Conflict and conservation

NATURE IN A
GLOBALISED
WORLD
report no.1

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IUCN is a membership Union uniquely composed of both government and civil society organisations. It provides public, private and non-governmental organisations with the knowledge and tools that enable human progress, economic development and nature conservation to take place together.

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This first report focuses on armed conflict and nature. The theme is highly timely as armed conflicts cause great economic and social harm, as well as environmental damage around the world. Conflicts have stretched societies to their limits in terms of financial and human resources. Lives and property have been lost and disrupted, livelihoods destroyed, and people displaced. Regrettably, policies to better manage and moderate pressures that drive armed conflicts have been unable to prevent their number from reaching what is now their highest level for 30 years. IUCN therefore explores the complex relationships between nature and conflict to inform policies to better advance both peacebuilding and conservation.

Conflict and conservation

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IUCN is pleased to acknowledge the support of its Framework Partners who provide core funding: Ministry of Foreign Affairs of Denmark; Ministry for Foreign Affairs of Finland; Government of France and the French Development Agency (AFD); the Ministry of Environment, Republic of Korea; the Norwegian Agency for Development Cooperation (Norad); the Swedish International Development Cooperation Agency (Sida); the Swiss Agency for Development and Cooperation (SDC) and the United States Department of State.

This publication has been made possible by funding from the Agence Française de Développement and the Italian Development Cooperation.

Published by: IUCN, Gland, Switzerland

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Citation: IUCN (2021). *Conflict and conservation*. Nature in a Globalised World Report No.1. Gland, Switzerland: IUCN.

ISBN: 978-2-8317-2115-6 (PDF)

DOI: <https://doi.org/10.2305/IUCN.CH.2021.NGW.1.en>

Cover photo: paulkempvideo / Shutterstock.com

Layout by: Imre Sebestyén jr. / UNITgraphics.com

Available from: IUCN, International Union for Conservation of Nature
Science and Economic Knowledge
Rue Mauverney 28
1196 Gland, Switzerland
www.iucn.org/resources/publications

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Overview of the Contents

This report comprises two parts, Part I and Part II. Part I, comprising the bulk of the report, assesses the relationships between nature conservation and conflict in our globalised world, drawing from data, publications, and expertise from IUCN and beyond. Within this, Chapter 1 provides definitions and framing of ‘conflict’, ‘nature’, and associated terms. Chapter 2 uses both synthesis of the evidence and empirical analysis to explore how conflict affects nature. Chapter 3, conversely, explores the role that nature and natural resources, including their scarcity and degradation, have as potential drivers of conflict, and the possibility that conservation of nature may improve security and build peace. Chapter 4 discusses policy options for simultaneously conserving nature and building peace. Chapter 5 presents key messages for four key sectors: natural resource management and conservation; international agreements and law; humanitarian and development agencies; and the military. Finally, Part II documents four key indicators of nature and conservation, drawing in part from data based on IUCN standards for countries across the world.

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*From death that hurtles by
I crouch in the trench day-long,
But up to a cloudless sky
From the ground where our dead men lie
A brown lark soars in song.
Through the tortured air,
Rent by the shrapnel's flare,
Over the troubleless dead he carols his fill.
And I thank the gods that the birds are
beautiful still.*

Sergeant L. Coulson, Somme, August 1916
(From Douie 1929 quoted in Lewis-Stempel, J. 2016. Where
Poppies Blow. Wiedenfeld & Nicolson, London, UK)

FOREWORD BY IUCN

With this report, IUCN launches a flagship report series, *Nature in a Globalised World*, to demonstrate how critical conserving nature is for human wellbeing and all life on Earth. Each report will address a pressing global challenge and explore the significance of nature conservation in that context. In addition to offering a new thematic assessment, each report will also publish country-level data – based on IUCN standards where possible – on selected dimensions of nature, including its status, related threats and pressures, conservation actions and economic benefits. This inaugural report focuses on armed conflict and nature. The theme is timely as armed conflicts continue to stretch many societies to their limits, disrupting lives, displacing people, destroying livelihoods and causing great environmental damage.

The imperatives of conserving nature and preventing conflict are formalised in the United Nations Sustainable Development Goals. However, while there is a long history of scholarly and policy consideration of interlinkages between war and environment in general, specific relationships between armed conflict and nature conservation have received relatively less attention. This report fills this gap through synthesis, targeted data analyses, and an assessment of implications for policy and practice. A key question addressed in this report is whether investments in conservation may indeed yield dividends in peace, by improving peoples' livelihoods and well-being in conflict areas, thereby serving as building blocks towards peace and security.

