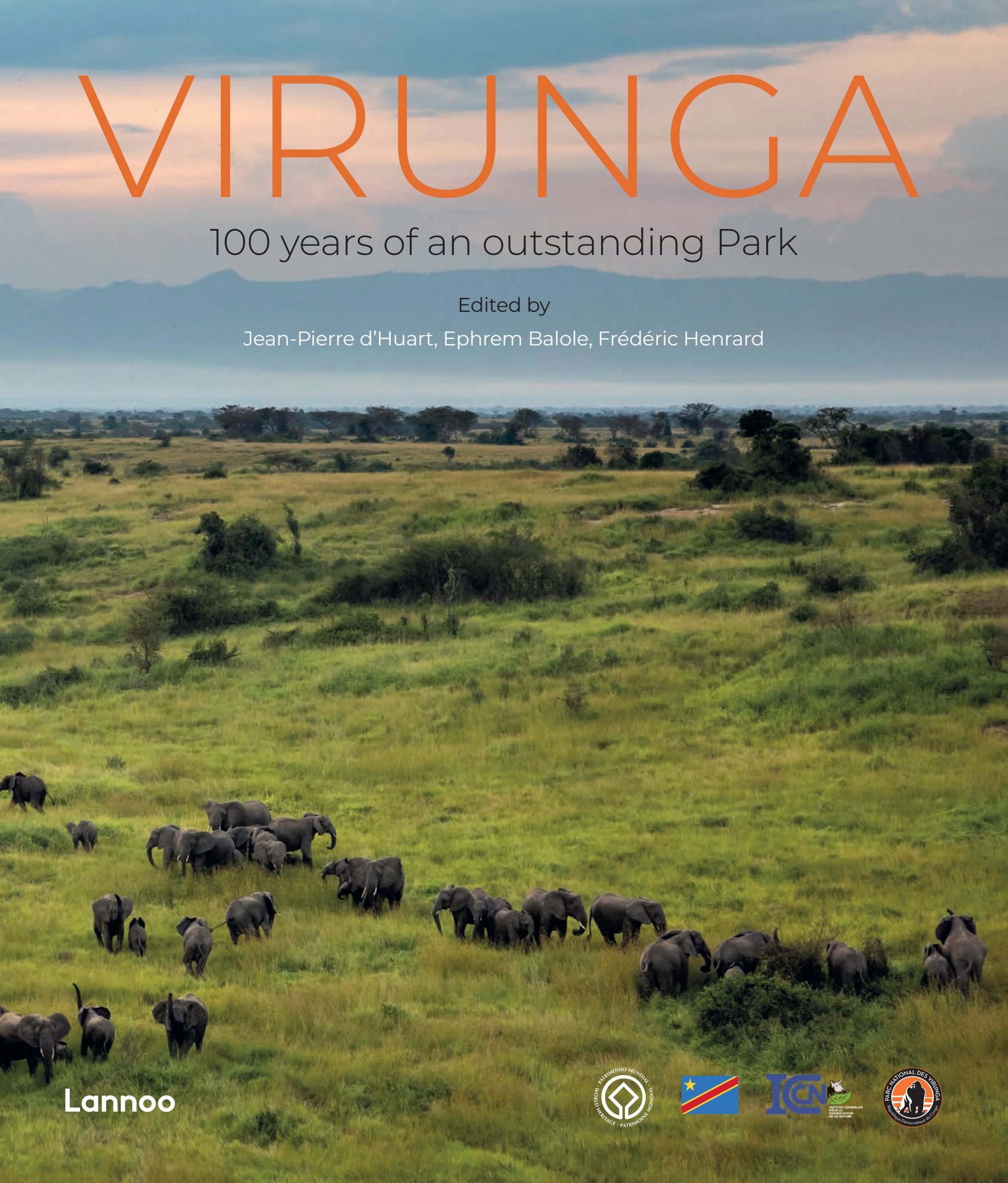
VIRUNGA

100 years of an outstanding Park

Edited by

Jean-Pierre d'Huart, Ephrem Balole, Frédéric Henrard



Lannoo

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The authors have used the most common and/or most recent taxonomy. However, it has not always been possible to apply the latest nomenclatural recommendations. Where this is the case, it does not imply any disagreement with the most recently introduced taxonomy.

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Any information on the content of the present publication can be obtained from info@virunga.org. Comments or questions about the publication can be sent to art@lannoo.com.

Introduction

A century of history

100 years of dynamics

Challenges and perspectives

Conclusion

Appendix

INTRODUCTION

0.1 Smoke rising from the summit of the Nyiragongo volcano.

Preamble

MARC LANGUY, EMMANUEL DE MERODE

Located in eastern DRC, Virunga National Park (*Parc National des Virunga* – PNVi) is the protected area of all superlatives. Not only is it the oldest national park in Africa, but it is also the richest in biodiversity and landscapes. Unfortunately, it is also the national park that faces the most pressures and challenges, holding the tragic record for the highest number of rangers who have lost their lives guarding a protected area.

These characteristics make the history of the Park unique, marked by cycles of construction and destruction, hope and despair, discoveries, mobilisations, desire and passion. Despite the challenges, 100 years after its creation, the PNVi still stands. It has retained its exceptional character and is increasingly contributing to the development and stabilisation of North Kivu, offering hope for its continued existence for the next 100 years, despite the troublesome context of its centennial. The survival of the PNVi, both past and future, is owed to the courage and dedication of its rangers and civilian staff, supported by many local, national and international actors. This book aims to pay tribute to their efforts and sacrifices.

The 100th anniversary of the PNVi is an opportunity to rediscover the biological and human treasures it holds, recall its history, document the challenges and the responses provided by its teams, and suggest pathways for its future. This book is therefore organised into five thematic sections:

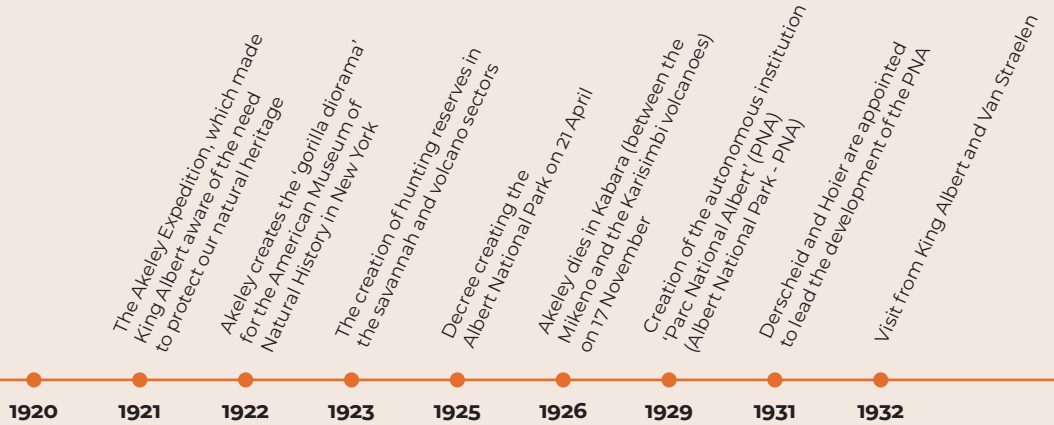
- a factual description of the Park's habitats and biodiversity;
- an overview of 100 years of an extraordinary history;
- the evolution of dynamics affecting its biodiversity, landscapes and management model;
- the challenges posed in terms of security and politics, as well as the bold response of the Virunga Alliance to save the Park and transform it into a driver of sustainable development;
- lessons learned and perspectives for the next 100 years.

