories have, in many instances, involved violent acts of enclosure and dispossession of land and natural resources, often changing and reshaping economic, social, and environmental relations (see Kelly 2011; Neumann 2004; Peters 2004; Peluso & Watts 2001; Peluso 1993; Moore 1993).

Arguably, the most known types of protected areas are National Parks. The first National Park, the Yellowstone National Park in the United States, was created in 1872, and since then, many more have been established globally (Protected Planet 2021). The overall objective of National Parks is "To protect natural biodiversity along with its underlying ecological structure and supporting environmental processes, and to promote education and recreation" (Dudley 2008: 16). Therefore, the successful management and upkeep of National Parks have multiple advantages, whether they are environmental, economic, educational, or health-related. Through the great varieties and amount of fauna and flora in National Parks, these protected areas can "considerably reduce emissions at a low cost and with potential co-benefits for adaptation and sustainable development" (Atiqul Haq 2016: 5).

However, these objectives and presumed benefits do not always occur in many National Parks. These kinds of protected areas in developing countries are often more likely to be

affected by violent conflicts in general, as conflicts over (natural) resources are more common (Mukherjee 2009: 54). Furthermore, protected areas are known to be used by armed rebel or terrorist groups as hiding ground due to the naturally more protected environment or as base camp from which they operate and collect resources in order to finance their activities (see Butsic et al. 2015: 267-268; Hanson et al. 2009: 586). (Eco)tourism in National Parks is often halted because of the dangerousness for visitors and park staff who have to be evacuated, stopping their environmental protection efforts temporarily or completely because of violent clashes with such groups or individuals (Hanson 2018: 53). On the other hand, new conflicts can arise in and around National Parks, for example, over natural resources associated with green grabs or over the hunting/poaching of endangered species within Park territory. It is worth emphasizing that armed conflicts are generally prevalent in biodiversity hotspots. In this regard, "between 1950 and 2000, over 90% of major armed conflicts took place within countries containing biodiversity hotspots, and more than 80% included fighting directly within hotspot areas" (Hanson 2018: 51).

Whether in the form of National Parks or any other type, protected areas are incredibly important, not only for general biodiversity conservation but also for the sake of our climate and human well-being and survival. However, violent conflicts exist and arise in exactly these areas, which are supposed to be peaceful environments on which societies depend on in various ways. While nature conservation can often be contested, it is even so in the settings of ongoing violent conflicts. Although studies have long recognized the importance of conservation enclosures as key drivers of conflicts and transformation in rural livelihoods, evidence on the dynamics, nature and extent of their linkages, especially in the context of recent increased interest in neoliberal conservation involving varied actors in the era of climate change, remains limited. More particularly, very few studies have insofar explicitly examined the dynamics of conservation in contexts where protected areas are embedded in ongoing violent conflicts. This study, therefore, aims to contribute to the understanding of the dynamics and linkage between conservation and conflicts, especially in settings where National Parks are embedded in violent conflicts.

This thesis is structured as follows: After stating the research objectives and questions, relevant existing literature on the political ecology and conflict studies fields are provided. The currently available research conducted on how and why conflict and conservation are increasingly intertwined will be presented. Chapter 3 presents the methodologies used for the filtering and classification analysis as well as the overview and justification of the utilized data. Next, in Chapter 4, the results of the analyses are reported and discussed. Chapter 5 focuses on one specific case identified through the analyses and discusses the Virunga National Park as an example of a National Park affected by violent conflict. Finally, the conclusion Chapter 6 summarizes and synthesizes the key findings and provides answers to the research questions, outlines the limitations of this study, and presents ideas for further research.

1.1 Research Objectives and Questions

The main objective of this research is to introduce a quantitative perspective on this particular field and understand the dynamics and linkage between conservation and conflict, especially in contexts where National Parks are embedded in violent conflicts. It specifically aims:

- To investigate whether, how and to what extent violent conflicts are directly related to conservation, particularly National Parks.
- To examine the factors and actors that influence and shape conflict dynamics in and around National Parks.

- To identify patterns and similarities amongst National Parks affected by violent conflict.

The general research question that this study seeks to answer is: How and to what extent are conservation and conflicts linked and why?

The research more specifically addresses the following sub-questions:

- How and in what ways are National Parks linked to violent conflicts and what are the factors that shape these linkages?
- Why do certain National Parks experience more violence than others?
- What are the patterns and similarities in the conflict dynamics and indicators for the occurrence of violent conflicts in National Parks?

Chapter 2
Theoretical Framework and Literature Review

2.1 Political Ecology and Conflict Studies

Taking political ecology as the central analytical framework, this study combines conceptual discussions in conflict studies for an interdisciplinary analysis of the dynamics of conservation in settings where National Parks are connected to violent conflicts. Political ecology focuses on resource distribution and access questions and how economic, social, historical, and political factors influence relations around environmental resources and conflicts over the use and control of resources (see Watts & Peet 2004; Robbins 2004; Moore 1993). In analyzing environmental resource conflicts, political ecology emphasizes the "constantly shifting dialectic between society and land-based resources and also within classes and groups within society" (Blaikie & Brookfield 1987: 17). It illuminates how uneven power relations shape the control, use and conflict over resources and the environment, as well as how such power relations shape discourses and practices of environmental governance. Furthermore, it also highlights the importance of understanding how broader processes shape the interaction of various actors with the environment and how local-level/place-based processes, in turn, influence broader discourses and practices (see Moore 1993; Blaikie & Brookfield 1987). Political ecology underscores how National Parks and protected areas and other conservation landscapes are often materially and symbolically contested (Moore 1993). It has increasingly become a critical field that addresses questions around the construction of knowledge about nature, the neoliberalization of nature, climate change politics and narratives, the changing nature of conservation, environmental resource conflict, livelihoods, dispossession, green grabbing, accumulation, etc., within the contemporary dynamics of global capitalist development (see Adams 2017; Cavanagh & Benjaminsen 2017; Fairhead et al. 2012; Arsel & Büscher 2012; Kelly 2011; McCarthy & Prudham 2004; Watts & Peet 2004).

As defined by Robbins (2004: 14), "environmental conflict" is one of the five major areas of political ecology "along with degradation and marginalization; conservation and control; environmental identity; and social movements; most of which also include conflictual dimensions" (Le Billon & Duffy 2018: 240). In general, as Le Billon & Duffy (2018) argued, political ecology has not yet extensively been brought into connection with conflict and peace studies, two fields that are certainly intertwined and are becoming more and more relevant. Especially the threat of climate change and environmental/resource conflicts are increasingly studied, however, mainly from the conflict studies perspective (Le Billon & Duffy 2018: 243). More research on environmental conflicts from the political ecology perspective could provide new and very relevant insight for both sides, as "Conflicts can shed light on the divergent interests, powers, and vulnerabilities of different social groups" (Turner 2004: 864). Although both perspectives can be critiqued for their approaches to conduct research on environmental conflict, both have made significant and relevant contributions, whether they are comparative, statistical analyses, or field-based and historical-grounded studies of "structural and social dimensions of uneven power relations" (Le Billon & Duffy 2018: 242-243).

Similar to the political ecology approach, conflict and peace studies also focus on several factors that can cause violent conflict. Although international/world wars have decreased in the last few decades, the number of civil wars and smaller violent conflicts have increased, and there is a consensus in the conflict field that the frequency and intensity of those conflicts are related to environmental or resources issues (Collier et al. 2003: 98). Therefore, the need to properly understand "the details, mechanisms, and nature of conflict" in order to find effective solutions is higher than ever before (Mekonen 2020: 2). One quantitative analysis

conducted by Collier-Hoeffler finds that predominantly economic factors, specifically "the level, growth and structure of income", are attributed to cause conflict as they tend to change more rapidly than other factors such as political management, social characteristics (e.g., religious or ethnic compositions) or the historical background of a country (Collier & Hoeffler 2002: 436; Collier et al. 2003: 98). According to Mack et al., a country "with no economic growth, […] has a 42% risk returning to conflicts within 10 years. With a 10% growth rate the risk declines to just 29%" (2008: 2). These results are supported by many others within the conflict field; however, it is increasingly pointed out that other and especially environmentally relevant factors should not be disregarded when explaining the causes of violent conflicts (Murshed 2014: 70; Cramer 2003: 409; Gleditsch 2015: 88). Although these conflict analyses are focused on the country level and not specific to conservation areas, it is assumed that the results for a more focused study may not be different. This connection seems to have only been made from a more qualitatively perspective, even in the conflict studies field.

2.2 Conservation (National Parks) and Conflicts

An overarching concept that emerged from studies on environmental conflicts is "green militarization", which is defined as "the use of military and paramilitary (military-like) actors, techniques, technologies, and partnerships in the pursuit of conservation" (Lunstrum 2014: 817). It is one explanation for conflicts in and around protected areas, such as National Parks, and relates to the concepts of "green violence", "green wars", and "green security" (see Büscher & Fletcher 2018; Büscher & Ramutsindela 2016; Dutta 2020; Lunstrum 2014; Marijnen 2017; Marijnen 2018; Verweijen 2020). The involvement of (para-)military in conservation can already be observed in the creation of many protected areas, especially in previously colonized countries, and in the general up-keep/management of such conservation areas (Dutta 2020: 3). Nevertheless, and contrary to these "positive" responsibilities of military forces, Lunstrum points out that "profound ecological destruction" has been caused by military activities, such as militarized conflicts and wars (2014: 818).

Today there are additional reasons for military involvement in conservation activities, for example, to "mitigate deforestation, slow biodiversity loss, provide ecosystem services and restrict terrorist access to valuable resources and nation-state borders" (Kelly & Ybarra 2016: 171). Currently, one major issue that calls for the use of militarized forces in protected areas are "wildlife crimes including trading in animal parts and/or organs, poaching and hunting, especially in the global south" which are mainly driven by insurgent or terrorist groups (Dutta 2020: 4). A lot of academic literature surrounding environmental conflicts builds on the issue of endangered species (e.g., rhinos, gorillas) being hunted and killed (see Büscher & Ramutsindela 2016; Glew & Hudson 2007; Hanson 2018; Lunstrum 2014; Titeca et al. 2020). Another critical issue is land-grabs, specifically "green-grabs" which have either diminished the environment for important flora and fauna or extended the boundaries of protected areas, leading to "violent dynamics of dispossession and removal" of people who were expelled from their homes and livelihoods without proper compensations, increasing the chances of violent conflict between the grabbers and the dispossessed (Ojeda 2012: 358; see also Büscher & Fletcher 2015; Dunlap & Fairhead 2014; Fairhead et al. 2012; Kelly 2011; Ojeda 2012). Apart from land as a resource issue leading to conflicts in or around conservation areas, other resources such as oil, wood or mineral resources which are often abundantly found within the territories of protected areas cause violent clashes especially when they are illegally extracted (see Butsic et al. 2015; Dunlap & Fairhead 2014; Hanson 2018; Marijnen 2018). Such illegal extractions are frequently conducted by rebel groups who use the profits of those resources to finance their activities, thereby creating and exacerbating conflict (Glew & Hudson 2007: 145). Since it is generally implied that protected areas are in more rural

landscapes worldwide, the chances of different ethnic groups surrounding such areas is quite high and conflicts nowadays also arise because of clashes between ethnic groups (Dutta 2020: 2). Furthermore, protected areas are also often found close to borders and are generally assumed to be more peaceful and resourceful, which is why refugee settlements are often established close to conservation areas (Titeca et al. 2020: 3). In such instances, the differences, rivalries, and contestations between and among different groups, for instance, between refugees or internally displaced people and local host communities, can lead to conflicts that often impact the surrounding conservation areas. Our increasingly changing climate are additionally fueled by the above-mentioned extractivist behavior and the continuous biodiversity loss within protected areas. In this case, nature is fighting back with, for example, extreme rainfalls and consequential floods as well as higher temperatures and wildfires. This could lead to conflicts between affected populations, due to the possible destruction of their livelihoods and loss of human lives. However, so far there is little research on this climate change-conflict relation as most recorded natural disasters have not yet been reported as cause for the outbreak of conflicts.

As mentioned above, further causes and conflicts completely unrelated to the environment are not to be ruled out for conflicts specifically in and around protected areas, including, for example, the governance structures of the country in which the protected area is located (Marijnen 2018). According to Bannon & Collier (2003: 2), economic factors such as poverty levels, unemployment and income rates are also good indicators for analyzing the likelihood of environmental conflicts as they are closely connected to the need for natural resources, which can be conflict-starters. Lastly, the literature consulted so far has implied that conservation areas in connection to conflicts are often found in previously colonialized countries (e.g., Virunga NP in DRC, Manas NP in Northeast India, Tayrona NP in Colombia, etc.), and in some cases, the still existing external influences on the (financial) management of such conservation areas could be connected to the ongoing conflicts in these protected areas (see Dutta 2020; Marijnen 2017; Marijnen 2018; Ojeda 2012).

The following chapter elaborates the methodology and the source and type of data needed to answer the research questions of the study.

Chapter 3
Methodology and Data

3.1 Data Filtering and Classification Model

This thesis analyses the connection between National Parks and violent conflicts, trying to understand in which countries and National Parks violent conflicts occurred and if it is possible to determine through the data why such conflicts arise in National Park territory. Although the number of studies drawing from Political Ecology and Conflict Studies is growing, there is no quantitative-based research on conservation and violent conflict, to the best of the author's knowledge.

Therefore, the first part of the analysis is based on data from the World Database for Protected Areas (WDPA) and the Uppsala Conflict Data Program (UCDP) and additional relevant data, mainly from the World Bank database. Using the statistical software program "R" (see Appendix A) and "Excel" the following steps were followed to conduct a quantitative analysis:

1. Starting with the World Database for Protected Areas (WDPA), all protected areas were filtered out to identify only National Parks, determining exactly how many parks are currently registered and in which countries.
2. Based on those countries, data on violent conflicts was collected from the Uppsala Conflict Data Programme (UCDP). The National Park database was then connected with the conflict database, separating those countries with National Parks with reported violent conflict from those without.
3. The remaining sample was further filtered through map-matching the park territories with the locations of reported violent conflict in order to identify whether they occurred within or in close proximity to the National Park area or not.
4. The final outcome shows three groups ranked according to whether there was violent conflict within the National Park territory (Rank A), no conflict even close to a National Park (Rank B) or National Parks where it was impossible to exactly place violent conflicts, meaning they were very close to National Park territory but not clearly identifiable within the territory (Rank C).
5. Based on the results of the filtering process, relevant descriptive statistics were identified to determine why violent conflicts arise in the National Parks within the Rank A sample.
6. Lastly, through a classification model conducted with the help of possibly relevant exogenous variables, the violence levels of the National Parks under Rank A are classified, and a prediction for possible changes in the violence intensity is made.

The second part of the analysis is based on one specific affected protected area, the Virunga National Park located in the Democratic Republic of Congo. It intends to explain the relationship between National Parks and violent conflicts in more detail, applying the main findings of the quantitative first part of the thesis, supported by existing academic literature as well as news reports and governmental and non-governmental reports. The case aims to further discuss the tested factors that possibly influence the different violence levels in more detail, to show how and why violent conflicts can be linked to National Parks based on a concrete example.

3.2 National Park Data

The most comprehensive and currently publicly available database listing all protected areas in the world is the "World Database for Protected Areas" (WDPA) available on the Protected Planet website (Protected Planet 2021). The database is "a joint project of United Nations Environment Programme (UNEP) and the International Union for Conservation of Nature (IUCN)", providing details gathered by governmental and non-governmental organizations on marine and terrestrial protected areas worldwide (UNEP-WCMC 2019). Separated into seven world regions (Asia & Pacific, Africa, Europe, Latin America & Caribbean, Polar, North America and West Asia), csv-files with all different types of protected areas registered at the time are available for download on the Protected Planet website (for this research project the data from July 2021 was used). One important indicator for these differentiations comes from the IUCN_CAT variable which indicates the IUCN Management Category ranging from I to VI or Not Applicable/Not Reported.

Many of the protected areas are listed more than once, depending on their exact area (GIS_AREA), name (NAME) or designation (DESIG_ENG), etc. Although, it might be possible to accurately filter all these duplicates, priority was placed only on protected areas that are considered as "National Parks", considering the limited scope of this research project. The variables IUCN_CAT and DESIG_ENG were used to accurately filter out only National Parks. The official IUCN Management Category for National Parks is Category II and defines this specific type of a protected area as

> "Large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities." (Dudley 2008: 16).