The linkages between conflict and nature and natural resources go both ways, with nature and natural resources playing a role in conflict, and conflict in turn affecting them.

The impacts of armed conflict on nature are overwhelmingly negative. By analysing armed conflicts over the last 30 years, this report reveals that biodiversity in general, and threatened species in particular, are more likely than expected to exist in areas that have experienced armed conflict. In assessing how nature and natural resources affect conflict, this report finds that countries with scarce availability and low productivity of natural resources, especially agricultural lands, tend to be more conflict-prone, as are those more dependent on natural resources and at greater risk of drought.

These interconnections offer a suite of potential policy options that can simultaneously conserve nature and promote peace. Conservation must continue even in war-torn regions, implemented with the safety of frontline environmental defenders, as well as the environment they are defending, as paramount considerations. Explicit protections for protected area staff, and sanctions against those who commit environmental war crimes must be established. The benefits that strengthening natural resource management can provide to environmental peacebuilding must be recognised and supported; and military and humanitarian operations should seek to mitigate harm to living nature, both during and after a conflict. In sum: understanding the dynamic interaction between nature, natural resources and conflict demonstrates that investing in conservation increases the prospects for peace. Nothing less than the achievement of the Sustainable Development Goals is at stake.

Dr Bruno Oberle
Director General
International Union for Conservation of Nature

FOREWORD BY AGENCE FRANÇAISE DE DÉVELOPPEMENT

The year 2020 demonstrated that crises are much more multiple with rapid and global impact. They can be due to difficulties of sharing power, economic or natural resources.

After 5 years, the Paris Agreement remains at the heart of the AFD Group mandate. The Agency draws on public and private resources to fund capital investments that protect the Earth from climate change and biodiversity loss. In 2019, 50% of AFD's fund, i.e. € 6 billion have been considered as benefiting to climate (climate markers), among which € 2 billion for adaptation. The implementation of the Sustainable Development Goals & the Paris Climate Agreement agendas is a priority of the International Development Finance Club (IDFC) currently chaired by the AFD. Last November, the summit of Development Banks held in Paris, in parallel with the Paris Peace Forum, illustrated AFD's development vision associating development, peacebuilding and responses to climate change. Our strategy rests on a vision of a "world in common" and the "5 Ps": the Planet Earth (100 % Paris Agreement), the well-being of Populations (100% social link), Peace (through 3D development thinking), shared Prosperity, and global Partnerships.

To provide more effective responses to the numerous and multifaceted crises arising in the world, AFD is promoting new integrated approaches with the aim of considering their root causes and taking action collectively, based on humanitarian emergency and long-term social and economic development. In order to avoid tensions due to a broken social contract, which excludes some communities and exacerbates inequalities, AFD promotes conflict and crises prevention approaches. All populations must be taken into account equally, within a framework of inclusive development. The objective is to

take action on all the economic, territorial and educational inequalities, but also on gender inequalities, as they are the root causes of these current conflicts.

For these reasons, AFD is proud to be a sponsor of the present IUCN's flagship report on armed conflict and nature, first of the kind of a report series entitled *Nature in a Globalised World*. It will be an important contribution to the IUCN World Conservation Congress, to be hosted in Marseille, France, in September 2021. This support is taking place in the framework of the 4th France - IUCN partnership agreement covered by a budget of € 8.8 million over the 2017- 2020 period.

Effectively, AFD needs to be able to assist States facing conflicts on shared resources (environmental and economic), education, health, territorial and socio-economic development, etc. It involves integrating all the parameters of crises so that they can be addressed over the long term with all stakeholders, and stopping them from happening again or even happening in the first place.

The theme is highly timely, as armed conflicts cause not only great economic and social harm, but also environmental damage, around the world. Regrettably, policies have failed to better manage and moderate pressures that drive armed conflicts. IUCN therefore usefully explores the complex relationships between nature and conflict to inform policies to better advance both peacebuilding and conservation. AFD enthusiastically looks forward to using this key publication to guide activities and investments towards peace, security and sustainable and inclusive development.

Rémy Rioux
Director General
Agence Française de Développement

FOREWORD BY THE ITALIAN DEVELOPMENT COOPERATION

2020 was supposed to be a “super year for nature”. Instead, it will be remembered for the COVID-19 crisis, the worst one we have faced for many decades, but hopefully the one from which we will build back better. The pandemic has dramatically exposed the nexus between environmental degradation, on one hand, and infectious diseases, socio-economic inequalities and unsustainable growth, on the other. One lesson we have learnt the hard way in 2020 is that we urgently need to re-balance the relationship between humans and nature if we truly want to ensure a sustainable, inclusive and resilient future for all and the generations to come.