This book builds on a first edition published in 2006 (*Virunga. The Survival of Africa's First National Park*, Languy & de Merode), particularly concerning the history of the PNVi in the 20th century. The section on dynamics has been largely rewritten and fully updated with data collected up to 2024, while the chapters on current challenges and perspectives are entirely new.

In the same spirit as the 2006 edition, this work was written by over 50 authors, co-authors and contributors of 8 different nationalities, from various institutions, all with an intimate knowledge of the Park. Its coordinating editorial committee comprised Ephrem Balole, Méthode Baguru-

TIMELINE 1920-2025:

Some notable events marking the century of existence of Africa's first park



bumwe, Jean-Pierre d'Huart, Emmanuel de Merode, Frédéric Henrard and Marc Languy.

Overview of the PNVi

The first chapter presents and summarises the key features of the Park. It is based on a review of the considerable quantities of scientific work carried out since 1925. Few parks attract as much interest from the scientific community, especially in the French-speaking literature, to the point that it is difficult to mention all publications. For this reason, a bibliography listing the main sources of information on the PNVi is appended.

100 years of history

The six chapters of the second section recount the history of the PNVi. They document the creation of Africa's first national park and the efforts to keep it alive through Congo's turbulent past.

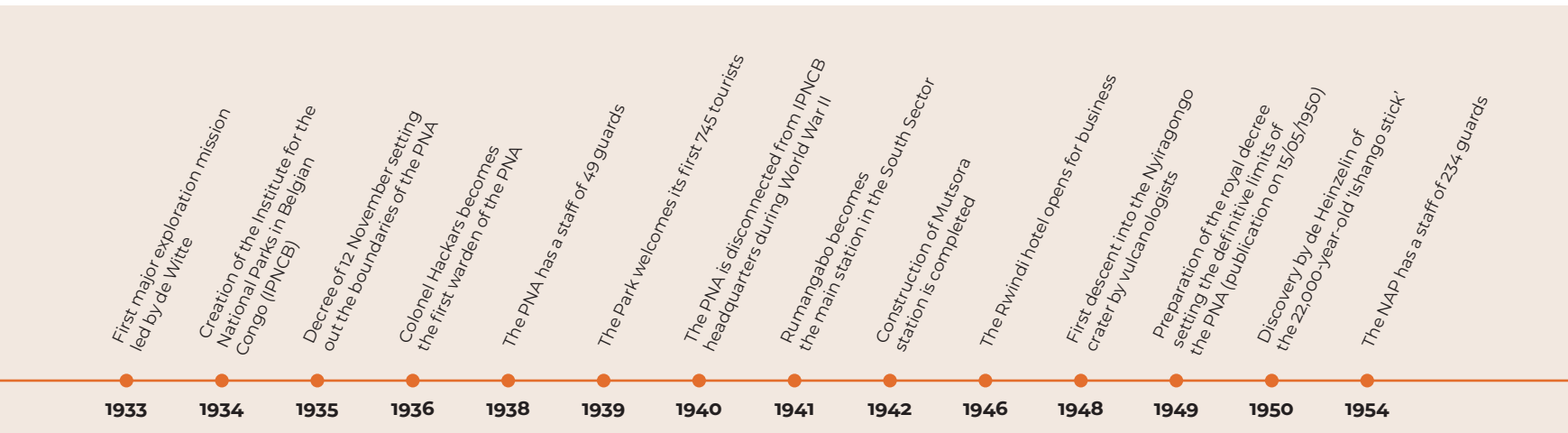
In chapter 2, Patricia Van Schuylenbergh, drawing on her years of research devoted to Congo's national parks, reviews the historical sources from the early 20th century. Her analysis details the legal and social processes surrounding the creation of the PNVi, the establishment of its boundaries and its subsequent extensions.

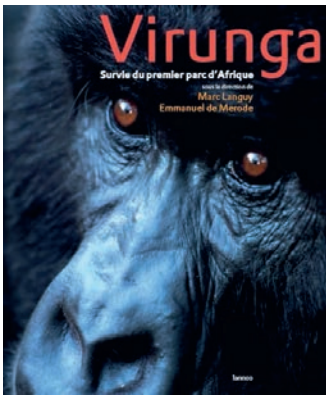
Chapter 3 also draws on a review of the literature. During preparations for the first edition, it became clear that few people have as thorough an understanding of the events as Jacques Verschuren, who dedicated his whole life to the PNVi. This chapter recounts the personal experiences of a man who lived in the Park for over 50 years. As a young researcher, curator, chief curator and eventually Director of the Congolese Institute for Nature Conservation (*Institut Congolais pour la Conservation de la Nature* – ICCN), Verschuren tells the story and pays tribute to those who built the PNVi from its earliest days.

Verschuren also wrote chapter 4 on the post-colonial history of the PNVi during its golden age from 1960 to 1989. His co-author, Samy Mankoto Ma Mbaelele, had a remarkably similar professional career to his mentor's and succeeded him as Director of the Institute. Together, they provide a historical chapter that covers a generally prosperous period in the PNVi's history.

Chapter 5, written by José Kalpers and Norbert Mushenzi, describes the challenging years from 1992 to 2005. This was a transitional period, marked by changes in political regimes, the impact of the Tutsi genocide in Rwanda, and the wars of 1996–1997 and 1998–2002, in a country that had meanwhile been renamed 'Democratic Republic of Congo'. The authors were actively involved in efforts to ensure the survival of the PNVi during this pivotal period, the first as coordinator of a mountain gorilla protection programme and the latter as chief curator of the Park.

Chapter 6 traces the history of the PNVi over the past 20 years, with the emergence of new challenges related to armed conflicts that are still ongoing at the time of writing and the growing pressure exerted by local or displaced populations. This section also describes how, in parallel, the PNVi has created new conservation and development opportunities. No one was better placed than Emmanuel de Merode, Director of the PNVi since 2008, to write this chapter. François-Xavier de Donnea, Belgian Minister of State, member of the Virunga Foundation Board of Directors and well-acquainted with the Congolese politi-





0.2 The first edition of the book, in 2006, highlights the key developments of the Park during the 20th century.

cal and security landscape, is his co-author, together with Rodrigue Mugaruka, the PNVi's Deputy Director.

Chapter 7 closes the historical section by highlighting the unparalleled prestige of the PNVi. In this chapter, Frédéric Henrard and Patricia Van Schuylenbergh recall the Park's renown from its creation to the present day. They explain how its resilience and vulnerability are intertwined, a paradox that becomes apparent when considering the incredible local, national and international support the PNVi receives, encouraged by significant media exposure. This chapter also discusses the notion of the Park's 'Outstanding Universal Value', justifying its inscription on the UNESCO World Heritage List.