However, some National Parks are neither listed under Category II or any other category in the WDPA database. To get a more accurate sample of all National Parks worldwide, the results of filtering according to the designation variable (DESIG_ENG) for "National Park" which provides the official "designation of a protected area or OCEM" in English were included as well (UNEP-WCMC 2019). Aside from the designation variables, the WDPA also provides information on the size of each protected area as well as the ISO3 country codes.

3.3 Data on Violent Conflicts

Among the different conflict databases that could have been chosen for this research project, the Uppsala Conflict Data Programme (UCDP) is recognized as the "World's main provider of data on organized violence" with its continued collection of reported conflicts dating back to 1989. The UCDP is the most-used conflict database in the field of Conflict Studies and therefore offers an excellent bridge to the field of Political Ecology/Conservation. Its definition for armed conflict provides the "global standard of how conflicts are systematically defined and studied", which further underlines the superiority of this database to others in the conflict field (UCDP 2021). Having established what constitutes a National Park, clarification of what exactly is "violent conflict" is needed. Working with the UCDP definitions, armed/violent conflict is defined as

> "A state-based armed conflict is a contested incompatibility that concerns government and/or territory where the use of armed force between two parties, of which at least one

is the government of a state, results in at least 25 battle-related deaths in one calendar year." (UCDP 2021a).

In addition to the armed conflict data, which is also referred to as "state-based conflict", non-state violence and one-sided violence recordings are included in the data collection to ensure that as many reported violent conflicts and therefore deaths are included in the analysis. Non-state violence is defined as conflict between two organized, non-governmental groups with at least 25 battle-related deaths in one year whereas one-sided violence constitutes conflicts between either a government or organized group against civilians with at least 25 battle-related deaths in one year (UCDP 2021a). Working primarily with the UCDP, this research project is limited to the available conflict types, which means that smaller violent conflicts that occurred in National Parks in the last 10 years are excluded in this sample, as data on such smaller conflicts is not available in an organized setting. All reported violent conflicts and deaths in each country between 2011-2021 were accounted for. This specific timespan was chosen to reflect a relatively up-to-date sample but also include possibly significant conflicts in the recent past. Furthermore, the focus on and importance of National Parks has increased a lot more in the last ten years due to climate change mitigation imperatives which have been accelerating neoliberal conservation initiatives.

In the manual method of violence-related death data collection, a 0 ranking would be allocated for every country that had no reported deaths and a 1 for one or more deaths in a country in the selected timeframe. In addition to the type of violence causing deaths for each conflict, the UCDP also provides information on the actors involved in the conflict (Side A vs. Side B), the date(s) of the conflict and a more concrete location of the conflict.

3.4 Additional Data

In order to collect further descriptive statistics and conduct a classification model to be able to classify the violence level in the different National Parks and predict possible changes, mainly data from the World Bank was utilized. The World Bank database provides statistical information either on country-level or according to specific indicators, ranging from Agriculture & Rural Development, Climate Change, Education or the Financial Sector to Gender or Poverty statistics and many more indicators, especially tailored to development research (World Bank 2021). The available data stems directly from reports from the 189 Member States to the World Bank Group (World Bank 2021a). Due to missing values for the available World Bank corruption indicator (CPIA), the Corruption Perceptions Index provided by Transparency International is used (Transparency International 2021). An additional variable (TNPAGL) was created through the available information given by the WDPA and World Bank data: for every country with a National Park, the total size of each park was combined and divided by the total land area, to show the percentage of land that is covered by National Park territory.

Taking into consideration the literature review of different qualitative studies on conservation-conflict issues, the availability of data as well as overlapping indicators, Table 1 lists the seven variables chosen for the main analysis. Economic, political, social and environmental indicators are possible conflict starters, which is why from each level indicators were included.

Table 1.
Description of the key variables for analysis

Abbreviation	Variable Name	Year	Source
GDPC	GDP per capita, PPP (current international $)	2019	World Bank (2021)
UNEM	Unemployment, total (% of total labor force) (modeled ILO estimate)	2020	World Bank (2021)
MAST	Mammal species, threatened	2018	World Bank (2021)
RPOP	Rural Population (% of total Population)	2020	World Bank (2021)
FUEL	Fuel Exports (% of merchandise exports)	2018	World Bank (2021)
CPIR	Corruption Perceptions Index 2020: Rank	2020	Transparency International (2021)
TNPAGL	Total National Park Area (GIS_AREA) to Land Area (km^2)	2021	Protected Planet (2021), World Bank (2021)

Source: World Bank (2021), Transparency International (2021), Protected Planet (2021), Data collated by the Author (Carla Henzler).

Conflicts often arise over economic and poverty issues. For example, low GDP per capita rates can raise tensions and lead to violent conflicts, for instance over basic resources such as food or water, shelter, health and safety which are less accessible without sufficient financial stability. Similarly, an increasing unemployment rate can lead to comparable conflicts over resources and might even encourage people to turn to more illegal and violent work out of desperation (Murshed 2014: 74; Collier & Hoeffler 2002: 436). Therefore, these indicators were chosen to represent the economic level.

On the political level, low and/or decreasing corruption rankings for a country indicate more injustice and less (political) stability which at a certain level is often met with resistance that can turn into violent conflict involving those who explicitly suffer from those injustices (Murshed 2014: 73; Bannon & Collier 2003: 6).

From a social perspective and assuming that most National Parks are located in rather rural areas, the higher the percentage of the rural population the higher the chances for those people to be affected by the National Park and vice versa (Gleditsch 2015: 82-83; Cramer & Richards 2011: 294). This can of course be positive, for example through tourism or park-related jobs which bring more income opportunities. However, there are equally negative consequences for surrounding populations that might lead to violent conflicts, such as the dispossession of their farm- or even homeland, increasing restrictions on hunting and gathering practices threatening the stability of livelihoods, the disruption of traditional lifestyles by tourists and other intruders or through the general exclusion of local communities from the benefits of the National Park. If on top of that the percentage the of the rural population increases, the more likely it is for violent conflicts to break out as many of the negative consequences intensify either between the locals themselves or between the locals and the park.

The number of threatened mammal species and the total National Park area as a percentage of the total land area are indicators from the environmental level. Threatened species, especially mammals, are often found in National Parks, as protected areas serve as their last sanctuary. The more species are threatened, the higher their value rises, for example on the black market. Professional and amateur poaching of those endangered species proliferate, and mammals specifically are often also seen as trophies and therefore even more popular to hunt. As many others have previously confirmed, a major source for violent conflicts in National Parks are certainly clashes between park rangers or anti-poaching units and poachers, as both sides are often heavily armed (Dutta 2020: 4; Duffy 2014: 828). The percentage of the National Park area to the total land area gives a good indication of how much land in

a country is protected, therefore not easily accessible for local populations. This restriction can lead to violent conflicts. If there is less space for people to settle and work on the relations to the protected area can become conflictual (Gleditsch 2015: 83).

Lastly, the fuel export indictor can give indications for the economic, political and environmental level. Fuel, in form of oil resources is nowadays often found in National Park territory and is possibly the most violently fought over resource in the past, whether or not it is legal to extract it. If there are more oil exports, that means there are oil resources to be found in that country as well as a higher possibility for violent conflicts, in relation to this so-called black gold. In most cases it is therefore not only an environmentally connected indicator but also a political one. The environmental destruction that comes with the oil extraction is either politically accepted or even supported due to the economic profits that can be gained (Murshed 2014: 75; Ross 2004: 352).

3.5 Limitations and Risks

Given the predominantly quantitative nature of this research project, there are some limitations involving the collection of adequate data for certain countries and the variables indented to use for the analyses. Some datasets might only have limited/incomplete information on selected variables, others might not have certain variables at all. Most data will also be country-based, whereas data specific to the regions of the National Parks-conflicts in question would be more accurate for the analysis and increase the validity and reliability of the findings. Although, the variable selection is based on previous literature on conflict and conservation issues and should therefore include the most relevant indicators for assessment, the analysis could of course miss significant indicators that have not been discussed anywhere. The map-matching process also runs the risk of not being completely accurate due to possible differences in the maps or difficult identification of the exact conflict locations. Furthermore, this research project is limited to only a discussion and analysis of violent conflict as defined by the UCDP and related to the conservation type of National Parks, whereas the many other protected area designations as well as violent conflicts that do not fall under the definitions of the UCDP will be excluded due to the scope of this research project.

Regarding the qualitative part of the research project, the research project was conducted during the COVID-19 pandemic, in which primary data collection through fieldwork was highly restricted. Additionally, fieldwork for the chosen case-study region is very dangerous and difficult to access. Using online data and working with existing literature and other already existing sources was therefore the most logical and accessible way to pursue this research project. A possible risk might be that some of the available and used sources might not be up to date anymore.

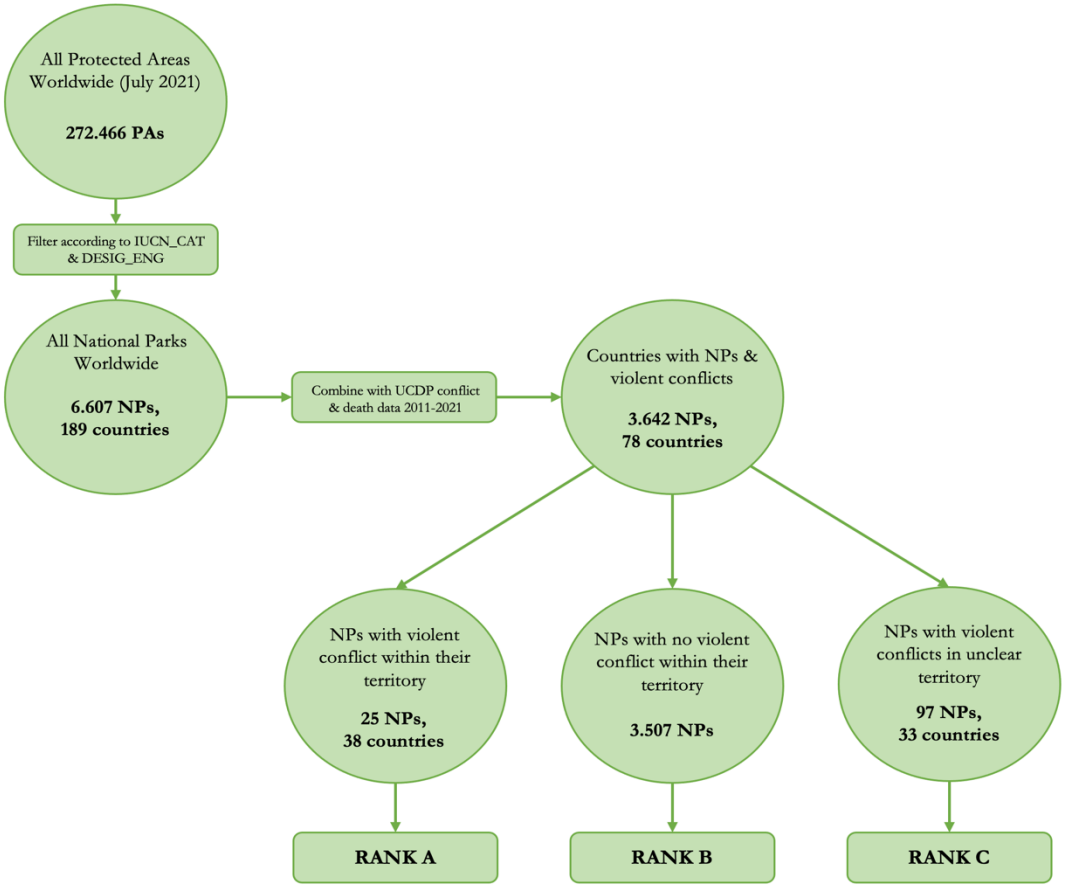
Chapter 4
Analysis and Discussion

4.1 Descriptive Statistics of the Filtering Process

Collecting and sorting through the WDPA data, a total of 272.466 protected areas worldwide were registered as of July 2021. After filtering according to the IUCN_CAT and DESIG_ENG variable, 6.607 National Parks were identified across 189 countries. The number of violent deaths between 2011-2021 for each of the 189 countries was collected from the UCDP, followed by the elimination of all countries that had either no reported deaths in the past ten years or were not available in the UCDP (predominantly small island states). The sample was narrowed to 78 countries which had one or more deaths reported between 2011-2021 and left a total of 3.642 registered National Parks to check.

All 3.642 National Parks were listed for each of the 78 countries and ranked according to a map-matching procedure (Figure 1). The WDPA/Protected Planet website provides a map feature for each protected area that shows the location of the protected area/National Park territory, while the UCDP website provides a map feature for every country with pop-up fields at the locations were violent conflicts were reported offering information on each case (see Appendix B & C).

Figure 1.
Simplified chart of the filtering process results and National Park Rankings



Source: Author's own computations based on databases.

Through these tools each of the 3.642 National Park territories were as accurately matched to the UCDP conflict locations as possible to identify those violent conflicts that occurred within or close to National Park territory. A total of 38 National Parks were ranked with an A, as it was clear that one or more violent conflicts had occurred within the National Park territory. Table 2 provides an overview of the number of deaths (high estimates and normal estimates) as well as the total number of deaths in the respective countries for the chosen timeframe. The following link provides an interactive map, created by the author, which displays the National Parks under Rank A with their respective information: http://rpubs.com/cmh_96/NPMap.

Table 2.
National Parks affected by violent conflicts

Country	National Park	Deaths (High Estimate)	Deaths (Normal Estimate)	Total Deaths
Afghanistan	Nuristan	480	442	163134
Armenia	Sevan	2	2	43
Azerbaijan	Zangazur	6	6	7991
Burundi	Kibira	1	1	808
Benin	Boucle de la Pendjari	1	1	1
Cote d'Ivoire	Taï National Park	21	21	1333
Cameroon	Mont Cameroun	5	5	5862
Cameroon	Ndongere	10	10	
DRC	Garamba	16	16	24496
DRC	Kundelungu	65	65	
DRC	Virunga	1108	1091	
DRC	Okapis	10	10	
Colombia	Serrania de Chiribiquete	12	12	1550
Colombia	Catatumbo Bari	5	5	
Colombia	El Cocuy	13	13	
Colombia	Tinigua	1	1	
Algeria	Chréa	7	7	1227
Ethiopia	Arsi Mountains	4	4	6766
Ethiopia	Halledeghe Asobot	44	38	
Indonesia	Lorentz	62	56	117
Iran	Bamou	8	8	853
Kenya	Buffalo Springs	21	21	2313
Kenya	Shimba Hills	1	1	
Kenya	South Turkana	7	7	
Cambodia	Southern Kravanh	1	1	11
Mexico	El Tepozteco	2	2	48524
Mexico	Cañón del Río Blanco	50	50	
Myanmar	Hkakaborazi National Park	4	2	6588
Mozambique	Quirimbas	491	449	2514
Philippines	Manila Bay Beach Resort National Park	1	1	5873
Philippines	Mt. Dajo National Park	22	22	
Philippines	Northern Negros Natural Park	7	7	
Russia	Priel`brus`e	7	7	1776
South Sudan	Boma	150	150	12655
Thailand	Bang Lang	14	14	1243
Tunisia	Chambi	52	46	313

Uganda	Semuliki	7	7	41
Venezuela	Waraira Repano	1	1	33

Source: Author's computation using data from Protected Planet (2021), UCDP (2021).

More detailed information on the conflicts within the 38 parks which spread across 25 countries and include different types of violence, state and non-state actors as well as the different years violent conflict occurred in the National Park territory are given in the annex (see Appendix D). Nevertheless, the majority of 3.507 National Parks were ranked with a B, indicating that there were no violent conflicts reported in or close to the protected areas. 97 National Parks across 33 countries were ranked with a C, indicating that it was either impossibly difficult to determine whether a conflict had occurred in park territory, or it was very close to its borders.

At this point, a first descriptive analysis could be made, namely that the majority of affected National Parks are located in poorer, more rural and politically unstable countries. Observing the mean of each key variable during each filtering step, the GDP per capita rate decreases, while the number of threatened mammal species as well as the percentage of the rural population, the fuel exports and the corruption rankings increase. These developments are as expected the closer the sample gets to the most relevant cases for this study (Table 3). Only the unemployment variable shows unexpected values, as the mean rate decreases even though it was expected for the rate to increase as explained in section 3.4.

Table 3.
Development of key variables throughout the filtering process

		GDPC	UNEM	MAST	RPOP	FUEL	CPIR
158 (189) countries[1]	Mean	20521.2	8.093	18.97	40.86	16.066	91.16
78 countries	Mean	14695.9	7.588	27.44	44.58	19.840	111.97
25 countries	Mean	9067.3	6.543	37.4	50.00	20.79787	127

Source: Author's computation using data from World Bank (2021), Transparency International (2021), Protected Planet (2021).

Focusing on the affected National Parks and countries under Rank A only, ten of the 25 countries are on the least developed countries list according to the UN: Afghanistan, Burundi, Benin, DRC, Ethiopia, Cambodia, Myanmar, Mozambique, South Sudan, Uganda (UN 2021). Apart from Russia, every country on this list is considered to be located in the so-called "Global South". Fifteen National Parks with reported violent conflicts are located directly at international borders. Only in Burundi, 100% of all deaths reported in the last ten years occurred in a National Park. Most conflicts are state-based (219) with fewer one-sided conflicts (147) and only 33 non-state conflicts. Throughout the chosen timeframe, most of the conflicts were actually reported in 2020 (126), while in 2019 only 59 conflicts were

[1] The original sample included 189 countries; however, a full data set is only available for 158 countries. Information on Aruba; Antigua and Barbuda; Bonaire, Sint Eustatius and Saba; Belize; Bermuda; Cocos Islands; Cook Islands; Curaçao; Christmas Islands; Cayman Islands; Western Sahara; Fiji; Guadeloupe; Greenland; French Guiana; British Indian Ocean Territory; Jersey; St. Kitts and Nevis; New Caledonia; Norfolk Islands; Palau; Réunion; St. Helena, Ascension and Tristan da Cunha; Svalbard and Jan Mayen; Turks and Caicos Islands; Tokelau; Tonga; Taiwan; Virgin Islands, British; Virgin Islands, US; and Samoa are not included in the Table 3 results.

reported and 48 in 2018. Out of the 38 National Parks only seven were directly named as the location of violent conflicts (Kibira NP, Pendjari NP, Garamba NP, Virunga NP, Chrea Mountains, Arsi Zone and Buffalo Springs Game Reserve) while all other conflicts were reported under different location names (e.g., villages or communities, etc.). Out of the 25 countries, 17 have a history of colonialism, while Afghanistan was the only country in the sample that had been occupied by different forces for a longer time period. However, only five National Parks were actually established during colonial times, before the respective countries gained independence (Kibira NP, Garamba NP, Virunga NP, Mt. Dajo NP, Boma NP). According to the WDPA, 20 National Parks are state-owned, while one is under multiple ownership and for 17 National Parks the ownership type is not reported. The responsibility for the park management lies for 29 parks with a "federal or national ministry or agency", one is managed by a "Government-delegated management" and for eight National Parks the style was not reported.

In the following section, the results of the filtering process will be further categorized and analyzed by generating a classification model for the countries where violent conflict was clearly identified within National Park territory (Rank A).

4.2 Classification Model

A noticeable outcome of the filtering process above shows that the number of deaths in the final sample of the 25 countries varies significantly. Therefore, an even deeper analysis of what influences the scale of violence in those National Parks would be interesting.

A so-called Classification Model represents an appropriate tool to further analyze this significant difference and find possible explanations for it. In other words, since the filter procedures above already explained which countries reported deaths in National Parks, the following analysis aims to find how certain exogenous variables lead to and can predict an especially high number of violence/deaths. As a precondition for using the model a two-class-system is introduced. One class of countries with less than 10 deaths over the past ten years (rank 0 or "low violence") and a second class with more than 10 deaths (rank 1 or "high violence"). The utilized model then tests whether the individual set of exogenous variables for each country is able to predict their true individual ranking with a probability of more than 50%. Depending on the results and accuracy of the model it may be used to estimate the probability that a "low violence" country is on the verge to become a "high violence" country and vice versa in further studies.

More technically speaking, classification models can create two types of predictions, a continuous valued prediction or a predicted class (Kuhn & Johnson 2013: 247). The second type was used for this particular modelling and focusses on "discrete prediction", meaning that it creates a definite decision as outcome, which in this case is whether or not there is ("low/high") violent conflict/deaths. The seven variables introduced in section 3.4 (Table 1) are used to run the classification model. In order to work as accurately as possible with the available data, missing values were imputed. Furthermore, logarithmic functions of the dataset were created in order to correct for "skewedness" and minimize outliers. Using the National Park Deaths (High Estimate) indicator as the dependent variable, the two-class system was established through a new discrete variable named "Chaos" which shows the rank of every country with more than 10 reported deaths as rank 1 and all countries with less than 10 deaths as rank 0, as already mentioned above. By running a generalized linear model using the seven exogenous or independent variables the model calculates an endogenous Chaos variable named "ChaosPred" together with a related probability rate which indicates whether a country falls into the rank-1-class ("high violence") or the rank-0-class ("low violence"). In other words, the results categorize each country into the rank-1-class (high violence) if the

estimated probability is higher than 50%. If it is lower than 50% the country will be categorized into rank-0-class (low violence).

In most cases the model predictions (ChaosPred) remain at the same violence level as indicated through the original categorization (Chaos). However, for five countries (Armenia, Myanmar, Uganda, Mozambique and Thailand) the ranking is different to the original. At a first inspection, the model calculates probabilities (ChaosProb) for Uganda and Myanmar significantly high above 50%, which means they are expected to turn from "low violence" into "high violence" countries. For Armenia, the probability rates are slightly above 50%, switching it from a "low violence" to a "high violence" country. Similarly, for Thailand and Mozambique the probability rates are very closely below 50%, predicting a classification switch from a "high violence" level to a "low violence" level. The probability rates for these countries are very close to the threshold and without yet knowing the accuracy rate for the model, should be treated with caution. There is always a possibility for some sort of blur within the model specification which could classify countries in the wrong ranks, especially when the probability rate is very close to the indicated threshold. Thus, there is a need to further evaluate the model accuracy. Table 4 shows the "low violence" countries ranked according to the probability to be considered "high violence" countries and vice versa in Table 5.

Table 4.
"Low violence" countries ranked according to the probability to turn into "high violence" countries

Country	NP Deaths (High Estimate)	Chaos	ChaosProb	ChaosPred
Uganda	7	0	0,878	1
Myanmar	4	0	0,766	1
Armenia	2	0	0,554	1
Venezuela	1	0	0,290	0
Russia	7	0	0,093	0
Benin	1	0	0,039	0
Iran	8	0	0,032	0
Algeria	7	0	0,008	0
Cambodia	1	0	0,006	0
Burundi	1	0	0,005	0
Azerbaijan	6	0	0,002	0

Source: Author's computation using data from Protected Planet (2021), UCDP (2021).

Table 5.
"High violence" countries ranked according to the probability to turn into "low violence" countries

Country	NP Deaths (High Estimate)	Chaos	ChaosProb	ChaosPred
Mozambique	491	1	0,465	0
Thailand	14	1	0,487	0
Tunisia	52	1	0,643	1
Afghanistan	480	1	0,655	1
Mexico	52	1	0,746	1
Philippines	30	1	0,822	1
Cote d'Ivoire	21	1	0,828	1
Kenya	29	1	0,855	1

South Sudan	150	1	0,920	1
Cameroon	15	1	0,953	1
Ethiopia	48	1	0,970	1
DRC	1199	1	0,975	1
Colombia	31	1	0,997	1
Indonesia	62	1	0,999	1

Source: Author's computation using data from Protected Planet (2021), UCDP (2021).

Kuhn & Johnson suggest as the most common evaluation tool, a confusion matrix (2013: 254). Part of this confusion matrix is the cross-tabulation shown in Table 6 through which the so-called sensitivity and specificity of the model can be determined.

Table 6.
Confusion Matrix cross-tabulation results

Cross-Tabulation

	0	1	
0	8	3	← Specificity (0/0 = 8 correct out of 8+13 = 11 => 8/11 = 0,727)
1	2	12	← Sensitivity (1/1 = 12 correct out of 12+2 = 14 => 12/14 = 0,857)

Source: Author's computation.

The sensitivity, or "true positive rate", of a model indicates "the rate that the event of interest [in this particular case Chaos = violent conflict/death(s)] is predicted correctly for all samples having the event" (Kuhn & Johnson 2013: 256). The formula for sensitivity is as follows:

$$Sensitivity = \frac{number\ of\ samples\ with\ the\ event + predicted\ to\ have\ the\ event}{number\ of\ samples\ having\ the\ event}$$

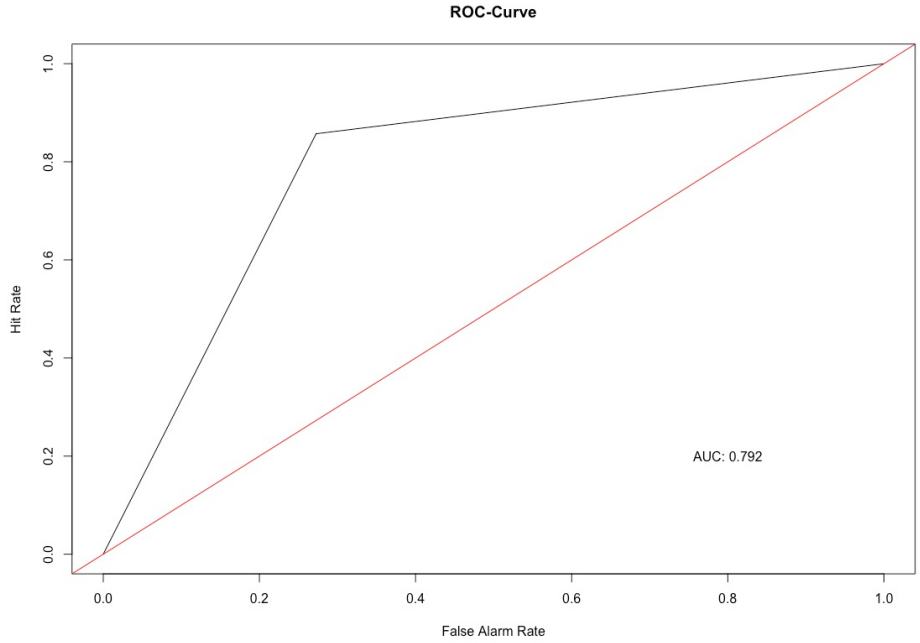
The specificity, or "false positive rate", of a model shows "the rate that non-event samples are predicted as non-events" and is calculated through the following formula:

$$Specificity = \frac{number\ of\ samples\ without\ the\ event + predicted\ as\ non{-}events}{number\ of\ samples\ without\ the\ event}$$

(Kuhn & Johnson 2013: 256). According to the cross-tabulation, the sensitivity of the model lies at 12/14 (0,857) while the specificity lies at 8/11 (0,727). It is possible to tweak both the sensitivity and specificity of a model depending on the chosen variables and thresholds. However, increasing the sensitivity would most likely lead to a loss of specificity of the model. The so-called Receiver Operating Characteristic (ROC) curve is a helpful tool in evaluating this trade-off. The ROC-Curve (Figure 2) determines the most fitting threshold "that appropriately maximizes the trade-off between sensitivity and specificity" by combining sensitivity and specificity into a single value (Kuhn & Johnson 2013: 263). The area under the (ROC-) curve, called "AUC" ranks the predictions according to accuracy (a rounded value is shown in the Confusion Matrix Statistics under Accuracy), ranging from a bad model ranked 0 to a perfectly accurate model ranked 1. Using the ROC-Curve provides the advantage of "insensitivity to disparities in the class proportions" (Kuhn & Johnson 2013: 264). The ROC-Curve

generates an AUC of 0,792 (≈0,8), therefore revealing a relatively good accuracy of the tested model.

Figure 2.
ROC-Curve and AUC result



Source: Author's computation.

Another way to determine the accuracy of a classification model is the Kappa-Statistic which can range between -1 and 1 and is calculated through the following formula:

$$Kappa = \frac{O - E}{1 - E}$$

where O represents the observed accuracy and E the expected accuracy. The closer the result to 1 the higher the concordance of the model predictions and the observed classes (Kuhn & Johnson 2013: 255). Table 7 shows the Kappa score which is set at 0,5902 and therefore shows moderate agreement with the accuracy of the model (Landis & Koch 1977: 165).

The generalized linear model revealed the expected influence of each variable on the dependent Chaos variable. Variables with a negative auspice indicate that more conflict arises when the value of the variable decreases, while the variables with positive auspice indicate more conflict when the value of the variable increases. As the output of the generalized linear model shows, the chosen variables show no real significance to the dependent variable according to their p-value and t-test (Table 8). However, this is due to the small sample size of the rank A countries and does not impact the overall results of the classification model.

Table 7.
Confusion Matrix statistics

Indicator	Results
Accuracy	0,8

95% CI	(0,593, 0,9317)
No Information Rate	0,6
P-Value [Acc > NIR]	0,02936
Kappa	0,5902
Mcnemar's Test P-Value	1,00000
Sensitivity	0,8000
Specificity	0,8000
Pos Pred Value	0,7273
Neg Pred Value	0,8571
Prevalence	0,4000
Detection Rate	0,3200
Detection Prevalence	0,4400
Balanced Accuracy	0,8000
'Positive' Class	0

Source: Author's computation.

Table 8.
Generalized Linear Model output

	Dependent variable:
	Chaos
GDPC	-1,263
	(1,349)
MAST	5,420**
	(2,653)
UNEM	3,333*
	(1,753)
RPOP	3,393
	(2,182)
CPIR	-2,667
	(3,034)
FUEL	0,050
	(0,363)
TNPAGL	0,796
	(0,727)
Constant	-9,064
	(26,006)
Observations	25
Log Likelihood	-8,251
Akaike Inf. Crit.	32,501
Note:	*p<0,1; **p<0,05; ***p<0,01

Source: Author's computations.

4.3 Discussion

4.3.1 Discussion of the Descriptive Statistics

According to the matching and filtering process above, the majority of National Parks worldwide are not affected by violent conflict, considering that a lot of protected areas are located in countries that generally do not report a lot or any violent conflict anywhere in their territory. Most of the so-called "Global North" belongs to these more peaceful territories. However, as confirmed by the descriptive statistics above, National Parks that are affected by violent conflict are mainly located in the so-called "Global South", in countries that are often categorized as "least developed" or "developing countries". Such countries, unfortunately, have a higher possibility for political, economic, social, and/or environmental instability, which often affects protected areas, since they require financial support and upkeep that is often provided by the state. Due to the categorization as a "developing country" it is not unusual for such countries to have a certain dependence on and influence by foreign players, for example in the form of "green security" or "green militarization" (Dutta 2020: 3; Lunstrum 2014: 817-818; Kelly & Ybarra 2016: 171). While on the one hand, such support can help the management and survival of protected areas greatly, it can on the other hand mean less focus on conservation concerns or that if there is focus placed on National Parks and other protected areas, it can fall under the authority of un-trained/foreign people or organizations that are not familiar with the territory and the different relations between the protected areas and their surrounding area which can lead to mismanagement and other conflictual outcomes. The possibility for National Parks to be affected by conflicts that might escalate into violence with deaths is therefore higher than in countries that are considered "developed" and have the resources and authority to manage a protected area on their own, especially on the level of National Parks.

Through the map-matching procedure, fifteen National Parks were identified to be located at international borders. As it is generally more common for conflict to arise in border regions, it further opens the question whether the violent conflicts in those fifteen parks are related to the protected area itself or not (Butsic et al. 2015: 268). Although, a National Park can act as a great natural border, it does also mean less border posts and better hiding ground due to the natural terrain which increases the chances to stay undetected and therefore attracts more people wanting to cross borders through the National Park territory. Nevertheless, the missing border posts might be replaced by uncontrolled patrolling which can lead to violent run-ins between illegal crossers and the authorities. Furthermore, hunters and/or poachers are not only limited to locals from one side but the access to the respective National Parks are somewhat more easily extended to foreigners crossing from the other side(s) (Bannon & Collier 2003: 4; Titeca et al. 2020: 3). On top, the clashing of different civilizations or ethnic groups native to the different sides is also possible to then occur in National Park territory, especially if the conflicts originated over resources that are found only in the specific protected area.