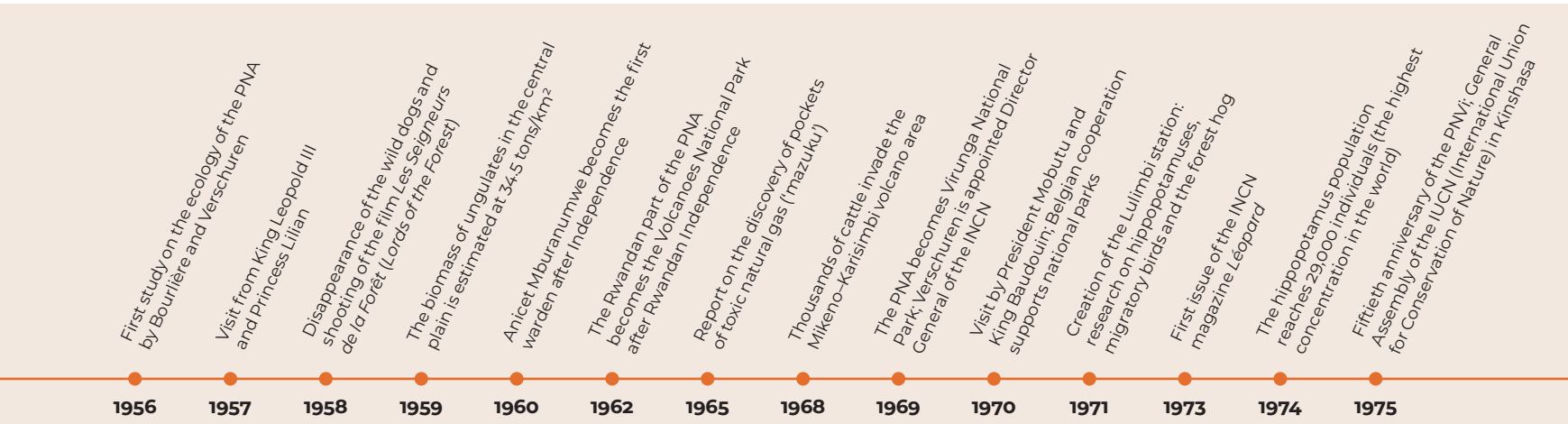
100 years of dynamics

In this third section, the authors highlight the natural and human dynamics that have shaped the PNVi and how it has changed over the years. The Park has indeed undergone, and continues to undergo, multiple pressures to which successive managers have responded. By documenting these dynamics, the book describes the strong resilience of the PNVi, which is an essential element of its survival.

Ibirunga means 'volcanoes' in Kinyarwanda, and chapter 8 explores the Park's geology, focusing on the volcanological processes of the past 100 years. The PNVi is dominated by several extinct and two active volcanoes, largely responsible for the region's exceptional biodiversity. Dario Tedesco et al., complementing Jacques Durieux's 2006 text, trace the volcanic history, with a particular emphasis on the Nyiragongo and Nyamulagira volcanoes, and provide an overview of their future dynamics.

Climate change, in particular direct anthropogenic pressures (agriculture, charcoal production and fisheries) and indirect pressures (changes in elephant and hippopotamus populations), strongly impact the PNVi's vegetation. In chapter 9, Sébastien Desbureaux et al. document the vegetation dynamics since 1930 using photographs and satellite images. The Park's major habitats have been monitored for nearly a century and, remarkably, periodic photos from 1930 to the present offer unparalleled scientific documentation of the changes that have occurred.

The dramatic changes in large mammal populations are presented in chapter 10. For 60 years, censuses have been conducted regularly, though often using different techniques. Moreover, the wide variety of the PNVi's habitats requires techniques specifically adapted to each biotope. Despite these difficulties, building on Marc Languy's 2006 chapter, Sébastien Desbureaux et al. update the data and analyses on key large mammal species. The chapter describes the dramatic fate of many species, yet also the recovery, since 2018, of elephant, hippopotamus and mountain gorilla populations, which provides a strong



message of hope regarding the Park's potential for further rehabilitation.

The dynamics in Lake Edward are addressed by Henrard et al. in chapter 11. The authors consolidate and revisit the two chapters dedicated to the lake in the 2006 edition, trace its complex history – crystallising political, economic and environmental issues since the PNVi's creation – and document the pressure exerted on the lake by legal and illegal fisheries. Lake Edward is an integral part of the PNVi, but fishing is allowed, and nearly 100,000 people depend on it for their livelihood. However, the steep decline in hippopotamus numbers and the uncontrolled development of illegal fisheries in the early 2000s threaten its fishing potential. By putting these dynamics into perspective, the authors explain the PNVi's approach to establishing a governance framework that protects ecosystems and sustains the socio-economic benefits for local populations.

Its variety of habitats, the multiple pressures on the Park, the volatile political and security context, and evolving environmental protection paradigms all contribute to the rich dynamic in its management approaches. In chapter 12, Jean-Pierre d'Huart et al. explain how the mandate of the PNVi has radically evolved. During the colonial era, the objectives were almost exclusively centred on exploration, conservation and research, all of which entailed the complete separation of natural processes and human activities.

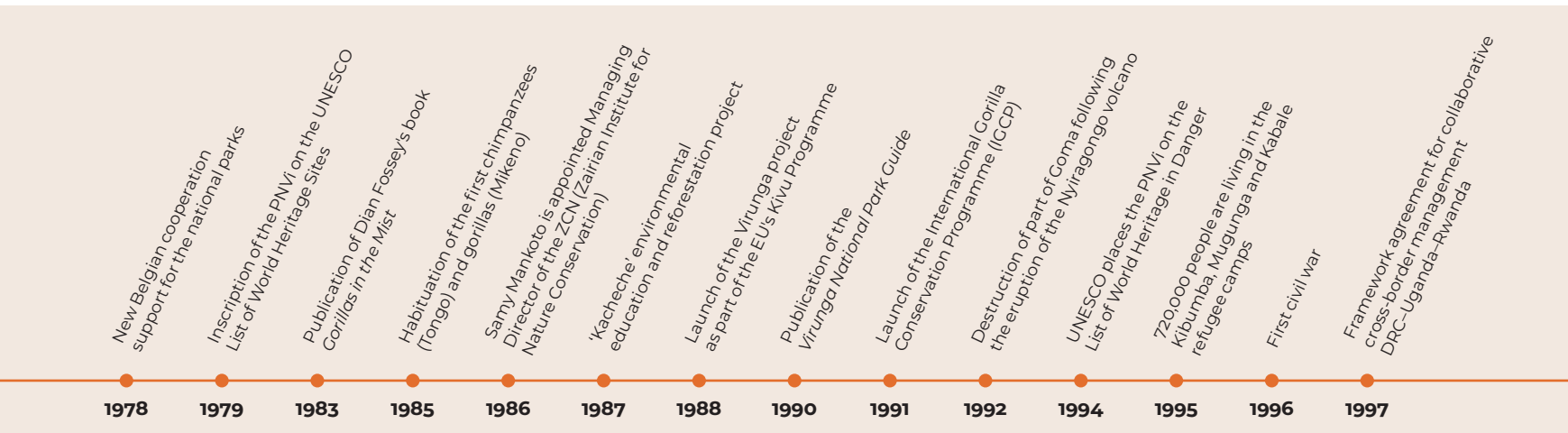
Starting in the 1990s, the PNVi became heavily dependent on external programmes and survived thanks to international funding that encouraged greater openness to the aspirations of local populations. The implementation of a public–private partnership in the 2010s represented a radical shift and positioned the PNVi as a societal and economic player within a sustainable economy approach. This approach, called the Virunga Alliance, is detailed in chapter 17.