In most of the Rank A countries the deaths reported in National Park territory are 5% or less of the total death rate in the respective countries. As mentioned, only in Burundi all deaths (1) in the last ten years occurred in National Park territory. Generally, all of the 25 countries in the sample have high violent conflict/death rates which further confirms that there is a high chance that some or most of the reported National Park conflicts have nothing directly to do with the parks themselves but rather just un-relatedly occurred in their territory. Since violent conflicts in those countries are relatively widespread and prevalent it is possible that it is only a matter of time until one or more of those conflicts extend into National Park territory. Although not too much specific information is provided on the individual conflicts, the locations of 17 conflicts were reported under the name of the National Parks themselves

(Kibira NP, Pendjari NP, Garamba NP, Virunga NP, Chrea Mountains, Arsi Zone, Buffalo Springs Game Reserve). All other violent conflict locations are more precise and name specific villages, towns, districts, communities, or municipalities that are located within the National Park territory. This raises the question whether the 17 incidents might be conflicts that are more directly related to the fact that they happened in National Park territory. As already suggested, follow-up research on the individual parks is necessary and while the Rank A countries are already a narrowed sample to investigate further, it might be even more interesting to start with these 17 cases which specifically named a National Park as the location of the clashes.

Examining the types of conflicts within the Rank A sample, most were categorized as state-based or one-sided conflicts, meaning the state was always part of those conflicts which coincides with the fact that the majority of the 38 National Parks are state-owned (20) and 29 parks are managed at least partly by state-authorities. The state can take form as park personnel or the military or both who, from the state-based conflict perspective, deliberately enter National Park territory to fight against rebel groups or terrorist organizations. Such groups often use the natural environments as (base-)camps due to the more difficult terrain that allows for better hiding spots and protection (Simpson & Pellegrini 2022: 2). Similar to poachers and civilians, organized groups often use National Park resources to finance their activities, as several other conservation-conflict authors have previously observed (Hanson et al. 2009: 584; Glew & Hudson 2007: 145; Dutta 2020: 7). From the one-sided conflict perspective, the other conflict actor to the state are civilians. Individual intruders into National Park territory can range from (professional) poachers to local individuals who enter the park illegally to hunt or gather other park resources. Confrontations between park personnel and such individuals can often lead to violent conflicts and deaths due to the more surprising nature of confrontation and the fact that such individuals are often equally or even more armed than the park personnel for defense purposes.

A particularly outstanding result from the data collection is that the number of reported violent conflicts within the 38 National Parks are highest in the last three years (2018-2020). The increase in (visible) negative climate change consequences in the last few years have not only increased the protection of National Parks but also the need for natural resources that are often still available in protected areas. Both aspects also increase the chances for more violent conflicts, since it is likely that more violent measures are being implemented to protect National Parks leading to more conflict, while at the same time more people illegally try to enter and harvest resources, regardless of whether they are civilians or organized groups. 2020 counted the most reported violent conflicts (126) in National Park territory and a possible explanation in connection to the COVID-19 pandemic is not to be ruled out. The pandemic certainly increased tensions across many communities and although the total number of deaths worldwide was steadily declining since 2015 due to "the de-escalation of violence" in state-based conflicts, especially in the Syria and Iraq wars, it increased for the first time from 77.522 in 2019 to 81.447 deaths in 2020 (UCDP 2021; Pettersson et al. 2019: 589). Due to COVID-19, there was less (National Park) tourism which in most cases also negatively affected surrounding communities that depend on tourism for their income and survival. If there is missing income due to the "underperformance" of a National Park, locals might be more inclined or desperate enough to illegally take resources from the protected area which, if detected, could increase the violent clashes. If and how exactly the COVID-19 pandemic influenced the increase in violent conflicts in National Parks is still in need for more research.

Lastly, a look at the history of the Rank A sample revealed that although most of the countries were colonized at some point in recent history, only five National Parks were established under colonial rule (see Appendix E). Being able to trace back the origins of a protected area to colonialism can in some cases provide reasons for the continuous violent conflicts in such areas. Even if the creation of protected areas was supported by the native

population it often involved forceful dispossession of land, strict restrictions on entering and using the areas resources and other limitations which were mostly implemented to only benefit the colonizers and mainly disadvantage locals (Benjaminsen & Bryceson 2012: 336; Kelly 2011: 684). Disputes over such unfair treatment did turn into violent conflicts and even after gaining independence these disputes continued as most protected areas remained as such and no or very little reparations were provided to local populations that suffered under the mistreatment. A colonial background of a National Park could therefore help to explain why violent conflicts occurred and might still occur today. However, the cause for violent conflicts in National Parks from the Rank A sample is less likely to be connected to these historical reasons as only five out of 28 National Parks can be characterized as such protected areas. Nevertheless, a historical connection should never be ruled out completely as a possible cause even for violent conflicts that arise today.

4.3.2 Why do certain National Parks experience more violence than others?

As established from the data, it is difficult to say what exactly causes violent conflicts in National Parks. However, through the classification model it is possible to find out which and why certain National Parks from the Rank A sample experience a lot of violence and others less. After using several tools to evaluate the accuracy of the classification model it can be confirmed that the model is able to predict the violence levels in the relevant National Parks with good accuracy.

A closer look at the outcome of the generalized linear model shows how and why the violence levels can fluctuate. The only values with a negative auspice are GDPC and CPIR, while all other variables have a positive auspice. As expected, this indicates that more chaos (i.e., violent conflict/death) ensues if the GDP per capita rate and the Corruption Perception Index ranking decline and the amount of threatened Mammal species, the unemployment rate, the percentage of rural population, the fuel exports as well as the amount of land covered by National Park territory increase. If a country matches these trends, it is more likely to either stay a "high violence" country or turn into one. Consequently, in order to either stay a "low violence" country or have higher chances to turn into one, the reversed trends have to be achieved (i.e., higher GDPC and CPIR rates and lower MAST, UNEM, RPOP, FUEL and TNPAGL rates).

Focusing on the predictions, the majority of National Parks is expected to stay with the same violence levels of the last ten years according to the variables levels that were used for the model (which are for each variable the latest available year, ranging from 2018-2021). However, as seen in the results, two countries are expected to turn from "high violence" countries into "low violence" countries. Three "low violence" countries are expected to turn into "high violence" countries, which is of course a less desirable prediction, not only for the National Parks but the countries in general.

Since the predictions are based on the chosen variables (see Table 1), it means that Mozambique and Thailand show more similar characteristics in form of the variables that are closer to the majority of countries with "low violence" National Parks. In other words, if really only these variables are relevant for the violence levels in National Parks, Mozambique and Thailand would have to maintain the variable levels that were used for the model to decrease their violence levels. For Thailand this seems accurate as the number of deaths in National Park territory is already close to the threshold for a "low violence" country (there are 14 deaths reported, which means it could very well be possible that keeping the chosen

variables at the current levels is enough to reduce the ranking from "high" to "low", i.e., below 10 deaths). However, for Mozambique this prediction is rather unlikely as the number of deaths in National Park territory is very high, which means that there are certainly other factors that influence the violence levels and it becomes highly questionable whether this prediction is accurate. In contrast to Mozambique and Thailand, the predictions for the "low violence" countries Uganda, Myanmar, and Armenia to turn into "high violence" countries are slightly less questionable. The probability rates for Uganda and Myanmar are significantly above the threshold and in Uganda's case coincide with the fact that the number of deaths in National Park territory is already close to the "high violence" threshold. Although Myanmar's reported deaths are still a little low, the high probability rate could certainly be enough for the prediction to be accurate. The probability rate for Armenia is only slightly above the 50% while the number of deaths is also still relatively low. Similar to Mozambique, this prediction could be inaccurate.

Overall, out of the five cases in which a new violence level is predicted, only two seem very unlikely to be accurately predicted which, however, does not pose a significant problem, as the overall accuracy of the model is accordingly rated as "good" and not "perfect". While there is the option to improve the model for an even better accuracy through additional work, another option could be to introduce a third class for countries with National Parks but no reported violent conflicts/deaths. This would enable the model to even predict if violent conflicts could arise in those countries. Nevertheless, this version of the classification model is still good enough to be used in future studies regarding this topic, but with caution as pointed out above. As times goes by all variables are bound to change either for the better or worse. The model could therefore be used to evaluate these probabilities on an ongoing basis, which then would give the model not only a value in a static analysis (as it is the case for this thesis) but also in a dynamic analysis.

4.3.2 Conclusion

The results presented in Chapter 4 show that the data collection, combination and filtering made it possible to identify which National Parks have been affected by violent conflicts in the last ten years. By identifying not only the clear cases but also potential cases of violent conflict in and around National Parks (Ranking A and C), it is now possible to easily pick specific parks in order to conduct further research on each case, which is necessary as discussed above. Additionally, the classification model could further be utilized to rank the violence levels of the National Parks under Rank C or even Rank B and predict possible changes in their violence levels.

Nevertheless, the main result that can be taken away from this research project so far is that the currently available data from both the conservation and the conflict field are not yet precise enough to clearly identify which violent conflicts in National Parks are directly related to the conservation areas themselves. Meaning, it is not clear which of the incidences are actually directly related to the existence of the affected National Park and in which cases violent conflicts just happen to occur in National Park territory. Furthermore, the identified cases are of course restricted to the UCDP definitions of violent conflict. Therefore, this study does not account for violent conflicts within National Parks that do not exactly match these definitions. This further increases the need to conduct individual case-studies not only on the National Parks found in the Rank A sample but also on the National Parks under Rank C. The next chapter will discuss in more detail one specific National Park from the Rank A sample, the Virunga National Park in the Democratic Republic of the Congo.

Chapter 5
The Virunga National Park

5.1 Introduction

The Virunga National Park is located in the Eastern part of the Democratic Republic of the Congo and borders both Rwanda and Uganda at different parts of its territory. As the first National Park in Africa, established in 1925 under Belgian colonial rule, the park now stretches North of the city Goma to an area of approximately 7,800 km^2. It is the habitat for an incredible variety of animal and plant species, including the endangered Mountain Gorillas (Silverbacks), which can only be found in this area of the world (Hochleithner 2017: 100-101). The diverse landscape of the park ranges from mountains and volcanoes to lakes (e.g., Lake Edward), swamps and forests and even includes a lowland savannah (Ramsay 2017). This particular region has been and still is highly unstable due to many reasons. Violent conflicts have impacted the park ever since its establishment and are continuously present in the Virunga area. Additional issues have emerged over the last years: the fight over oil and other resources in the National Park, the poaching of the Mountain Gorillas and the clashing of park rangers and hunters/rebels. Furthermore, health issues including the highly contagious Ebola virus and recently the Corona virus as well as corrupt (political) leadership and very limited economic opportunities for the surrounding population have created additional sources for conflict (see EJAtlas 2019; Hochleithner 2017; Verweijen 2020: 5-7; Marijnen 2017; Marijnen 2018; Ramsay 2017; Verweijen & Marijnen 2018: 307; Glew & Hudson 2007; Christensen & Arsanjani 2020; UNEP et al. 2015; UNHCR 2000).

Although certain assumptions can be made about the actual causes and reasons of the reported violent conflicts in the Virunga National Park, the data does not provide enough substantial information, as discussed in the previous chapter. In the following sections, the results of this research project focusing in particular on the DRC and the Virunga National Park will be presented and then further elaborated on through the help of existing academic and non-academic literature on the Virunga region.

5.2 Quantitative outcomes regarding the DRC and the Virunga National Park

The results from the data analysis show clear evidence for the significance of the Virunga National Park as one of the most interesting cases to study the conservation-conflict nexus. Among all National Parks, the most violent conflicts (110) and deaths (1199) were recorded in Virunga over the last ten years. However, the DRC is placed third when it comes to the highest numbers of total deaths in a country (after Afghanistan and Mexico). Furthermore, the variety of actors involved in violent conflicts were highest in Virunga with three different governments (DRC, Rwanda, and Uganda), sixteen rebel/terrorist groups and civilians listed as actors in the reported conflicts. Most of the conflicts are state-based (63) and one-sided (54). A possible cause for this rather unique involvement of so many actors, especially multiple governments, is the location of the Virunga National Park which borders the two other nations involved, Rwanda and Uganda. Although there is significant state-involvement in the reported violent conflicts in Virunga, there is no reported information on the government type, management authority or ownership of the park, according to the WDPA. Similar to the overall trend, the most conflicts in a year (32) were reported in 2020. As analyzed in the previous chapter, the Virunga National Park is one of the seven parks of which out of the

110 reported conflicts, six conflicts (five state-based, one one-sided, counting a total of 29 deaths) were specifically reported with the National Park's name as the official conflict location. Furthermore, Virunga is one of only five parks that was established under colonial rule. Additional country-specific data that was gathered for the analysis can be found in Table 9 below.

Table 9.
Country-specific data on the Democratic Republic of the Congo and the Virunga National Park

Variable	Value	Ranking within Rank A
Total Deaths (2011-2021) – DRC	24.496	3/25
Land Area (km^2) (2018) – DRC	2.267.050,0	3/25
Total Population (2020) – DRC	89.561.404	6/25
GDP per capita (2019) – DRC	1.144,381	22/25
Total Natural Resources Rents (% of GDP) (2019) – DRC	10,8132454	5/25
Unemployment rate (2020) – DRC	4,55	12/25
Mammal species, threatened (2018) – DRC	32	12/25
Internally displaced people, total displaced by conflict and violence (2020) – DRC	5.268.000	1/25
NP Deaths (High Estimate) (2011-2021) – DRC	1.199	1/25
NP Deaths (Normal Estimate) (2011-2021) – DRC	1.182	1/25
NP Deaths/Total Deaths (2011-2021) – DRC	5%	7/25
Poverty headcount ratio at 1.90$ a day (2011 PPP) (% of population) (2011-2021) – DRC	77,2	2/25
Rural Population (2020) – DRC	54,362%	12/25
Fuel Exports (2018) – DRC	NA	NA
TNPAGL (2021) – DRC	7%	10/25
Corruption Perception Index Ranking (2020) – DRC	170/179	3/25

Source: Author's computation using data from World Bank (2021), Transparency International (2021), Protected Planet (2021), UCDP (2021).

The results from the classification model regarding the Democratic Republic of the Congo indicate that the original violence level ("high violence") is not predicted to change. The country shows a probability rate of 0,976 (> 0,5) which is in accordance with the incredibly high deaths rates reported in the Virunga territory but also in the other three affected National Parks in the DRC (Garamba NP, Kundelungu NP and Okapi NP). It is therefore safe to say that the prediction that the Virunga National Park will stay a "high violence" protected area is accurate.

5.3 Explaining the high level of violence in the Virunga National Park

Despite the fact that other regions in the DRC are similarly unstable like the Virunga region, there is an incredibly high violence level concentrated on the Virunga National Park. This could be an indication that the park is not just an unfortunate site for violent conflicts but rather that the violent conflicts are indeed more directly connected to the fact that the territory is designated as a National Park. This is further supported by the fact that some conflicts in the Virunga territory are reported specifically with the National Park as conflict location.

Collier et al. offers another explanation, namely that "newly independent countries have a much higher risk of conflict than other countries", due to weaker institutional structure

and "a legacy of decolonization wars [which] makes them five times more war prone in their first year of independence than comparable but older countries" (2003: 98). This argument connects with the findings that the Virunga National Park belongs to the very few protected areas in the Rank A sample, which were actually established under colonial rule. Therefore, a historical approach to finding reasons for violent conflicts in the park is needed.

Dating back to its creation under Belgian rule, conflicts emerged due to the expulsion and dispossession of local people who resided in the territory before it was declared National Park. Without any compensation for their displacement, the people were forced to move and some of them are still raising this issue today (Marijnen 2018: 798). Unfortunately, the conflicts in this particular region seem to have further increased in the last 25 years, even long after the DRC gained its independence. Although many different starting points could be chosen, the Rwandan Genocide in 1994 was another major fire-starter for violent conflicts in the eastern part of the DRC in which the Virunga National Park is located. By the end of it in 1996, the DRC had experienced a high influx of refugees from Rwanda, including many of the exiled and responsible leaders of the genocide (Glew & Hudson 2007: 143). The Eastern part of the DRC was not equipped for such a refugee crisis, as pointed out by the UNHCR High Commissioner Sadako Ogata in 1994:

> "With the rocky volcanic topography and already dense population, the surrounding area is almost totally inadequate for the development of sites to accommodate the refugees. Water resources are severely deficient and local infrastructure with the capacity of supporting a major humanitarian operation is virtually non-existent." (UNHCR 2000: 246-247).