The transboundary dynamics of natural resource management are described in chapter 13 by Jean-Pierre d'Huart et al. Located in the heart of the Albertine Rift, in the western branch of the Great African Rift, the PNVi is connected to five other national parks in Rwanda and Uganda, which are in turn directly adjacent to other protected areas. Its location makes the PNVi the backbone of a vast transboundary complex of protected areas. This chapter highlights the willingness of the authorities from the three countries to cooperate on ecosystem management and the shared challenges they face. While the threats are transboundary, the contiguity of the protected areas and the collaboration between their managers are also vectors for solutions.

Challenges and prospects

In their description of the tumultuous history of the PNVi and the various dynamics at work within its territory, the first sections of the book identify the challenges facing the protected area. The social, security and political context in which the PNVi's personnel operates is covered in this new section. It also describes the approaches used to meet these challenges.

Chapter 14 deals with a fundamental aspect of any future strategy: how can the PNVi ensure social and environmental justice in the context of the major socio-economic inequalities and growing demographic pressures that characterise North Kivu? Ephrem Balole – who wrote his doctoral thesis on the socio-economic value of the Park – and his co-authors show that the pressures and opportunity costs can be minimised if some conditions are met, including the restoration of the rule of law and improved governance. This



chapter provides the context in which the Virunga Alliance, the subject of chapter 17, was established.

In addition to its outstanding universal value, the PNVi is also known, sadly, for the armed conflicts that have been taking place in and around it for some thirty years. In chapter 15, Frédéric Henrard et al. tackle the complex subject of law enforcement interventions in the PNVi. They describe the landscape of armed groups, analyse the mandate of the ICCN and explain the security arrangements put in place to carry out interventions as per the law.

In chapter 16, Bagurubumwe et al. discuss the political and sociological context of the PNVi's boundaries. Far from being self-evident, the territorial determination of the Park results from a compromise between objectives: protecting ecosystems and granting legitimate access to natural resources to local populations, in particular access to land for farming. To be respected, the PNVi's boundaries must be recognised, understood and accepted by all stakeholders. The PNVi teams, building on the approach developed by WWF in the early 2000s, have developed a participatory demarcation methodology to achieve this objective.

Chapter 17 focuses on the Virunga Alliance, a vast programme to develop the PNVi's natural resources for the benefit of local communities. Based on the environmental and social injustice described above – an environmental wonderland declared a World Heritage Site that exists in a sea of poverty and violence – the Virunga Alliance aims to make the Park a lever for the development and stabilisation of North Kivu. The importance of the issue and the scale of the efforts made over the last 10 years justify covering the subject in several sections.

In section 17a, Emmanuel de Merode sets out the vision of the Virunga Alliance, its participatory working approach and its objectives: to protect and restore the Park, generate 1 billion dollars in annual economic activity, create 100,000 jobs and ensure the sustainability of the PNVi's funding.

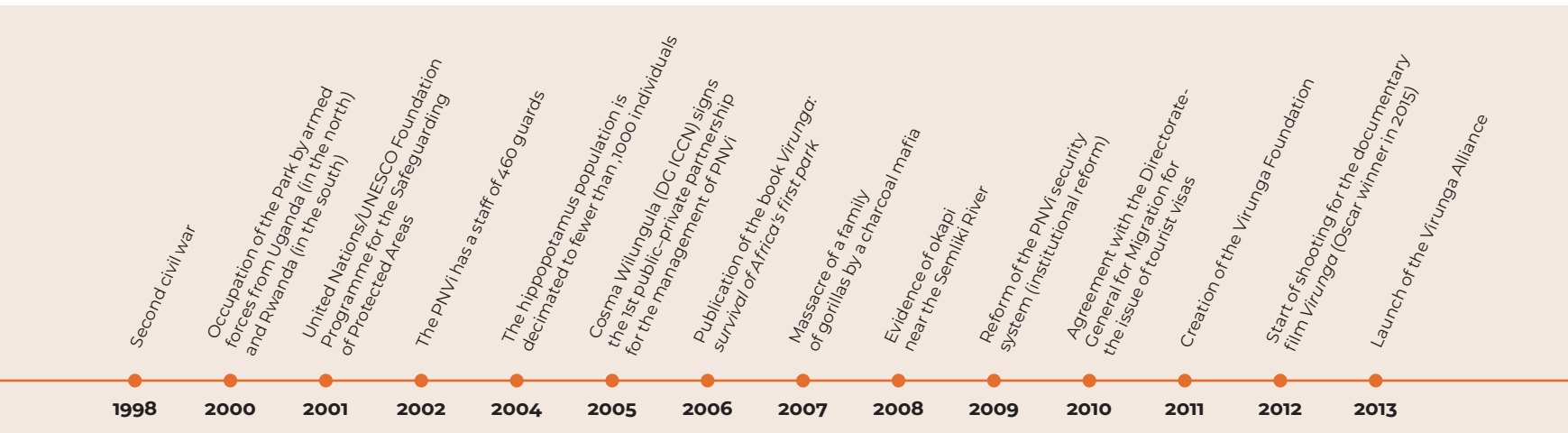
In section 17b, Williams et al. revisit the history of tourism in the Park, its successes and setbacks, and analyse its impact on local communities, the public and staff. In addition to the income it generates, tourism is the visiting card of the PNVi, North Kivu and even the whole country.

The Virunga Alliance's Energy programme is covered by Gabriel et al. in section 17c. They explain how the PNVi rivers are sources of clean, high-quality and inexpensive electricity, produced by Virunga Energies. The arrival of electricity in towns and villages is transforming the economy and the daily lives of its inhabitants. Outstanding engineering and huge investments have turned the PNVi into the largest electricity producer in eastern DRC.

As a corollary to the arrival of electricity, the development of entrepreneurship, at the heart of the new economic fabric, is explained in section 17d by Weinand et al. The PNVi stimulates economic activity by providing entrepreneurs with financial loans – according to a unique model based on their electricity consumption – and industrial parks.

In section 17e, Alard et al. discuss the final pillar of the Virunga Alliance, agriculture, which remains the province's leading sector of activity. The PNVi promotes agricultural value chains by working on harvest improvements, the transformation of raw crops into value-added products, and their distribution on local, national and international markets. This integrated approach, made possible by electricity and the prestige of the 'Virunga' brand, contributes to food resilience and revives a sense of pride.

Finally, in section 17f, Balole et al. analyse the impact of the Virunga Alliance, drawing on data from the initial scien-



tific research, and the impact of job creation on the reduction of violence and demobilisation of armed groups.

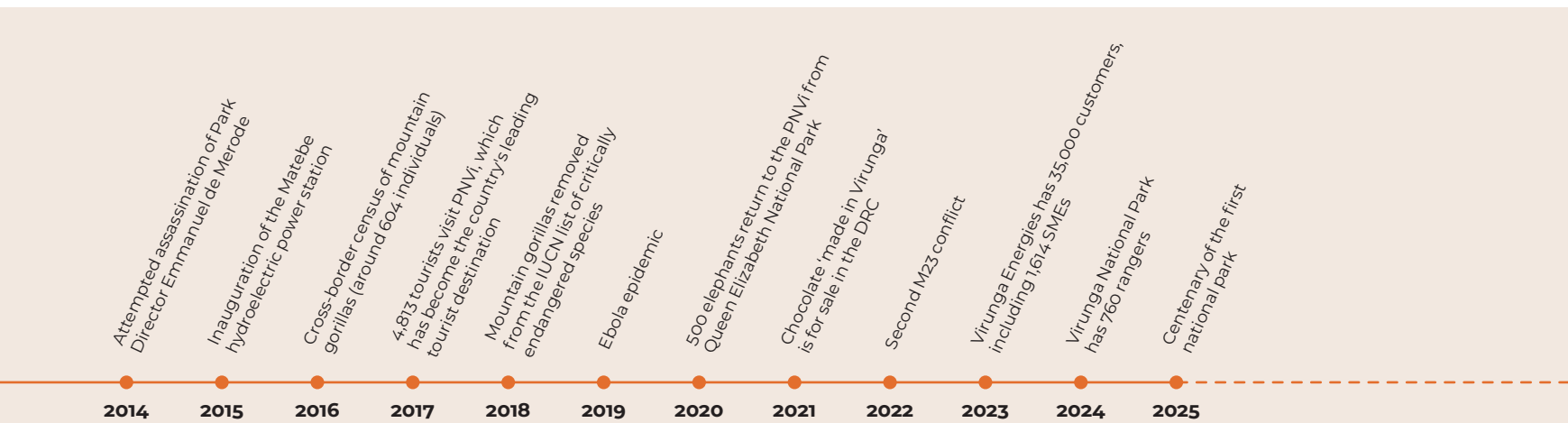
Conclusion

In chapter 18, the editorial committee collates the lessons learned over the first 100 years of the PNVi's history, from both its successes and unfortunate events. Based on this assessment, the book's authors highlight the conditions necessary for preserving the PNVi and discuss the conservation prospects for the next 100 years with optimism and realism. They also offer recommendations to achieve this long-term goal.

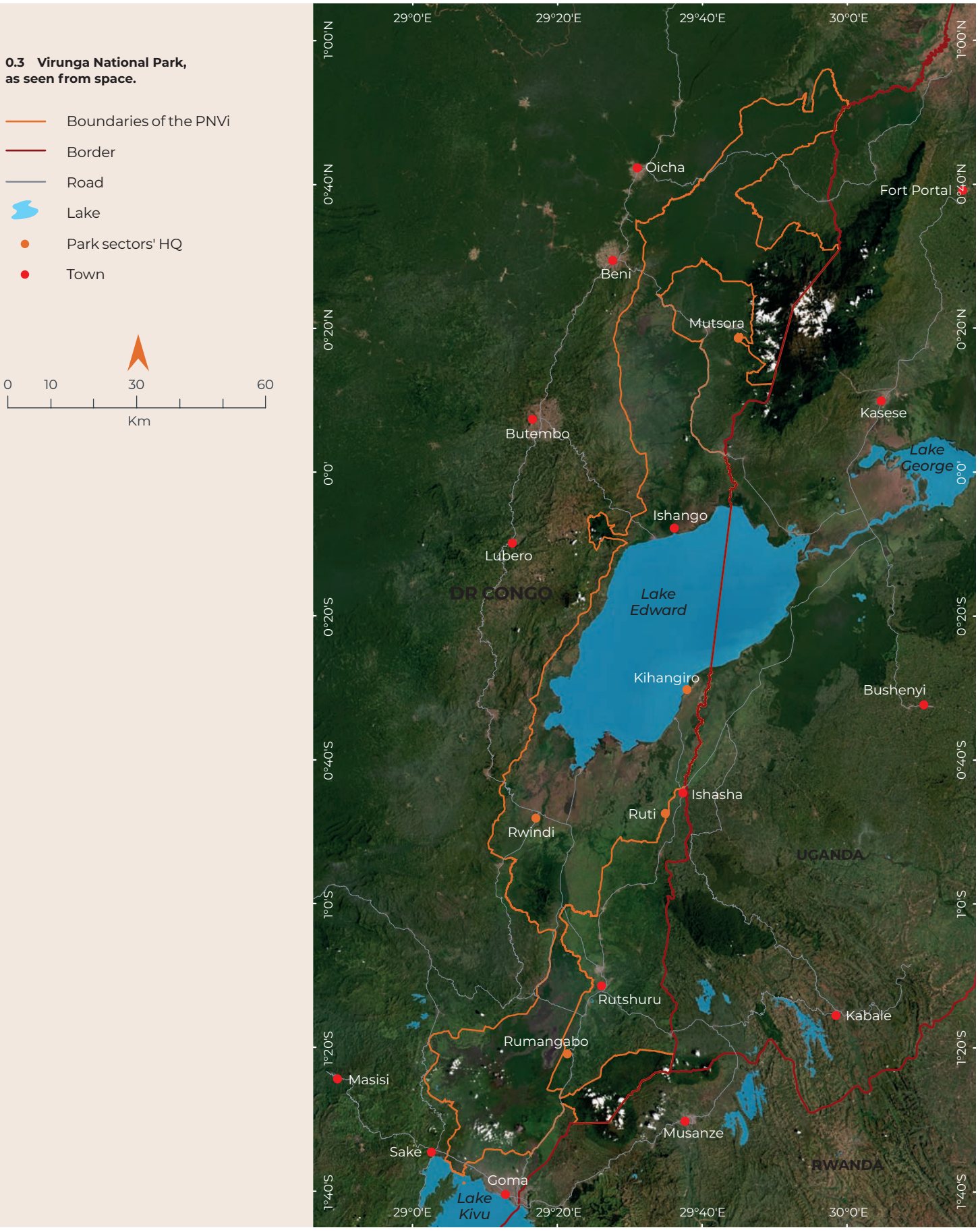
At the end of this volume, readers will find seven appendices, respectively: the acronyms used in the text; the Park's boundaries; wardens and directors; mammals; birds; biographies of authors and co-authors; and bibliographic sources.