On top of the political and economic instability in the DRC, the limited accommodations, food and water resources and other unavailable supplies and spreading diseases in the area increasingly led to tensions and were major causes for the First and Second Congo Wars (UNHCR 2000). Even though an official peace agreement was signed in 2002, the violence especially in the eastern part of the DRC continued under a new conflict name: the Kivu Conflict. Already during the previous wars, several rebel groups had been established either by former Rwandan refugees or ex-members of the military of the DRC (FARDC) who were unhappy with the political leadership in the country and sought to bring change, especially in the Kivu region. These groups were present out- and inside the Virunga National Park and in 2008, reports confirmed that one of the main rebel groups, the "National Congress for the Defence of the People" (CNDP), operated from a basecamp inside the park, due to its strategic location close to the city of Goma (CNN 2008; Marijnen 2018: 805). During the second (2012-2013) and the currently on-going third phase of the Kivu conflict, violent clashes between the rebel groups (e.g., FDLR, M23, Mayi-Mayi-militias, etc.) and the FARDC became increasingly more common. Even UN peacekeepers under the "United Nations Organization Stabilization Mission in the Democratic Republic of the Congo" (MONUSCO) mission were more and more involved in violent clashes in the Virunga territory, even though they had been deployed to control the conflicts to their best efforts and minimize human rights abuses "including all forms of sexual and gender-based violence and violations and abuses committed against children" (UNSC 2014: 6). In more recent years (2017-today), the "Allied Democratic Forces" (ADF) rebel group with links to ISIS has been the most active, but not the only rebel group in the Virunga region. In 2017, the UN estimated around 5,000-8,000 armed combatants in the North Kivu province alone and although the number of armed groups have decreased from 130 in 2019 to approximately 120 in 2020, the data shows that the number of violent conflicts and deaths increased in the last year (see Appendix D; KST 2021: 3).

The history of the Eastern DRC shows very clearly that violent conflicts have persisted for a very long time, especially in the Virunga region. The dispossession and displacement of many local populations in the Virunga National Park during colonial times may have been the starting point for the instability in the region. As pointed out by Glew & Hudson, "Conflict may trigger mass movement of human populations, the decline or near total collapse of state functions and consequently a forced reliance on wild resources, and uncontrolled natural resource exploitation" (2007: 140). These were exactly the outcomes of the forceful and conflictual establishment of the Virunga National Park: Not wanting to move too far from their previous home, many people stayed in the outskirts of the newly established protected area, which then became too crowded to sufficiently offer good living standards. This led to additional violent relations not only between the colonial forces and civilians due to the creation of the National Park but also between civilians themselves over general differences due to the multiple different ethnic groups which were then (newly) native to this area and access to and availability of resources (Hochleithner 2017: 101). Considering that already in 1994 "up to 40,000 people entered the park every day, taking out between 410 and 770 tons of forest products", it can only be expected that this trend and cause for violent conflicts has not yet decreased sufficiently (McNeely 2003: 146). On the contrary, today, the number of displaced persons, especially due to conflict and violence, even reached a new all-time high in 2020 with approximately 5,3-5,5 million displaced people across the DRC (see Table 9; KST 2021: 3). As mentioned, these dislocation conflicts are still present today and while they might not be as violent as before or strictly connected to the displacement caused by the creation of the Virunga National Park, the general violence has not decreased in the park.

Long after gaining independence, the DRC has not yet been able to establish a stable government. The more recent conflicts involving rebel groups started with less of a connection to the National Park itself as the rebels were/are fighting against the government due to their opposition towards the poor (political) leadership. Nevertheless, the advantages of Virunga were quickly used by the rebels, which is why conflicts manifested themselves further in the territory. For example, the Mayi Mayi engage in illegal "resource exploitation, in particular of columbo-tantalite, or coltan, to finance their campaign and acquire wealth", while the FDLR not only operates in the park and collects resources, but also gains revenue from protection taxes from civilians (Glew & Hudson 2007: 145; Hochleithner 2017: 100; Marijnen 2018: 804). According to the UNEP, MONUSCO & OSESG report in 2015, "revenue from illegal natural resources exploitation finances a high number of well over 25 armed groups (up to 49 according to some estimates) continuing to destabilize eastern DRC" (UNEP et al. 2015: 3-4).

On top, the FARDC is also active in the National Park and has been involved in violent conflicts with park guards in the past. From 2011 to 2014, the intrusion by SOCO International PLC created a lot of tension in Virunga (Pearce 2014). Granted by the Congolese government, the British oil company had gained access to enter the National Park in order to start extracting the oil resources found in the territory. In National Parks, such activities are however forbidden under state and international law and the park management opposed the actions of the oil company which were supported by the FARDC. These tensions led to violent conflicts, in which even the park's manager, Emmanuel de Merode, was shot 14 times but luckily survived (EJAtlas 2019; Marijnen 2018: 803-804). It is unclear whether these specific conflicts are even counted in the UCDP database, as it is questionable if the park staff falls under the "Civilians" description within the database as there is no other mention of conflicts between the Government of the DRC and the Virunga Park personnel. Such missing conflict data is therefore more likely to be uncovered through research on the ground in National Parks. These historical, displacement and resource-related conflict causes are however not the only reason for violent conflict in and around the Virunga National Park and previous literature has identified several other factors.

As indicated by the Corruption Perception Index ranking, the accusations against and within the Congolese government have not yet significantly improved. Not only the government is accused of corrupt leadership but also the management of the Virunga National Park itself (Kujirakwinja et al. 2010: 24). Although the WDPA has no reported records of the ownership or management of the protected area, it is no secret that the park was under the control of the "L'Institut Congolais pour la Conservation de la Nature" (ICCN) until the European Commission (EC) proposed a public-private partnership (PPP) in 2005 in order to better control the funding of the park. Since 2010, the now-called Virunga Foundation, a UK-based NGO, has full control of the park management, with an active PPP that is still binding until 2040 (Marijnen 2018: 801). The take-over led to a more militarized approach in protecting the National Park, as financial aid was granted to train the park guards in paramilitary combat techniques (Marijnen 2017: 1572). This development in the Virunga National Park is therefore a perfect example for the "green militarization" of conservation areas (Büscher & Fletcher 2018: 106). Not only are the park guards equipped to defend the park and themselves against the many insurgent groups but also the often heavily armed poachers and locals who enter the park illegally. It is argued however, that "this militarized approach to the Virunga Park exacerbated instead of diminished conflict between the park and the adjacent population" (Marijnen 2017: 1567). Once again, such violent conflicts do not seem to be reported in the UCDP according to the actor descriptions, even though they are highly significant for conservation-conflict studies. Although green militarization shows clear disadvantages, it was still welcomed, especially from an international perspective, as it meant further protection for this extraordinary conservation area. Even before the PPP was officially signed, a UNESCO World Heritage report discussed the Virunga example and concluded that "Preventive action to minimize damage might actually be a more cost-effective way than ecosystem rehabilitation after the conflict", meaning that it was more important to continue protecting the Virunga National Park at any cost as it would be cheaper than risking the loss of its great biodiversity (Debonnet & Hillman-Smith 2005: 31).

Furthermore, these developments show that Virunga is also part of the neoliberalization of conservation areas. As pointed out by Hughes, "Contemporary conservation dabbles in nostalgia for the colonial period", a statement that, in the case of Virunga, could be supported by the fact that the park is strongly influenced, managed and financially supported by foreign players (e.g., Virunga's Park director, de Merode, comes from royal Belgian heritage) (Hughes 2010: 133). Several other aspects of the neoliberalization of conservation areas, as discussed by Büscher, can be detected in Virunga (2011: 94-101). As pointed out there is a certain degree of commercialization of the park management. (Eco)tourism, in Virunga often in the form of Gorilla Trekking, is strongly promoted and presents a major income source for the park. However, the benefits from international tourism are not always guaranteed to also profit the local populations and although Virunga seemingly does its best to share these advantages it is not yet very visible (Büscher 2011: 96). Instead, possible detriments from increased tourism can include the decrease or even loss of culture, the disruption of local environments not only inside but also outside of the National Park (e.g., due to infrastructure developments in form of hotels and streets, etc.), less available supplies for locals and as seen in Virunga a strong divide between "the rich tourists" and the often "poorer locals", considering that the Gorilla Trekking is set at very high prices and is therefore only easily available to wealthier individuals. Especially this aspect has led to violent conflicts, as kidnappings or killings of tourists has occurred several times in Virunga in the past years. The last kidnapping with casualties occurred in May 2018, after which the Virunga National Park closed for eight months to evaluate its security measures (Reuters 2019). Therefore (eco)tourism can and certainly has led to violent conflicts in the park and its surrounding area. Another practice of neoliberal conservation found in the Virunga National Park is the carbon trading which is increasingly planned, in form of several hydropower plants (UNESCO 2021). Similar to

(eco)tourism, the benefits from such hydro-plants are supposed to be of value for the park and the surrounding populations (in form of electricity which is desperately needed) and of course for the planet as a sustainable power-source. However, there are also contestations to be found in such seemingly environmentally-friendly and beneficial-for-all projects. First, there is added pressure on the immediate natural environments around the plant, which can massively disrupt the flora and fauna through and even after its construction. Second, existing hydropower-plants have already led to tensions through reportedly increased electricity prices and general suspicion of locals against these hydro-projects, as pointed out by Marijnen & Schouten (2019: 28-29). One more neoliberal conservation practice includes "new internet-based conservation strategies and new financial conservation mechanisms" (Büscher 2011: 100-102). For Virunga this comes in the form of its official website and social media presence (Facebook, Twitter, Instagram), which promote the opportunity to donate, make purchases in their shop or even adopt a gorilla (Virunga National Park 2021). Overall, negotiating these (neoliberal) developments in the Virunga National Park amidst continuous violent conflicts already presents a major challenge and has proven to additionally cause conflicts.

After the power transfer of the Virunga management, the corruption within the park decreased but nonetheless persists to a certain degree, as some park guards are still involved in illegal extractivist activities and even in contact with rebel groups, often due to low morale which is "[…] undermining their sense of loyalty to their conservation mission" in desperate times (Kujirakwinja et al. 2010: 24). Even though the salary for the park staff is guaranteed by the EC and the Virunga Foundation, the high poverty and unemployment rates as well as the low GDP per capita rates (see Table 9) are especially visible in the Virunga region (Verweijen & Marijnen 2018: 13). The possible profit that can be made by extracting natural resources and hunting wildlife within the park's territory is a very tempting but highly illegal undertaking that many, sometimes even the park personnel, are desperately risking for their survival. As explained by Collier & Hoeffler (2002), exactly such economic factors lead to violent conflicts and as the data above shows, the highest number of conflicts in the past ten years were reported last year (2020). The Kivu Security Tracker (KST), a joint project under the Congo Research Group at NYU and Human Rights Watch, reports that the COVID-19 pandemic did have a significant impact on financial aid in the DRC, stating that "only 34% of requested annual aid had reached the Congo in 2020" (KST 2021: 3). On top of the deficit, the Virunga National Park closed for gorilla tourism in March 2020 which additionally cut income opportunities, also for the surrounding areas that profit from international tourism (Virunga National Park 2020). Even though there might be more reasons for the increase in violent conflicts in 2020, it is no surprise that the COVID-19 pandemic contributed to this intensification.

Another major cause for violent conflicts in National Parks in general is attributed to the illegal poaching of animals. Poaching can either be directly related to violent conflicts or be the reason for new ones. According to the latest count in 2018, the DRC is home to 32 threatened mammal species (see Table 9) under which not all but certainly some continuously suffer from poaching. In the Virunga National Park, one of the most threatened mammal species is the Mountain Gorilla, or Silverback (*Gorilla beringei beringei*), which according to the IUCN Red List counted around 600 individuals in 2018, while a more recent number, provided to the author during a field visit in Virunga in the beginning of March 2020, counts around 1000 individuals (Hickey et al. 2020). Although the number of individuals has positively developed, the gorillas are still a major source for violent conflicts within the protected area. According to Hanson, leftover arms from conflicts or wars, whether they were related or not to the protected areas directly, are likely to remain in such areas, increasing the "scale and efficiency for local hunting and poaching" (2018: 55). This observation can certainly be made for the Virunga region, bearing in mind its intense and long-lasting violent history as

discussed above. Considering the economic profit that either alive or dead gorillas can bring, for example on black markets, it is not surprising that "wildlife crimes – including trading in animal parts and/or organs, poaching and hunting, especially in the global south – is recurrently driven by insurgent or terrorist groups" (Dutta 2020: 4). Alongside natural resource extractions by rebel groups in Virunga, the poaching of the gorillas has also been used to further fund their activities (Hanson 2018: 54). Since the green militarization of Virunga, clashes between (suspected) poachers and park rangers, who are armed and trained to protected the park and specifically the Mountain Gorillas, have become accordingly more violent. While poachers from rebel groups are suspected to be more common, local people have been caught in similar violent clashes with park rangers who either suspected or identified them as poachers. Arguably one of the most known poaching cases worldwide, has been the 2007 killings of seven Mountain Gorillas in Virunga. Even though this case did not actually involve a violent conflict between humans, the suspected poachers are believed to not be directly related to armed groups but rather to angered individuals who wanted to send a political message connected to the illegal charcoal industry that is very active in the Virunga area (Lovgren 2007). Again, it is unclear whether violent conflicts caused through poaching clashes are included in the UCDP. Similarly, to the other possibly undetected cases mentioned above, the number of violent conflicts could be even higher in the Virunga National Park than reported in the data and analysis above.

Apart from the original conflicts over land rights during the establishment of Virunga, land issues have persisted and recently further developed. More generally speaking, land- and green-grabbing activities have increased worldwide in recent years and Virunga is no exception. Green-grabbing is defined as "the appropriation of land and resources for environmental ends" and although it fits with the increasingly important mission of protecting the environment, it is often a contested undertaking (Fairhead et al. 2012: 238). The grabbing of land is closely connected to the power struggles within the Virunga area and whether the grabs are for environmental purposes or not, they often occur through "a 'top-down' approach, which consists of announcing and enforcing the borders, clearing villages and farms, and protecting the control gained over territory through the rehabilitation of patrol posts and increasing surveillance and patrols by the guards" (Marijnen 2017: 1575; Butsic et al. 2015: 267-268). However, the consequences for the people who depended on/owned the grabbed land are often dismissed or overlooked as less important compared to global climate issues. In Virunga, conflicts over land have been ever-present due to the unclear land designations, considering that the boundaries of the park differ according to different perspectives: the general population might see the borders at different places than is inscribed in the law, while the park rangers have yet another opinion on the boundaries (Marijnen 2017: 1575). Consequently, the reasons for violent conflicts over land are manifold. Not only are the historical dispossessions and the disagreement on the parks boundaries triggers for conflicts but todays (forceful) removals of people from their home- or farmland and resulting limited availability of arable land have led to violent clashes between park authorities and local populations (Christensen & Arsanjani 2020: 2; Verweijen 2020: 5). As observed by Christensen & Arsanjani, the Virunga land has been suffering under multiple influences, namely the continuous "civil unrest; illegal activities; land conversion and encroachment; livestock farming/grazing of domesticated animals; widespread depletion of forests in the lowlands and; a massive influx of 1 million refugees occupying adjacent areas of the park" (2020: 2). The forest area of Virunga is expected to decrease further in the coming years, and considering the general objective of National Parks "to protect natural biodiversity along with its underlying ecological structure and supporting environmental processes, and to promote education and recreation" it could be expected that the Virunga territory could counter these negative developments by green-grabbing surrounding areas which in return will most likely cause more violent conflict with the affected population (Dudley 2008: 16). Although, most of the

previous conflict causes are arguably equally difficult to solve, the land issues in and around Virunga have been known as conflict cause for a long time and are already expected to persist in the future but solutions are limited and if possible, very difficult to implement.