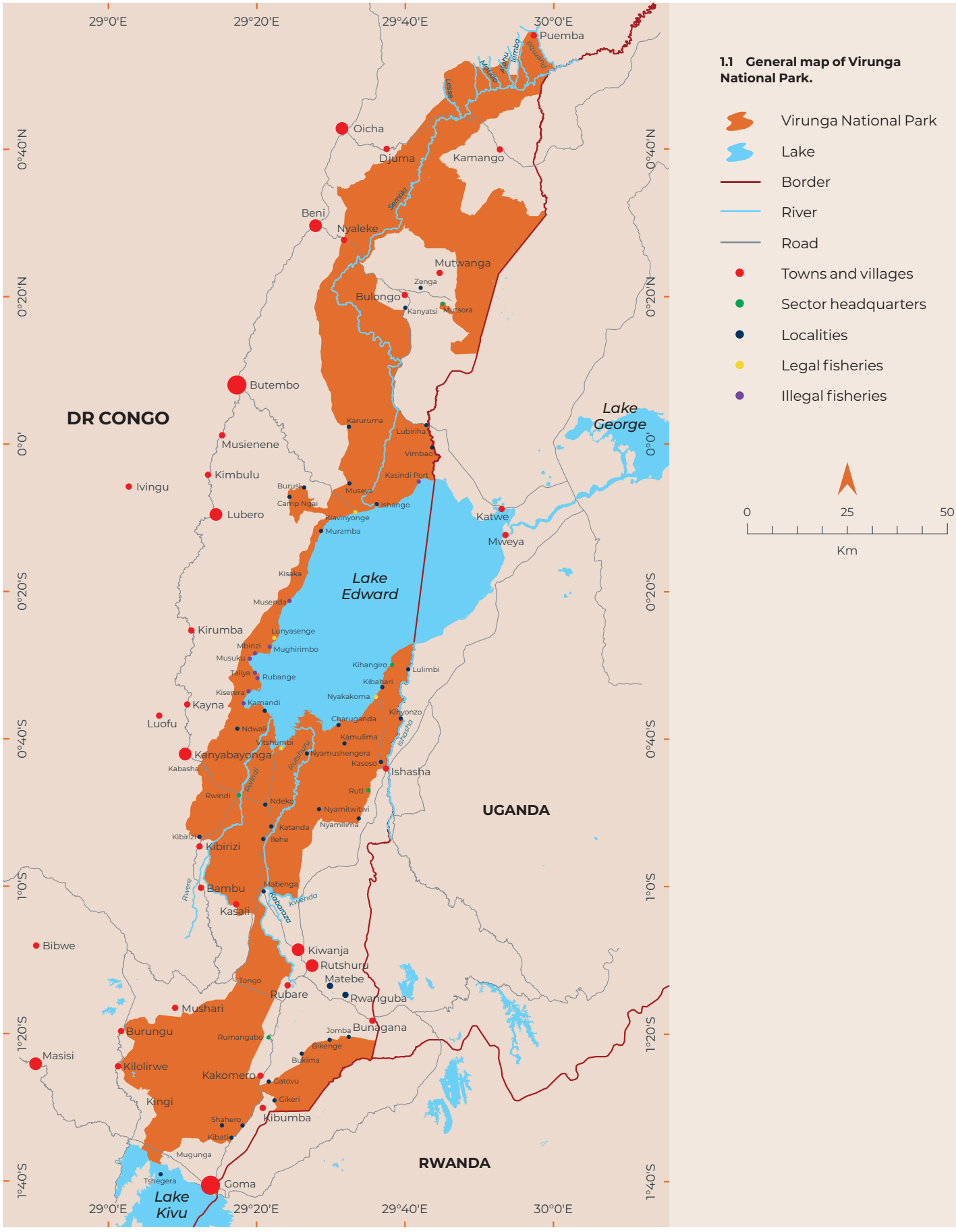
The authors of this book have been careful to give an objective account of the history and evolutions of the PNVi. The successes will remain sources of pride for a long time, while the failures will remind us daily of the importance of resilience.

It is our firm belief that the texts in this anniversary book celebrating the centenary of Africa's first natural park will be a milestone and a historical reference for all who cherish this priceless jewel, the green heart of the Democratic Republic of Congo.



0.3 Virunga National Park, as seen from space.

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Zenga
Bulongo
Kanyatsi
Mutsora
Butembo
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Karuruma
Lubiriha
Vimbado
Kasindi Port
Musienene
Kimbulu
Ivingu
Burusi
Camp Ngai
Museya
Ishango
Lubero
Kiavinyonge
Muramba
Katwe
Mweya
Lake George
Lake Edward
Kisaka
Musenda
Kirumba
Lunyasenge
Mbirizi
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Musuku
Taliya
Rubange
Kihangiro
Lulimbi
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Kiseresera
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Masisi
Bukima
Kilolirwe
Kakomero
Gatovu
Kingi
Gikeri
Kibumba
Shahero
Kibati
Mugunga
RWANDA
Tshegera
Goma
Lake Kivu
Lesse
Mbiliki
Semliki
Lamia
Ituri
Nzoia
Rwindi
Rutshuru
Ishasha
Rwenda
Kabonza
Rwere
0
25
50
Km
1.1 General map of Virunga National Park.
Virunga National Park
Lake
Border
River
Road
Towns and villages
Sector headquarters
Localities
Legal fisheries
Illegal fisheries

1

Overview of Virunga National Park

MARC LANGUY

The creation of the Park and its inscription on the World Heritage List are motivated by the protection of its exceptional fauna and its varied habitats. With more than 200 species of mammals and 700 species of birds, Virunga National Park is the richest protected area on the African continent.

1. Geography

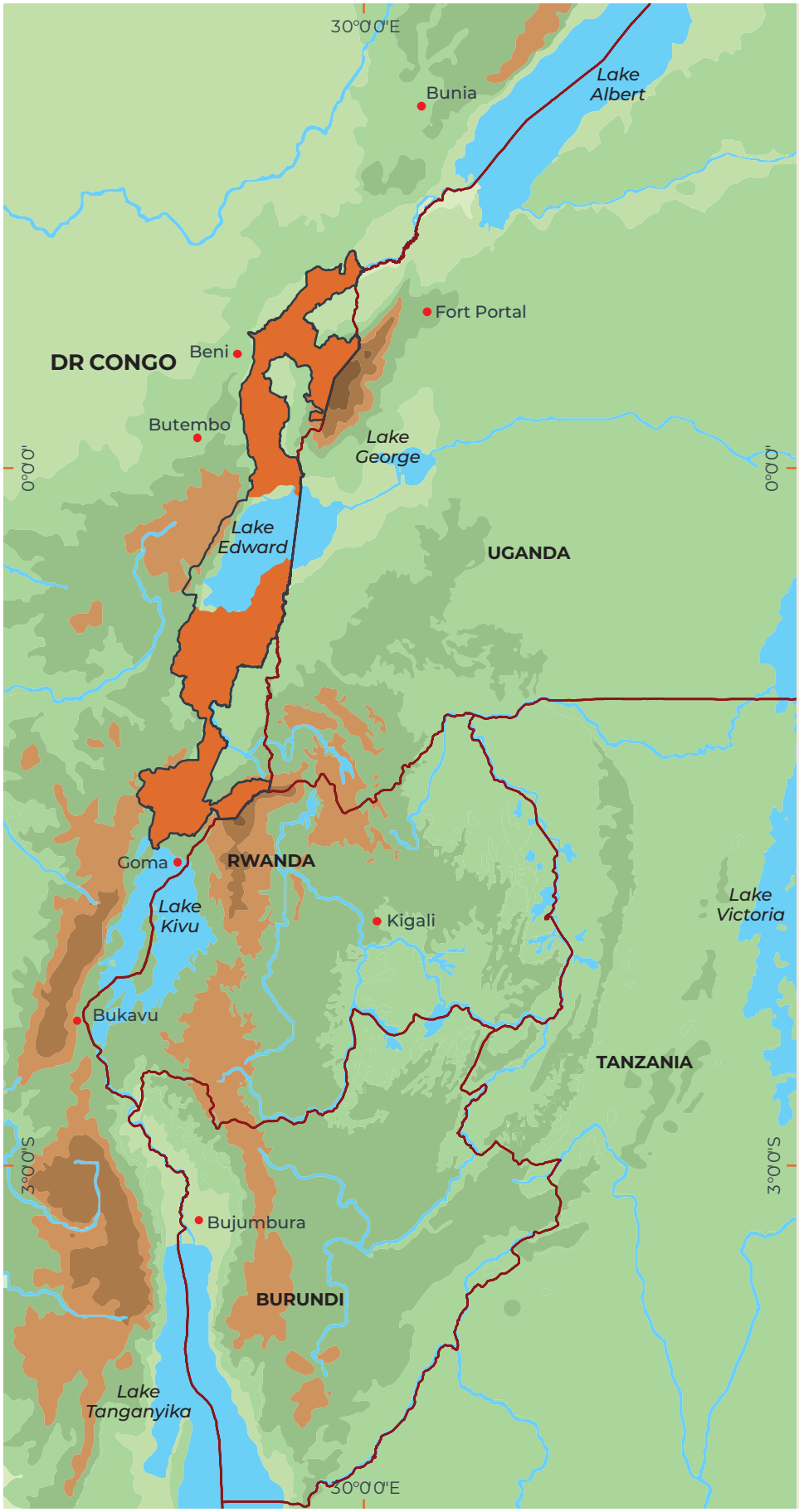
Virunga National Park (*Parc National des Virunga* – PNVi) is located on the equator, in the eastern part of the Democratic Republic of the Congo (DRC), along its borders with Rwanda and Uganda. Its elongated shape along a north–south axis covers an area of 784,368 hectares. It is bordered to the north by the Puemba River at 00° 56' N and to the south by Tchegera Island in Lake Kivu, at 01° 39' S. Most of the PNVi lies at the bottom of the Albertine Rift, the western branch of the Great Rift Valley. From north to south, its maximum length is 300 km, and its average width is 23 km, with a minimum of just 2.3 km south of Mabenga. Due to its elongated shape and specific boundaries, the perimeter of the PNVi is exceptionally long at 1,150 km. Its maximum altitude is 5,109 metres (Margherita Peak on the Ruwenzori, the highest point in the country and the third highest on the continent) and its lowest 680 metres, at the confluence of the Puemba and Semliki rivers.