The more in-depth discussion of the Virunga National Park clearly shows that (qualitative) research, especially through fieldwork and non-academic literature such as newspaper articles and official reports, is more likely to offer more precise insights into what causes violent conflicts in National Parks. The data outcomes made it possible to easily choose an affected National Park as case-study for further investigation and the tested indicators pointed in the right directions for causes regarding the reported violent conflicts. However, the limited information given from the data was only able to be complemented through already existing research on the Virunga National Park as seen above. The stated types of violent conflicts as defined by the UCDP are definitely major influences on the protected area, yet other types of violent conflicts are likely to also occur in the National Park territory. As pointed out, it is possible that, for example, the park ranger-poaching incidents are not fully included in the UCDP data. The qualitative approach showed in more detail the connection between political, economic, social and environmental factors to the conflict dynamics in the Virunga National Park. Most importantly the historical background of the Virunga region revealed itself to play a very crucial role in explaining the causes for the high number of conflicts with the equally high violence levels. These findings massively strengthen and explain the results of the classification model which identified the DRC including the Virunga National Park as a "high violence" country and predicted the same level of violence to persist. Overall, the Virunga National Park showcases each of the chosen key factors at arguably the highest level possible, whether in form of low economic growth and stability, specific resource-conflicts (oil), poaching incidents possibly connected to threatened species, corruption or land-issues on top of a high population density, even with a closer look at more recent developments, especially considering the COVID-19 pandemic, in and around the park. Moreover, relatively new conservation developments in form of "green militarization" as well as neoliberal conservation practices are identifiable in Virunga and are arguably additional causes for violent conflicts in the Virunga area. Concluding, the Virunga National Park presents itself as a highly unique and impressive conservation area and for the sake of the park and its biodiversity as well as the surrounding populations there should be high aims to continue to minimize the violent conflicts and improve the overall situation in the Virunga region.

Chapter 6
Conclusion

The aim of this thesis was to understand the dynamics and linkages between conservation and conflict by introducing a quantitative approach to the existing qualitative-dominated research on the topic. The study addressed the question how and to what extent are conservation and conflicts linked, and why, particularly by focusing on National Parks that are embedded in ongoing violent conflicts. The main assumption that underpinned this research was that nature conservation can be and is contested especially in the context of recent increased interest in neoliberal conservation involving varied actors and narratives in the era of climate change. The study argued that conservation and conflicts are closely linked and are more so in settings of ongoing violent conflicts. Clear linkages between conservation and conflicts were identified and further analyzed, by examining National Parks that have been affected by violent conflicts in the last ten years. The research yielded the following results.

A main finding shows that conservation, especially when carried out through the neoliberal perspective, can be and is contested. In many cases and as shown in the Virunga case-study, the populations around conservation areas are the core contesters, since the negative outcomes of conservation practices often outweigh the positive ones for them. The main disadvantages that raise such opposition include the displacement and dispossession of people through increased land/green-grabbing, the added pressure on the natural environments in and around protected areas for carbon trading purposes and the questioning of its actual effectiveness for locals or the possible exclusion of (eco)tourism benefits, which often only leave the disadvantages of promoted international tourism (e.g., loss of culture, added disruptions of environments even outside the protected area, less available supplies for locals, etc.). Moreover, Virunga's struggle over its oil resources showed that also higher local authorities or even the state can become contesters, especially when the protected area in question is not entirely under their own control but rather managed by international organizations or other foreign actors who are the ones pressuring for (neoliberal) conservation practices.

Furthermore, while the correlation between conservation (in the case of this study National Parks) and violent conflicts generally varies from one context to another, it is largely shaped by factors such as the country's GDP, corruption level, the number of threatened mammals the country has, the unemployment rate, the size of the rural population, the scale of oil exports and the size of land covered by National Parks. In countries where corruption is widespread and their GDP per capita is low, violent conflicts are prevalent in and around National Parks. In addition, National Parks are more likely to be affected by violent conflicts in countries where the number of threatened species of mammals is high, the unemployment rate is high, and the majority of the country's population is rural. Furthermore, if a country relies on oil export and the country's area covered by National Parks is large, it is likely that National Parks are entangled and affected by violent conflicts. Although these factors are mainly intertwined and play important roles depending on the individual case, the economic factors are arguably always a major influence on the conflict dynamics in and around National Parks which is less surprising considering the increase in neoliberal conservation. Moreover, a main pattern was identified through these factors, which shows that the majority of affected National Parks are located in poorer, more rural and politically unstable countries. Additionally, the classification model showed how these factors can and are influencing conflict dynamics. Depending on their development, they can significantly influence the violence levels in the countries in which the affected National Parks are located. The model was able to

show with good accuracy, which countries and therefore possible affected protected areas could change to either higher or lower violence levels.

Although the quantitative approach showed some new and valuable results, it has become clear that the currently available data from both research fields is not yet compatible enough to produce the best possible explanation(s) for the linkage between conservation and conflict. The individual case-study on the Virunga National Park showed how limiting the data can be on explaining the linkages between conservation and conflict, as the complementary qualitative work offered a necessary and more accurate perspective on violent conflicts dynamics (in this case) in the Virunga National Park. Individually-relevant factors are often only found through more case-specific research since they vary from case to case. For the Virunga case, the historical components played a major role in explaining the conflict dynamics in this specific area, on top of the more general factors and the neoliberal conservation practices.

Consequently, not only can conservation itself cause violent conflicts, especially when executed through neoliberal practices as argued above, but it can also increase already existing violent conflicts. A protected area which is already affected by violent conflicts, whether or not these conflicts are directly or indirectly connected to the protected area itself, generally suffers from those armed conflicts which increases the need for further protection of the conservation area. Seeing that neoliberal measures are nowadays increasingly used to conserve our nature, such measures on top of already ongoing violent conflicts in protected areas often run the risk of further increasing or even starting new conflict dynamics in and around conservation areas, especially if they are executed poorly and without the participation of the surrounding population.

Concluding, the findings presented in this research highlight the importance of using a quantitative approach to complement the existing qualitative-based studies on the dynamics and linkages between conservation and conflicts. In doing so, the quantitative approach used in this study confirmed some of the findings of available qualitative studies and contributed to addressing the lack of quantitative-based literature in the conservation-conflict nexus. The importance of preserving protected areas, especially in the form of National Parks is continuously increasing due to their great biodiversity and size compared to other protected area types as well as the contestations around them. Therefore, further fieldwork/case study-based research on the dynamics of conservation in settings of violent conflicts is necessary.