2. Climate

It is hard to determine the climatic characteristics of the PNVi as its habitats vary greatly over relatively short distances. It is, in fact, impossible to ascribe just one climate to the whole PNVi as the region is characterised by a multitude of microclimates. Ishango, the sunniest and least rainy site in the DRC, is situated 60 km from the least sunny and most rainy site, Ruwenzori, at an altitude of approximately 2,700 metres.

Basic weather stations have long existed in the localities surrounding the reserve (such as at Beni, Goma and Rutshuru), but these are far from indicative for the PNVi. Stations have, however, been established within the reserve (such as at Mutsora, Ishango, Rwindi, Rumangabo and Lulimbi). Many of these have remained operational despite the surrounding instability, and meticulous records have been kept.

Many authors, often in the distant past, have conducted in-depth studies into the global climate of Kivu (Bultot, Crabbé, Vandenplas), and numerous publications by zoologists or botanists begin by providing a general overview of the climate (Bourlière, Cornet d'Elzius, Delvingt, d'Huart, Lebrun and Verschuren). Caution is necessary, however, as instrument checks by specialists were often lacking. Rain gauges, for instance, often got clogged by hippopotamus faeces, while in other cases animals seem to have urinated into the instruments! Rain gauges were often torn off or damaged by hyenas, and



1.2 The Albertine Rift

- Virunga National Park
- Boundaries of the PNVi
- Border
- River
- Lake
- 700-1000 m
- 1000-1200 m
- 1200-1400 m
- 1400-1600 m
- 1600-1800 m
- 1800-4000 m
- 4000-5109 m
- Town

0 25 50 100
Km

Virunga National Park is located at the heart of the Albertine Rift, the western branch of the Great African Rift.

elephants sometimes destroyed weather stations by rubbing up against them.

Recent crises in the PNVi have prevented the development of a monitoring system specifically dedicated to climate change in the Park. However, people who have remained on-site in recent decades report much more abundant rains in the gorilla sector, more severe and more frequent storms at Lake Edward, and higher flood levels in the Ruwenzori rivers. The rapid melting of the Ruwenzori glaciers is also well documented (see section 4.1.2).

2.1. Rainfall

Due to its position on the equator, the PNVi typically experiences two dry seasons and two rainy seasons, with significant local variations in total precipitation, but relatively few variations in the seasonal pattern. The examination of the monthly rainfall for the three main stations in the reserve (1955–1960) shows a peak in rainfall from April–May and September–October, with minimal precipitation in February and July.

The examination of the number of rainy days at Ishango (900 m), north of Lake Edward, and at Mutsora (1,200 m), at the foot of the Ruwenzori, confirms this seasonal rhythm but clearly reveals the difference between these two stations in relatively close proximity, with Mutsora counting nearly four times more rainy days compared to Ishango, and three times more precipitation.

Ishango and Nyamushengero (lower Rutshuru) seem to be the weather stations with the least rainfall in the PNVi (and in the DRC). Only the station at Banana, at the other end of the country, records similar levels of rainfall.

The dry seasons are, in general, relatively mild, both on the plains and in the mountains. Indeed, months without any rain are exceptional, as is the sight of a completely cloudless sky. On the other hand, rainy episodes lasting several consecutive days (like in Western Europe) are rare. Rain typically falls as showers, most often in the late afternoon.

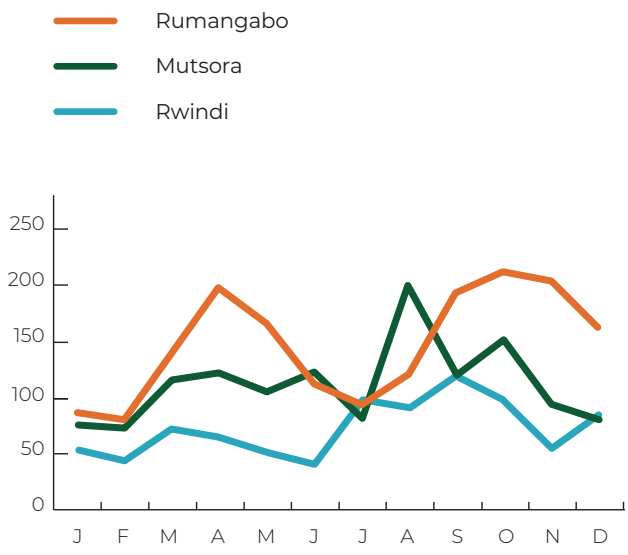
The station at Rwindi provides 14 years of rainfall data, which suggests a relatively stable level of rainfall over this time period. The annual average rainfall for Rwindi, calculated over 14 years, is 930 mm. During those 14 years, the driest year had 783 mm of precipitation, compared to 1,203 mm (50% more) for the wettest year.

A comparison of these figures with those from before 1960 (average 885 mm of rainfall) and those from 1960 to 1970 reveals that there has been no marked drying of the climate in Rwindi, and the 1,000 mm mark was reached several times. A slight increase in precipitation may even be confirmed.