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Appendices

Appendix A.
Code in "R".

```
Pre: Load all necessary packages and activate them. Please ensure that
R and all packages are up to date (RStudio Team 2021).

#Final Code

#Install and activate all necessary packages
library("caret")
library("itertools")
library("leaflet")
library("missForest")
library("randomForest")
library("ROCR")
library("shiny")
library("stargazer")

library("base")
library("data.table")
library("datasets")
library("dplyr")
library("foreach")
library("ggplot2")
library("graphics")
library("grDevices")
library("htmlwidgets")
library("iterators")
library("lattice")
library("methods")
library("readxl")
library("stats")
library("utils")
library("writexl")

#Import all Protected Planet Regions (7)
X_AFR <- read_excel("AFR.xlsx")
X_ASI <- read_excel("ASI.xlsx")
X_EUR <- read_excel("EUR.xlsx")
X_NAM <- read_excel("NAM.xlsx")
X_POL <- read_excel("POL.xlsx")
X_SAM <- read_excel("SAM.xlsx")
X_WAS <- read_excel("WAS.xlsx")
#Create a new data-frame with all regions combined:
X_All_Regions <- rbind(X_AFR, X_ASI, X_EUR, X_NAM, X_POL, X_SAM, X_WAS
)
#Export to excel
write_xlsx(X_All_Regions,"X_All_Regions.xlsx")

#Filter for all National Parks according to the IUCN_CAT = "II" + DESI
G_ENG = "National Park" variables
#Filter X_All_Regions = IUCN_CAT = II
```

```
subset(X_All_Regions, IUCN_CAT=='II')
X_All_Regions_NP_IUCN_II <- subset(X_All_Regions, IUCN_CAT=="II")
#Filter X_All_Regions = DESIG_ENG = National Park
X_All_Regions_NP_DESIG_NP <- subset(X_All_Regions, DESIG_ENG=="Nationa
l Park")
#Bind both data-frames together
X_All_Regions_NP <- rbind(X_All_Regions_NP_DESIG_NP, X_All_Regions_NP_
IUCN_II)
#Delete Duplicates
X_All_Regions_NP <- unique(X_All_Regions_NP)
#Export to excel
write_xlsx(X_All_Regions_NP,"X_All_Regions_NP.xlsx")
# --> X_All_Regions_NP = 6.607 National Parks

#Find out how many countries in total
duplicated(X_All_Regions_NP$ISO3)
which(duplicated(X_All_Regions_NP$ISO3))
X_All_Regions_no_duplicate1 <- X_All_Regions_NP[!duplicated(X_All_Regi
ons_NP$ISO3),]
#All_Regions_no_duplicate1 = 190 countries
#Row 16 has multiple country codes --> delete = 189 countries
X_All_Regions_no_duplicate1 <- X_All_Regions_no_duplicate1[-c(158), ]
#Export to excel
write_xlsx(X_All_Regions_no_duplicate1,"X_All_Regions_no_duplicate1.xl
sx")

#Take those countries and find out the death numbers from UCDP website
(manually --> check each country site and set the time period to show
the deaths between 2011-today)
#Import UCDP Deaths.xlsx
X_UCDP_Deaths <- read_excel("UCDP Deaths.xlsx")
#Create new column with Ranking 1 = one or more Deaths and 0 = zero De
aths
X_UCDP_Deaths$UCDPDS <- as.numeric(X_UCDP_Deaths$`Deaths total 2011-20
20 (UCDP)`> 0)
#Export to excel
write_xlsx(X_UCDP_Deaths,"X_UCDP_Deaths.xlsx")

#Prepare World Bank and Transparency International Data
#Import WB & TC data
X_GDPC <- read_excel("GDP per Capita.xls")
X_UNEM <- read_excel("WB-Unemployment, total.xls")
X_MAST <- read_excel("WB-Mammal species, threat.xls")
X_RPOP <- read_excel("WB_Rural Population, %.xls")
X_FUEL <- read_excel("WB_Fuel exports.xls")
X_CPIR <- read_excel("CPI2020_GlobalTablesTS_210125.xlsx")
X_LAND <- read_excel("Land Area.xls")
#Clean all WB & TC data-frames

#Clean X_LAND:
#Remove first two rows in X_LAND (Last updated date, NA)
X_LAND <- X_LAND[-c(1),]
X_LAND <- X_LAND[-c(1),]
```

```r
#Remove not necessary Columns (Indicator Name, Indicator Code, all yea
rs except 2018)
X_LAND <- X_LAND[, -c(3:50)]
X_LAND <- X_LAND[, -c(3:14)]
X_LAND$...64 <- NULL
X_LAND$...65 <- NULL
#Rename the variables in X_LAND:
names(X_LAND)
X_LAND <- X_LAND %>% select(`Country Name` = `Data Source`, `ISO3` = `
World Development Indicators`, `LAND` = ...63)
#Delete Row 1:
X_LAND <- X_LAND[-c(1),]
#Export to excel:
write_xlsx(X_LAND,"X_LAND.xlsx")

#Clean X_GDPC:
#Remove first two rows (Last updated date, NA)
X_GDPC <- X_GDPC[-c(1),]
X_GDPC <- X_GDPC[-c(1),]
#Remove not necessary Columns (Indicator Name, Indicator Code, all yea
rs except 2019)
X_GDPC <- X_GDPC[, -c(3:50)]
X_GDPC <- X_GDPC[, -c(3:15)]
X_GDPC$...65 <- NULL
#Rename the variables in X_GDPC:
names(X_GDPC)
X_GDPC <- X_GDPC %>% select(`Country Name` = `Data Source`, `ISO3` = `
World Development Indicators`, `GDPC` = ...64)
#Delete Row 1:
X_GDPC <- X_GDPC[-c(1),]
#Export to excel:
write_xlsx(X_GDPC,"X_GDPC.xlsx")

#Clean X_UNEM:
#Remove first two rows (Last updated date, NA)
X_UNEM <- X_UNEM[-c(1),]
X_UNEM <- X_UNEM[-c(1),]
#Remove not necessary Columns (Indicator Name, Indicator Code, all yea
rs except 2020)
X_UNEM <- X_UNEM[, -c(3:50)]
X_UNEM <- X_UNEM[, -c(3:16)]
#Rename the variables in X_UNEM:
names(X_UNEM)
X_UNEM <- X_UNEM %>% select(`Country Name` = `Data Source`, `ISO3` = `
World Development Indicators`, `UNEM` = ...65)
#Delete Row 1:
X_UNEM <- X_UNEM[-c(1),]
#Export to excel:
write_xlsx(X_UNEM,"X_UNEM.xlsx")

#Clean X_MAST:
#Remove first two rows in X_MAST (Last updated date, NA)
X_MAST <- X_MAST[-c(1),]
```

```
X_MAST <- X_MAST[-c(1),]
#Remove not necessary Columns (Indicator Name, Indicator Code, all yea
rs except 2018)
X_MAST <- X_MAST[, -c(3:50)]
X_MAST <- X_MAST[, -c(3:14)]
X_MAST$...64 <- NULL
X_MAST$...65 <- NULL
#Rename the variables in X_MAST:
names(X_MAST)
X_MAST <- X_MAST %>% select(`Country Name` = `Data Source`, `ISO3` = `
World Development Indicators`, `MAST` = ...63)
#Delete Row 1:
X_MAST <- X_MAST[-c(1),]
#Export to excel:
write_xlsx(X_MAST,"X_MAST.xlsx")

#Clean X_RPOP:
#Remove first two rows (Last updated date, NA)
X_RPOP <- X_RPOP[-c(1),]
X_RPOP <- X_RPOP[-c(1),]
#Remove not necessary Columns (Indicator Name, Indicator Code, all yea
rs except 2020)
X_RPOP <- X_RPOP[, -c(3:50)]
X_RPOP <- X_RPOP[, -c(3:16)]
#Rename the variables in X_RPOP:
names(X_RPOP)
X_RPOP <- X_RPOP %>% select(`Country Name` = `Data Source`, `ISO3` = `
World Development Indicators`, `RPOP` = ...65)
#Delete Row 1:
X_RPOP <- X_RPOP[-c(1),]
#Export to excel:
write_xlsx(X_RPOP,"X_RPOP.xlsx")

#Clean X_FUEL:
#Remove first two rows in X_FUEL (Last updated date, NA)
X_FUEL <- X_FUEL[-c(1),]
X_FUEL <- X_FUEL[-c(1),]
#Remove not necessary Columns (Indicator Name, Indicator Code, all yea
rs except 2018)
X_FUEL <- X_FUEL[, -c(3:50)]
X_FUEL <- X_FUEL[, -c(3:14)]
X_FUEL$...64 <- NULL
X_FUEL$...65 <- NULL
#Rename the variables in X_FUEL:
names(X_FUEL)
X_FUEL <- X_FUEL %>% select(`Country Name` = `Data Source`, `ISO3` = `
World Development Indicators`, `FUEL` = ...63)
#Delete Row 1:
X_FUEL <- X_FUEL[-c(1),]
#Export to excel:
write_xlsx(X_FUEL,"X_FUEL.xlsx")

#Clean X_CPIR:
```

```r
#Remove the first rows in X_CPIR
X_CPIR <- X_CPIR[-c(1),]
#Remove not necessary Columns
X_CPIR <- X_CPIR[, -c(6:22)]
X_CPIR$...3 <- NULL
X_CPIR$...4 <- NULL
#Rename the variables in X_CPIR
names(X_CPIR)
X_CPIR <- X_CPIR %>% select(`Country` = `Corruption Perceptions Index
2020:Global Scores`, `ISO3` = `...2`, `Rank`=`...5`)
#Delete Row 1:
X_CPIR <- X_CPIR[-c(1),]
#Export to excel:
write_xlsx(X_CPIR,"X_CPIR.xlsx")

#Merge all WB data into one data-frame
X_WB_DATA <- merge(X_GDPC, X_UNEM)
X_WB_DATA <- merge(X_WB_DATA, X_MAST)
X_WB_DATA <- merge(X_WB_DATA, X_RPOP)
X_WB_DATA <- merge(X_WB_DATA, X_FUEL)
X_WB_DATA <- merge(X_WB_DATA, X_LAND)
#Merge X_WB_DATA with X_CPIR
X_WB_DATA_1 <- merge(X_WB_DATA, X_CPIR)
#Clean X_WB_DATA_1 (delete Country column)
X_WB_DATA_1$Country <- NULL
#Export to excel
write_xlsx(X_WB_DATA_1,"X_WB_DATA_1.xlsx")

#Create a combined data-frame with X_WB_DATA1 and X_UCDP_Deaths
#Not possible without losing countries through R --> use Excel to merg
e X_WB_DATA1 and X_UCDP_Deaths manually = WB_Data_UCDP_Deaths
#Import merged excel data WB_Data_UCDP_Deaths
X_WB_DATA_UCDP_DEATHS <- read_excel("X_WB_DATA_UCDP_DEATHS.xlsx")
#Filter X_WB_DATA_UCDP_DEATHS for all Countries with UCDPDS = 1 --> cr
eate as new data-frame
subset(X_WB_DATA_UCDP_DEATHS, UCDPDS=="1")
X_WB_DATA_UCDP_DEATHS1 <- subset(X_WB_DATA_UCDP_DEATHS, UCDPDS=="1")
#Export X_WB_DATA_UCDP_DEATHS1 to excel
write_xlsx(X_WB_DATA_UCDP_DEATHS1,"X_WB_DATA_UCDP_DEATHS1.xlsx")

#78 Countries left with one or more Deaths between 2011-today.
#Check the countries from X_WB_DATA_UCDP_DEATHS1 for the location of t
heir National Park(s) (Protected Planet Map, if necessary, back-check
with Google Maps) and map-match with the reported violent conflicts (d
eaths) (UCDP Map) whether the violent conflicts occurred are in and/or
around the National Park territory.

#Create new excel with the countries I need to check (named: UCDPDS1+N
PS.xlsx) --> map-matching manually!
#All National Parks of the 78 countries from the original X_All_Region
s_NP = 3642 National Parks to check
#Rankings: 0 = no deaths anywhere close to National Park, 1 = deaths i
n National Park, 2 = unclear if deaths in National Park or very close
```

```
to National Park
#Ranking 0 = 3507 National Parks => later RANK B
#Ranking 1 = 38 National Parks => later RANK A
#Ranking 2 = 97 National Parks => later RANK C


#Create the TNPAGL variable (using the GIS variables from the Protecte
d Planet data and the LAND variable from the WB)

#First, create new variable TNPA_GIS (which is the total GIS_Area minu
s the GIS_M_Area to have the total GIS terrestrial area of each protec
ted area)
X_TNPA_GIS <- c(X_All_Regions$GIS_AREA - X_All_Regions$GIS_M_AREA)
X_TNPA_GIS <- transmute(X_All_Regions, TNPA_GIS = GIS_AREA - GIS_M_ARE
A)
#Combine the new variable with the X_All_Regions data-frame to a new d
ata-frame X_All_Regions1
X_All_Regions1 <- cbind(X_All_Regions, X_TNPA_GIS)
#Sort the data-frame by ISO3 column
X_All_Regions1 <- arrange(X_All_Regions1, ISO3)
#Export to excel
write_xlsx(X_All_Regions1,"X_All_Regions1.xlsx")

#For each country in X_All_Regions1, combine the TNPA_GIS --> you need
to have one row for each country left but the TNPA_GIS needs to includ
e all values from every National Park in each respective country = TNP
A_GIS value for each country

#First, filter out the National Parks from the X_All_Regions1 data-fra
me
#Filter for all National Parks according to the IUCN_CAT = "II" + DESI
G_ENG = "National Park" variables
#Filter X_All_Regions1 = IUCN_CAT = II
X_All_Regions_NP_IUCN_II1 <- subset(X_All_Regions1, IUCN_CAT=="II")
#Filter X_All_Regions1 = DESIG_ENG = National Park
X_All_Regions_NP_DESIG_NP1 <- subset(X_All_Regions1, DESIG_ENG=="Natio
nal Park")
#Bind both data-frames together
X_All_Regions_NP1 <- rbind(X_All_Regions_NP_DESIG_NP1, X_All_Regions_N
P_IUCN_II1)
#Delete Duplicates
X_All_Regions_NP1 <- unique(X_All_Regions_NP1)
#Export to excel
write_xlsx(X_All_Regions_NP1,"X_All_Regions_NP1.xlsx")
# --> X_All_Regions_NP1 = 6.607 National Parks + TNPA_GIS variable

#Second, sort the X_All_Regions_NP1 according to ISO3 variable alphabe
tically
X_All_Regions_NP1 <- arrange(X_All_Regions_NP1, ISO3)

#Third, find out how many countries in total --> HOWEVER, now with the
X_All_Regions_NP1 data-frame!
#Find out how many countries in total
```

```
X_All_Regions_no_duplicate1.1 <- X_All_Regions_NP1[!duplicated(X_All_R
egions_NP1$ISO3),]
#All_Regions_no_duplicate1.1 = 190 countries
#Row 16 has multiple country codes --> delete = 189 countries
X_All_Regions_no_duplicate1.1 <- X_All_Regions_no_duplicate1.1[-c(158)
, ]
#Export to excel
write_xlsx(X_All_Regions_no_duplicate1.1,"X_All_Regions_no_duplicate1.
1.xlsx")

#Fourth, combine the TNPA_GIS values from each country together (BE CA
REFUL WITH NA VARIABLES! --> use na.rm = TRUE)
X_SUM_TNPA_GIS <- aggregate(X_All_Regions_NP1$TNPA_GIS, by=list(X_All_
Regions_NP1$ISO3), FUN=sum, na.rm = TRUE)
#Export to excel
write_xlsx(X_SUM_TNPA_GIS,"X_SUM_TNPA_GIS.xlsx")

#Fifth, rename the variables in X_SUM_TNPA_GIS:
names(X_SUM_TNPA_GIS)
X_SUM_TNPA_GIS <- X_SUM_TNPA_GIS %>% select(`ISO3` = Group.1, `TNPAG`=
x)
#Row 16 has multiple country codes --> delete = 189 countries
X_SUM_TNPA_GIS <- X_SUM_TNPA_GIS[-c(16), ]

#Sixth, Combine X_SUM_TNPA_GIS with X_WB_DATA_UCDP_DEATHS
X_WB_DATA_UCDP_DEATHS2 <- merge(X_WB_DATA_UCDP_DEATHS, X_SUM_TNPA_GIS)
#Combine X_SUM_TNPA_GIS with X_WB_DATA_UCDP_DEATHS1
X_WB_DATA_UCDP_DEATHS3 <- merge(X_WB_DATA_UCDP_DEATHS1, X_SUM_TNPA_GIS
)
#Continue working with X_WB_DATA_UCDP_DEATHS3!

#Seventh, Convert all character variables into numeric variables in X_
WB_DATA_UCDP_DEATHS3 (except ISO3 and Country Name):
X_WB_DATA_UCDP_DEATHS3 <- transform(X_WB_DATA_UCDP_DEATHS3, GDPC = as.
numeric(GDPC))
X_WB_DATA_UCDP_DEATHS3 <- transform(X_WB_DATA_UCDP_DEATHS3, UNEM = as.
numeric(UNEM))
X_WB_DATA_UCDP_DEATHS3 <- transform(X_WB_DATA_UCDP_DEATHS3, MAST = as.
numeric(MAST))
X_WB_DATA_UCDP_DEATHS3 <- transform(X_WB_DATA_UCDP_DEATHS3, RPOP = as.
numeric(RPOP))
X_WB_DATA_UCDP_DEATHS3 <- transform(X_WB_DATA_UCDP_DEATHS3, FUEL = as.
numeric(FUEL))
X_WB_DATA_UCDP_DEATHS3 <- transform(X_WB_DATA_UCDP_DEATHS3, LAND = as.
numeric(LAND))
X_WB_DATA_UCDP_DEATHS3 <- transform(X_WB_DATA_UCDP_DEATHS3, Rank = as.
numeric(Rank))

#Eight, Create TNPAGL variable by dividing TNPAG by LAND (gives us the
percentage of how much land in a country is covered by National Park t
erritory)
X_WB_DATA_UCDP_DEATHS3 <- transform(X_WB_DATA_UCDP_DEATHS3, new = TNPA
G/LAND)
```

```r
#Nine, Rename variables in X_WB_DATA_UCDP_DEATHS3
names(X_WB_DATA_UCDP_DEATHS3)
X_WB_DATA_UCDP_DEATHS3 <- X_WB_DATA_UCDP_DEATHS3 %>% select(`ISO3`, `C
OUNTRY` = Country.Name, `UCDPD`= Deaths.total.2011.2020..UCDP., `UCDPD
S`, `GDPC`, `UNEM`, `MAST`, `RPOP`, `FUEL`, `LAND`, `RANK` = Rank, `TN
PAG`, `TNPAGL` = new)
#DONE

#Import the manually collected National Park Ranking excel file (UCDPD
S1+NPS.xlsx)
X_UCDPDS1_NPS <- read_excel("UCDPDS1+NPS.xlsx")
#Delete columns ...5 and ...6 (not relevant for the data right now)
X_UCDPDS1_NPS$...5 <- NULL
X_UCDPDS1_NPS$...6 <- NULL
#Only show the National Parks that were ranked 1
X_UCDPDS1_NPS[X_UCDPDS1_NPS$`No = 0, Yes = 1, Possibly = 2` == '1',]
X_UCDPDS1_NPS1 <- X_UCDPDS1_NPS[X_UCDPDS1_NPS$`No = 0, Yes = 1, Possib
ly = 2` == '1',]
#These are the National Parks and Countries that are relevant for the
further analysis and the classification model!
#In X_WB_DATA_UCDP_DEATHS3, delete all the rows of the countries that
are not listed in the X_UCDPDS1_NPS1 data-frame (they are not relevant
anymore)
X_WB_DATA_UCDP_DEATHS3_RANK1 <- X_WB_DATA_UCDP_DEATHS3
X_WB_DATA_UCDP_DEATHS3_RANK1 <- X_WB_DATA_UCDP_DEATHS3_RANK1[-c(2,4,5,
9,10,11,12,13,17,19,21,22,23,25,26,27,28,29,30,31,34,35,36,39,40,41,42
,43,44,45,47,50,51,52,53,54,55,57,59,60,61,62,63,65,66,67,69,71,73,74,
76,77,78),]

#Through the map-matching procedure, collect the information provided
from the UCDP on the relevant violent conflicts for the National Parks
in Rank 1 --> specifically collect the numbers of deaths (normal and h
igh estimates)
#Create a new vector with the Numbers of Deaths (DSHE (Deaths high est
imate)) in the National Park territories of each country (Data in 38 P
ark Details.xlsx)
vec <- c(480,2,6,1,1,21,15,1199,31,7,48,62,8,29,1,52,4,491,30,7,150,14
,52,7,1)
#(For safety) Duplicate X_WB_DATA_UCDP_DEATHS3_RANK1
X_WB_DATA_UCDP_DEATHS3_RANK1.1 <- X_WB_DATA_UCDP_DEATHS3_RANK1
#Add vector vec to WB_DATA_UCDP_DEATHS1_EXTRA_RANK1.1
X_WB_DATA_UCDP_DEATHS3_RANK1.1$DSHE <- vec
#Repeat process to add another column with DSWE (Deaths normal estimat
es)
#Create new vector
vec2 <- c(442,2,6,1,1,21,15,1182,31,7,42,56,8,29,1,52,2,449,30,7,150,1
4,46,7,1)
#Add vector vec2 to X_WB_DATA_UCDP_DEATHS3_RANK1.1
X_WB_DATA_UCDP_DEATHS3_RANK1.1$DSWE <- vec1

#Export X_WB_DATA_UCDP_DEATHS3 to excel
write_xlsx(X_WB_DATA_UCDP_DEATHS3,"X_WB_DATA_UCDP_DEATHS3.xlsx")
#Export X_WB_DATA_UCDP_DEATHS3_RANK1 to excel
```

```r
write_xlsx(X_WB_DATA_UCDP_DEATHS3_RANK1,"X_WB_DATA_UCDP_DEATHS3_RANK1.xlsx")
#Export X_WB_DATA_UCDP_DEATHS3_RANK1.1 to excel
write_xlsx(X_WB_DATA_UCDP_DEATHS3_RANK1.1,"X_WB_DATA_UCDP_DEATHS3_RANK1.1.xlsx")


#For shortening purposes, duplicate X_WB_DATA_UCDP_DEATHS3_RANK1.1 into X_FF (apart from changes made in the following code, X_WB_DATA_UCDP_DEATHS3_RANK1.1 and X_FF will be the same data-frame just with a different name!)
X_FF <- X_WB_DATA_UCDP_DEATHS3_RANK1.1
#In X_FF, rename RANK variable to CPIR
names(X_FF)
X_FF <- X_FF %>% select(`ISO3`, `COUNTRY`, `UCDPD`, `UCDPDS`, `GDPC`, `UNEM`, `MAST`, `RPOP`, `FUEL`, `LAND`, `CPIR` = RANK, `TNPAG`, `TNPAGL`, `DSHE`, `DSWE`)
#Export X_FF to excel
write_xlsx(X_FF,"X_FF.xlsx")

#Classification Model with variables: GDPC; UNEM; MAST; RPOP; CPIR; TNPAGL; FUEL
X_RAW <- X_FF
X_DAT <- X_RAW[c("GDPC","MAST","UNEM","RPOP","CPIR","FUEL","TNPAGL")]
# Missing values
set.seed(1234)
library(missForest)
X_IMP <- missForest(X_DAT)$ximp
# Logarithmic function
X_LOG <- as.data.frame(sapply(X_IMP, log))
# Classification
X_LOG$Chaos <- ifelse(X_RAW$DSHE >= 10, 1, 0)
X_fit <- glm(Chaos ~ GDPC + MAST + UNEM + RPOP + CPIR + FUEL + TNPAGL, data = X_LOG, family = "binomial")
X_LOG$ChaosProb <- predict(fit, data = X_LOG, type = "response")
X_LOG$ChaosPred <- ifelse(X_LOG$ChaosProb >= 0.5, 1, 0)
# Confusion matrix, Sensitivity Specificity
table(X_LOG$Chaos, X_LOG$ChaosPred)
# ROC-curve & AUC
library(ROCR)
X_DIAGNOSEDATEN <- prediction(X_LOG$ChaosPred, X_LOG$Chaos)
X_ROC.KURVE <- performance(X_DIAGNOSEDATEN, measure = "tpr", x.measure = "fpr")
X_AUC <- performance(X_DIAGNOSEDATEN, measure = "auc")@y.values[[1]]
plot(X_ROC.KURVE, xlab = "False Alarm Rate", ylab = "Hit Rate", main = "ROC-Curve")
abline(a = 0, b = 1, col = "red")
text(0.8, 0.2, paste("AUC:", toString(round(X_AUC, digits = 3)), sep = " "))
#Test Book: Kuhn & Johnson 2013: p.266, section 11.4 + online Info
library("caret")
confusionMatrix(table(X_LOG$Chaos, X_LOG$ChaosPred))
summary(X_fit)
```

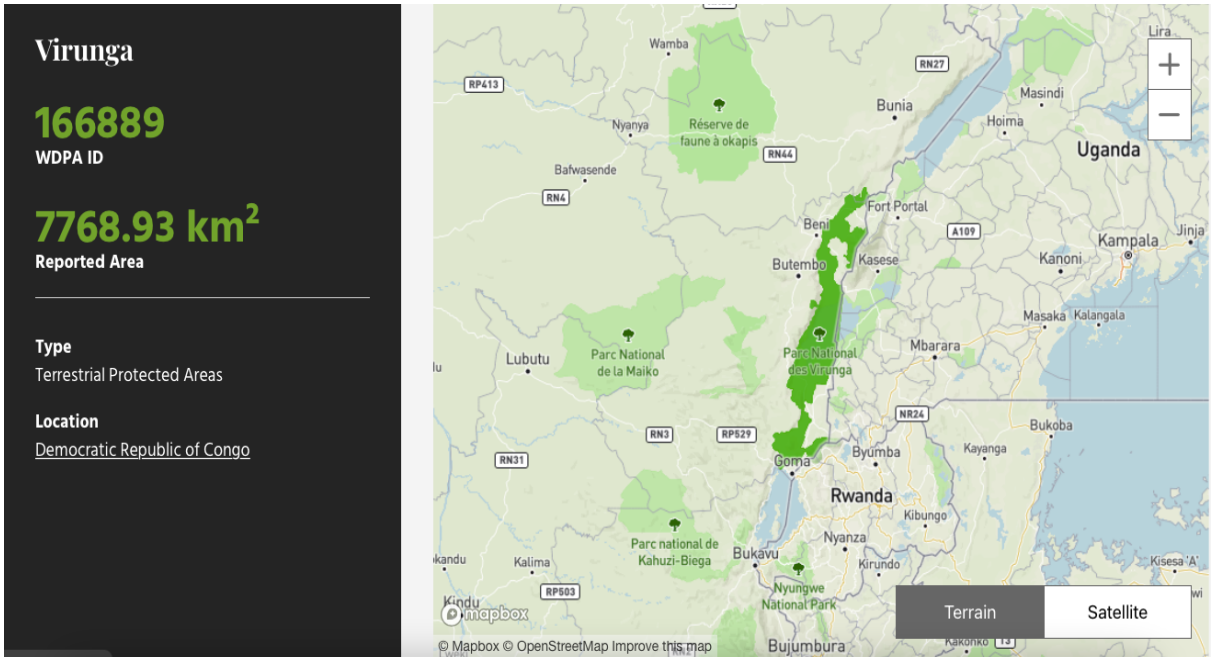
```r
#Output ConfusionMatrix results
capture.output(confusionMatrix(table(X_LOG$Chaos, X_LOG$ChaosPred)), f
ile = "Confusion_Output_NEW_X.csv")
stargazer(X_fit, title = "GLM_Output", style = "default", decimal.mark
= ",", out = "GLM_Output_NEW_X.html")
#Export X_LOG to excel
write_xlsx(X_LOG,"X_LOG.xlsx")

#Test variable changes throughout the sampling process
#First Filtering Step: 189 countries
#Take X_All_Regions_no_duplicate1 and duplicate and clear all columns
except ISO3
X_All_Regions_no_duplicate1.2 <- X_All_Regions_no_duplicate1
X_All_Regions_no_duplicate1.2 <- X_All_Regions_no_duplicate1.2[, -c(1:
28)]
X_All_Regions_no_duplicate1.2$SUPP_INFO <- NULL
X_All_Regions_no_duplicate1.2$CONS_OBJ <- NULL
#Arrange ISO3 alphabetically
X_All_Regions_no_duplicate1.2 <- arrange(X_All_Regions_no_duplicate1.2
, ISO3)
#Merge X_All_Regions_no_duplicate1.2 with X_WB_DATA_1
X_189_WB_DATA_1 <- merge(X_All_Regions_no_duplicate1.2, X_WB_DATA_1)
#Convert from character variables into numeric variables
X_189_WB_DATA_1 <- transform(X_189_WB_DATA_1, GDPC = as.numeric(GDPC))
X_189_WB_DATA_1 <- transform(X_189_WB_DATA_1, UNEM = as.numeric(UNEM))
X_189_WB_DATA_1 <- transform(X_189_WB_DATA_1, MAST = as.numeric(MAST))
X_189_WB_DATA_1 <- transform(X_189_WB_DATA_1, RPOP = as.numeric(RPOP))
X_189_WB_DATA_1 <- transform(X_189_WB_DATA_1, FUEL = as.numeric(FUEL))
X_189_WB_DATA_1 <- transform(X_189_WB_DATA_1, LAND = as.numeric(LAND))
X_189_WB_DATA_1 <- transform(X_189_WB_DATA_1, Rank = as.numeric(Rank))
#Leaves only data for 158 countries
#Summary 158 countries (All countries (possible) with National Parks w
orldwide)
summary(X_189_WB_DATA_1)
#Second Filtering Step: 78 countries
#Convert from character variables into numeric variables
X_WB_DATA_UCDP_DEATHS1 <- transform(X_WB_DATA_UCDP_DEATHS1, GDPC = as.
numeric(GDPC))
X_WB_DATA_UCDP_DEATHS1 <- transform(X_WB_DATA_UCDP_DEATHS1, UNEM = as.
numeric(UNEM))
X_WB_DATA_UCDP_DEATHS1 <- transform(X_WB_DATA_UCDP_DEATHS1, MAST = as.
numeric(MAST))
X_WB_DATA_UCDP_DEATHS1 <- transform(X_WB_DATA_UCDP_DEATHS1, RPOP = as.
numeric(RPOP))
X_WB_DATA_UCDP_DEATHS1 <- transform(X_WB_DATA_UCDP_DEATHS1, FUEL = as.
numeric(FUEL))
X_WB_DATA_UCDP_DEATHS1 <- transform(X_WB_DATA_UCDP_DEATHS1, LAND = as.
numeric(LAND))
X_WB_DATA_UCDP_DEATHS1 <- transform(X_WB_DATA_UCDP_DEATHS1, Rank = as.
numeric(Rank))
#Summary 78 countries (All countries with National Parks and violent c
onflicts)
summary(X_WB_DATA_UCDP_DEATHS1)
```

```r
#Third Filtering Step: 25 countries
#Summary 25 countries (All countries with National Parks with violent conflict within their territory)
summary(X_WB_DATA_UCDP_DEATHS3_RANK1)


#National Park (Rank A) Interactive Map
library(leaflet)
Map1Data <- data.frame(
  lat = c(35.593476, 40.340554, 39.001485, -2.977800, 11.207034, 5.841669, 4.197904, 4.615492, 4.268162, -10.462730, -1.291034, 1.445147, 0.511190, 8.978376, 6.429494, 2.485938, 36.357343, 7.953752, 9.002756, -4.622372, 29.680194, 0.561010, -4.257559, 1.802438, 11.734609, 19.032172, 18.830328, 28.074826, -12.661460, 14.545276, 6.011358, 10.658704, 43.242360, 6.353637, 6.013842, 35.195858, 0.838680, 10.558273),
  lng = c(70.903704, 45.332448, 46.068839, 29.504555, 1.572303, -7.183890, 9.137042, 8.927568, 29.497721, 27.730317, 29.163008, 28.364831, -72.888324, -73.216066, -72.280445, -74.138385, 2.804611, 39.444508, 40.377402, 138.017555, 52.745698, 37.614432, 39.414428, 35.648522, 102.988628, -99.080456, -97.133293, 97.845265, 40.272028, 120.994045, 121.055260, 123.244679, 42.604213, 33.826686, 101.355408, 8.677188, 30.057408, -66.792408),
  Description=c("Nuristan", "Sevan", "Zangazur National Park", "Kibira", "Boucle de la Pendjari", "Taï National Park", "Mount Cameroun", "Ndongere", "Garamba", "Kundelungu", "Virunga", "Okapis", "Serrania de Chiribiquete", "Catatumbo Bari", "El Cocuy", "Tinigua", "Chréa", "Arsi Mountains", "Halledeghe Asobot", "Lorentz", "Bamou", "Buffalo Springs", "Shimba Hills", "South Turkana", "Southern Kravanh", "El Tepozteco", "Cañón del Río Blanco", "Hkakaborazi National Park", "Quirimbas", "Manila Bay Beach Resort National Park", "Mt. Dajo National Park", "Northern Negros Natural Park", "Priel`brus`e", "Boma", "Bang Lang", "Chambi", "Semuliki", "Waraira Repano"),
  Size=c(480, 2, 6, 1, 1, 21, 5, 10, 16, 65, 1108, 10, 12, 5, 13, 1, 7, 4, 44, 62, 8, 21, 1, 7, 1, 2, 50, 4, 491, 1, 22, 7, 7, 150, 14, 52, 7, 1),
  Size1=c(442, 2, 6, 1, 1, 21, 5, 10, 16, 65, 1091, 10, 12, 5, 13, 1, 7, 4, 38, 56, 8, 21, 1, 7, 1, 2, 50, 2, 449, 1, 22, 7, 7, 150, 14, 46, 7, 1),
  Country=c("Afghanistan", "Armenia", "Azerbaijan", "Burundi", "Benin", "Cote d'Ivoire", "Cameroon", "Cameroon", "Congo, Dem. Rep.", "Congo, Dem. Rep.", "Congo, Dem. Rep.", "Congo, Dem. Rep.", "Colombia", "Colombia", "Colombia", "Colombia", "Algeria", "Ethiopia", "Ethiopia", "Indonesia", "Iran, Islamic Rep.", "Kenya", "Kenya", "Kenya", "Cambodia", "Mexico", "Mexico", "Myanmar", "Mozambique", "Philippines", "Philippines", "Philippines", "Russian Federation", "South Sudan", "Thailand", "Tunisia", "Uganda", "Venezuela, RB"))

leaflet() %>%addTiles() %>%addCircleMarkers(data = Map1Data, lat=~lat, lng=~lng)
leaflet() %>%addTiles() %>%addCircleMarkers(data = Map1Data, lat=~lat, lng=~lng, radius = ~3)

#Popup fields
```

```
Map1Data <- Map1Data %>% mutate(popup_info=paste("National Park:",Desc
ription, "<br/>", "Deaths (High Estimate):",Size, "<br/>","Deaths:",Si
ze1, "<br/>", "Location:",Country))
leaflet() %>%addTiles() %>%addCircleMarkers(data = Map1Data, lat=~lat,
lng=~lng, radius = ~3, popup = ~popup_info)
#color gradient for deaths
colors <- c("green", "red")
pal <- colorFactor(colors, Map1Data$Size)
leaflet() %>%addTiles() %>%addCircleMarkers(data = Map1Data, lat=~lat,
lng=~lng, radius = ~3, popup = ~popup_info, color = ~pal(Size))
#Export to html link
ParkMap <- leaflet() %>%addTiles() %>%addCircleMarkers(data = Map1Data
, lat=~lat, lng=~lng, radius = ~3, popup = ~popup_info, color = ~pal(S
ize))
library(htmlwidgets)
saveWidget(ParkMap, file="ParkMap.html")
#Published through rPub
#Final link: http://rpubs.com/cmh_96/NPMap
```

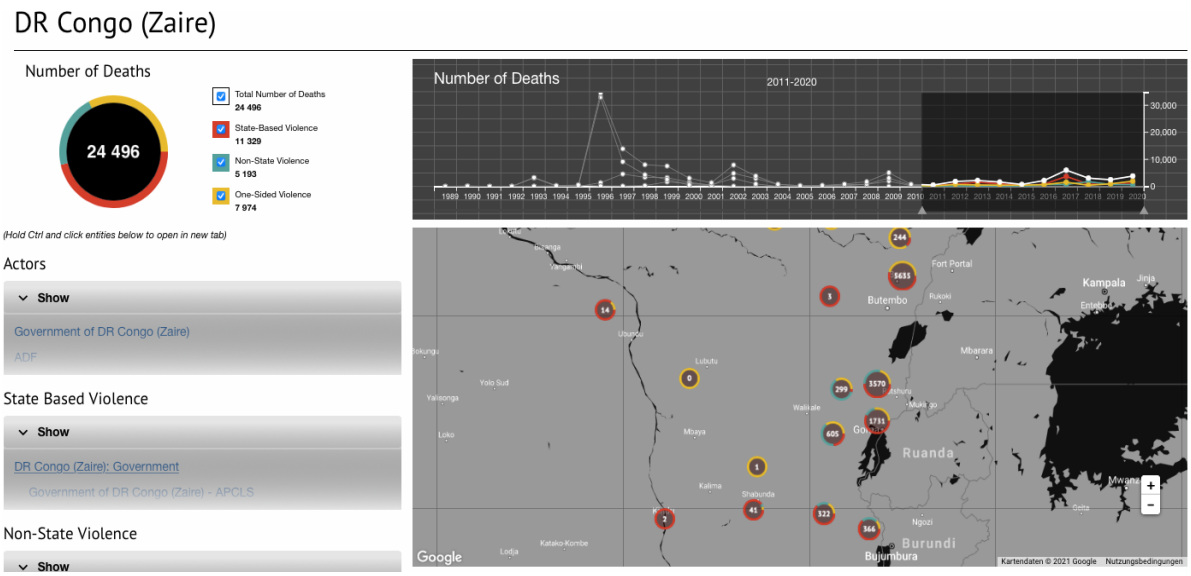
Source: Author's computation using data from Protected Planet (2021), UCDP (2021), World Bank (2021), Transparency International (2021).

Appendix B.
Protected Planet Map (Example: Virunga National Park)



Source: Protected Planet (2021).

Appendix C.
UCDP Map (Example: DRC, Focus on Virunga National Park region)



Source: UCDP (2021).

Appendix D.
National Parks affected by violent conflicts – Country details

Country	Reports	National Parks	Actors	Violence Type	Date
Afghanistan	67	1	Government of Afghanistan, Taleban, IS, Al-Qaida, United States of America, Civilians	State-Based: 66 One-Side: 1	2011: 7 2012: 9 2013: 9 2014: 6 2015: 3 2016: 4 2017: 6 2018: 10 2019: 10 2020: 3
Armenia	1	1	Government of Azerbaijan, Republic of Artsakh	State-Based: 1	2020: 1
Azerbaijan	5	1	Government of Azerbaijan, Republic of Artsakh	State-Based: 5	2014: 2 2016: 1 2018: 1 2020: 1
Burundi	1	1	Government of Burundi, Military faction (Forces of Godefroid Niyombare)	State-Based: 1	2015: 1
Benin	1	1	IS, Civilians	One-Side: 1	2019: 1
Cote d'Ivoire	2	1	Burkinabé, Guéré	Non-State: 2	2011: 2
Cameroon	3	2	Government of Cameroon, Ambazonia Insurgents, Civilians	State-Based: 1 One-Side: 2	2019: 1 2020: 2
Democratic Republic of the Congo	120	4	Government of DR Congo (Zaire), Government of Rwanda, Government of Uganda, LRA,	State-Based: 63 One-Side: 54 Non-State: 3	2011: 5 2012: 6 2013: 10 2014: 7

			Kata Katanga, M23, FDLR, CMC, Hutu, Nande, Mayi Mayi Mazembe, NDC-R, UPCP, ADF, IS, UPLC, Mayi Mayi Simba, Civilians		2015: 10 2016: 6 2017: 18 2018: 15 2019: 13 2020: 32
Colombia	12	4	Government of Colombia, FARC Dissidents, ELN, Civilians	State-Based: 6 One-Side: 6	2011: 1 2013: 1 2018: 5 2019: 2 2020: 3
Algeria	1	1	Government of Algeria, AQIM	State-Based: 1	2013: 1
Ethiopia	5	2	Government of Ethiopia, Amhara (Guraghe), Oromo, OLF, Civilians	State-Based: 1 One-Side: 3 Non-State: 1	2013: 1 2016: 1 2017: 1 2019: 1 2020: 1
Indonesia	15	1	Government of Indonesia, OPM, Civilians	State-Based: 12 One-Side: 3	2013: 1 2014: 3 2018: 3 2019: 7 2020: 1
Iran	1	1	Government of Iran, IS	State-Based: 1	2018: 1
Kenya	5	3	Government of Kenya, Samburu, Turkana, Pokot, Civilians	One-Side: 1 Non-State: 4	2014: 3 2015: 1 2020: 1
Cambodia	1	1	Government of Cambodia (Kampuchea), Civilians	One-Side: 1	2012: 1
Mexico	19	2	Government of Mexico, Jalisco Cartel New Generation, Los Rojos, Los Zetas, Civilians	One-Side: 1 Non-State: 18	2016: 1 2017: 7 2018: 3 2019: 5 2020: 3
Myanmar	2	1	Government of Myanmar (Burma), KIO, Civilians	State-Based: 1 One-Side: 1	2013: 2
Mozambique	96	1	Government of Mozambique, IS, Ansar al-Sunnah, Civilians	State-Based: 29 One-Side: 67	2018: 5 2019: 16 2020: 75
Philippines	8	3	Government of Philippines, ASG, CPP, Civilians	State-Based: 7 One-Side: 1	2011: 1 2015: 1 2016: 2 2018: 2 2019: 1 2020: 1
Russian Federation	1	1	Government of Russia (Soviet Union), Forces of the Caucasus Emirate	State-Based: 1	2011: 1

South Sudan	4	1	Jie, Murle, Bor Dinka (Lou Nuer), Lou Nuer	Non-State: 4	2012: 1 2018: 2 2020: 1
Thailand	9	1	Government of Thailand, Patani Insurgents, Civilians	State-Based: 6 One-Side: 3	2011: 2 2013: 1 2014: 2 2015: 1 2016: 1 2019: 1 2020: 1
Tunisia	18	1	Government of Tunisia, AQIM, Civilians	State-Based: 17 One-Side: 1	2013: 5 2014: 7 2015: 2 2017: 1 2018: 2 2019: 1
Uganda	1	1	Bakonzo, Bamba	Non-State: 1	2016: 1
Venezuela	1	1	Government of Venezuela, Civilians	One-Side: 1	2017: 1

Source: Author's computation using data from Protected Planet (2021), UCDP (2021).

Appendix E.
National Parks established during colonial times

Country	Independence	National Park	National Park Designation Year
Burundi	1960	Kibira	1934
DRC	1960	Garamba	1938
DRC	1960	Virunga	1925
Philippines	1946	Mt. Dajo National Park	1938
South Sudan	2011	Boma	1986

Source: Author's computation using data from Protected Planet (2021).