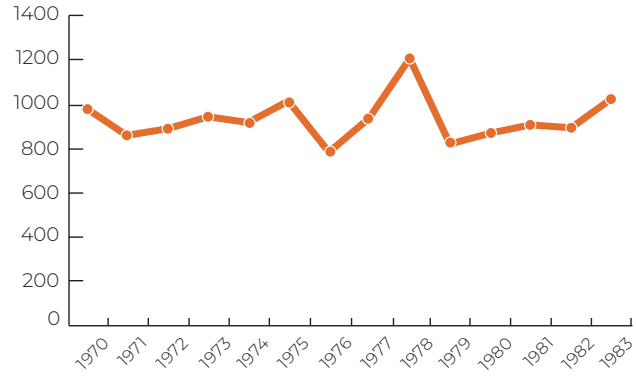
The Lulimbi station, southeast of Lake Edward, provides fragmentary data. Here, the average is 99 rainy days, with an annual rainfall of 701 mm. These figures can be usefully compared with those indicated by d'Huart (1978), which show relatively strong variations from year to year:

- 1972 – 988 mm
- 1973 – 585 mm
- 1974 – 755 mm
- Average – 776 mm

1.3 Monthly rainfall (mm) at the three main PNVi stations. Averages from 1955 to 1960.



1.4 Evolution of the annual rainfall in Rwindi, from 1970 to 1983 (rainfall in mm).



The scientist Misonne points out that the envisaged rainfall figure of nearly 4,000 mm on the slopes of the Ruwenzori is incorrect. Rainfall and cloudiness are generally highest on the slopes of the Ruwenzori and the large volcanoes at around 2,700 m (tree heather).

The rainfall is much lower on the summits, as evidenced by old rainfall records. Records dated 1930 to 1957 from the totalising rain gauge installed at the top of Karisimbi at 4,500 m show an average annual rainfall of only 940 mm, but with significant variations between years: an annual minimum of 562 mm versus a maximum of 1,329 mm, more than double.

A study by E. Roche in the PNVi shows that rainfall increases with altitude up to around 2,500 m where it is maximal, then decreases sharply with altitude past that point. True drought periods are very rare in the Park, even if the southern and northern plains of Lake Edward sometimes give a marked impression of aridity. None of the rivers are ever completely dry.

The PNVi's severely degraded meteorological network should be reorganised as soon as possible. A network of thermometers and monthly totalising rain gauges should be installed at the stations. The Park has been much less studied in terms of climate than the Garamba Park, where Noirfalise has conducted in-depth research. Given the significant climate changes observed globally in recent decades, and particularly in recent years, monitoring climate parameters in different sections of the PNVi should be resumed as a matter of urgency.

2.2. Temperature

Like rainfall, temperature is extremely variable in the PNVi, as indicated by the following monthly average daily figures for the three base stations between 1955 and 1960. In the mountains, the thermal gradient is 0.7° C/100 m at the equator level.

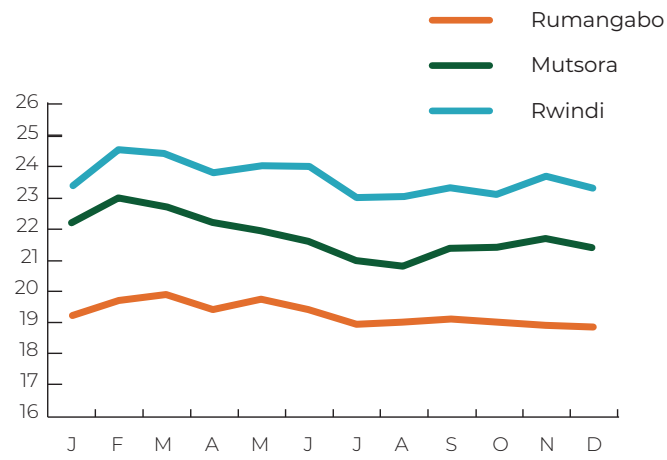
At Rwindi, over 14 years of observation, absolute minimums are around 15° C in standard conditions and 12° C to 13° C on bare ground. A minimum record was reached in February: 9.4° C on grass. The annual average of around 23° C at Rwindi can also be determined by measuring the permanent temperature recorded in the soil at 1.5 m depth. It should be noted that increases in soil temperature due to fires, which are rarely severe in the PNVi, are extremely limited.

In Kiondo, the ground freezes every night. Misonne and Verschuren registered -8° C on bare ground here. At Margherita Peak, a fairly constant temperature of -3.5° C was recorded. Snow is quite frequent on the summit of the Ruwenzori. On Karisimbi, the summit is often covered with snow, but it does not last more than 24 hours. Analysis of various temperatures

1.5 Maximum and minimum daily temperatures on the Ruwenzori slopes.

HABITAT	LOCATION	TEMPERATURE (°C)
Semliki (lowland forest)	(730 m) Watalinga	19–32
Kalonge (mountain forest)	(2,200 m)	14.8–23.5
Kalindere	(2,700 m) bamboo	11–19
Mahangu	(3,390 m) heather	5–14
Camp des bouteilles	(3,820 m) heather	0–8
Kiondo (alpine)	(4,200 m) ragwort and lobelia	- 0.3–+ 8.1

1.6 Monthly daily temperature at the three main PNVi stations (six-year average, from 1955 to 1960).



(average, maximum, minimum), both at low altitude and in the mountains, indicates that these have remained stable for several decades.

2.3. Sunshine

The data on sunshine hours at Rwindi over 10 years show that, on average, annual sunshine slightly exceeds 50% of the total possible hours (about 4,400 h) every other year. Despite subjective impressions, the number of sunshine hours is generally mediocre in the PNVi, even on the plains. At Rumangabo, sunshine hours do not exceed one-third of the total possible and can be compared to the number of sunshine hours registered in Brussels (1,400 hours).

An examination of winds, humidity, saturation deficit and evaporation would be superfluous as readers can refer to the studies of various authors, particularly Lebrun, for both the plains of the lake and the high lava plains. In general, with regard to the climate, it is to be noted that there is great spatial variety of climates within the PNVi, but also that the

climate in each sector of the reserve has benefited from a certain temporal stability for several decades, at least until the end of the last century. The impact of global climate change on the Park remains to be determined.

3. The PNVi, the Albertine Rift and climate change

The great East African Rift, also known as the African Rift, extending from Mozambique to the Red Sea, was formed 30 million years ago. From south to north, the rift corresponds with the graben of Lake Malawi, at which point it splits into two branches.

The eastern branch traverses first Tanzania, then Kenya. It is in this Eastern Rift, sometimes called the Gregory Rift, that Lakes Natron, Magadi, Naivasha, Nakuru, Bogoria, Baringo and Turkana are located. The western branch, or Western Rift, is more commonly referred to as the Albertine Rift. It runs from the southern end of Lake Tanganyika to Lake Albert, passing through Lakes Kivu and Edward. The two branches of the rift then converge to form the Great Ethiopian Rift, which extends to the Red Sea.

At the heart of the Albertine Rift, which is 1,380 km long and rarely wider than 150 km, lies the PNVi. The Masisi massif, the Mitumba mountain range and Mount Tshiaberimu correspond to the western flank of the rift, while the extinct volcanoes of the Mikeno sector correspond to its eastern flank. The northern shore of Lake Kivu corresponds to one of the narrowest stretches of the Albertine Rift (less than 45 km), and as a result delights visitors with particularly striking landscapes.

The Ruwenzori massif, which is not of volcanic origin, does not correspond to the eastern flank of the rift. This huge massif rose from the bottom of the rift less than three million years ago.

The geological history of the PNVi is closely linked to that of the Albertine Rift. But the formation of the rift is still ongoing, and the two flanks of the rift follow the plate tectonics that are pushing East Africa away from the rest of the continent. The Nyiragongo and Nyamulagira volcanoes bear

1.7 The Ruwenzori, Africa's third highest peak, is a non-volcanic mountain that rose from the bottom of the Albertine Rift two to three million years ago. This enormous massif, also known as the 'Mountains of the Moon', dominates the entire North Sector of the PNVi.