The Italian Development Cooperation has been supporting this view far before the COVID-19 heightened awareness of the human and financial costs of major climate and environment issues. IUCN has been a partner of the Italian Development Cooperation since 1995. We have worked together in five continents to support developing countries in the conservation, sustainable use and restoration of nature, in the firm conviction that it brings co-benefits on economic growth, inclusiveness, decent employment, well-being, human rights, stability, peace, security and resilience. Our priority is the people most in need, because they depend more on the goods and services provided by healthy ecosystems.

Luca Maestripietri
Director of the Italian Agency for
Development Cooperation

In this light, the Italian Development Cooperation is delighted to have supported this inaugural IUCN flagship report on “Conflict and Conservation”. The report reveals that it is possible to turn the vicious circle, through which violent conflict exacerbates environmental degradation, and vice versa, into a virtuous one, through “environmental peacebuilding”. IUCN concludes the report with a suite of practical recommendations targeted at different audiences, which can make a valuable contribution to the mainstreaming of environmental considerations in their respective activities.

We look forward to the development of future reports in the “Nature in a Globalised World” series to address the interface with conservation of other pressing societal concerns. As the world recovers from the COVID-19, these reports will help provide the much needed roadmap for how not just all of humanity but all of life may coexist and thrive in harmony into a common, better future. We will make sure that the Italian Development Cooperation does its part in this global endeavour for people, planet and prosperity.

Giorgio Marrapodi
Director General
for Development Cooperation Ministry of
Foreign Affairs and International Cooperation

EXECUTIVE SUMMARY

The imperative of conserving nature and mitigating conflict is formalised as three of the seventeen United Nations Sustainable Development Goals: 14 (Life below water), 15 (Life on land), and 16 (Peace, justice and strong institutions). However, while there is a long history of scholarly and policy attention to the interlinkages between war and environment in general, specific relationships between armed conflict and nature conservation have received relatively little attention. Part I of this Report fills this gap through synthesis of the literature, targeted data analysis, and assessment of implications for policy and practice.

Data from the Uppsala Conflict Data Program show that armed conflict events (that is, incidents where armed force used by an organised actor results in at least one death) have been increasing over the last 30 years and now exceed 7,000 armed conflicts annually worldwide. They are distributed globally but concentrated in Sub-Saharan Africa, and West and South Asia, and in aggregate are responsible for more than two million deaths over the period. Interlinkages with nature conservation occur across the conflict life cycle, encompassing not only war itself but also the preparation and post-war stages, with the latter often including forced displacement, which has affected more than 70 million people globally.

This report focuses on living nature – that is, biodiversity – encompassing a continuum of levels of ecological organisation from genetic diversity through species to entire ecosystems. There is great variation in the concentration of biodiversity at all three levels around the world, with the highest concentrations being in tropical forests, especially in mountains and on islands. However, this diversity of life is severely threatened. For example, the IUCN Red List of Threatened Species™ estimates that a quarter of species in well-known groups are threatened. Conservation responses addressing these threats encompass protection, sustainable use and restoration.

The linkages between conflict and nature and natural resources are not unidirectional but go both ways, with nature and natural resources playing a role in conflict, and conflict in turn affecting them. The impacts of armed conflict on nature are overwhelmingly negative, although they vary widely in detail. These impacts can include direct killing of individual organisms for food or trade, degradation of ecosystems as both a tactic and a consequence of war,

reduction in conservation capacity, and persecution of environmental defenders. While there is also some, mainly historical, evidence of the positive impacts of war on nature through “gunpoint conservation”, such impacts appear to be temporary and soon overwhelmed by the waves of unconstrained development that often follows armed conflict. Empirical data analysis reveals that species in general, and threatened species in particular, are more likely than expected to occur in areas that have experienced armed conflict over the last three decades. By contrast, Key Biodiversity Areas and protected areas contain less conflict than expected. Thus, the conflict-conservation relationships may be scale dependent, with positive associations at coarse scales but negative ones at fine scales.

Nature and natural resources affect conflict in many different ways. For example, the degradation of nature is strongly if variably associated with increasing risk of conflict. This is the case across multiple components of living nature. At the species level, there is some evidence for unsustainable exploitation of wildlife and timber as drivers in financing conflict; a counter-narrative highlights situations of “green militarisation” in which conservation in fact drives conflict. At ecosystem levels, both land degradation and deterioration of aquatic ecosystems can also increase the risk of armed conflict, while a prominent – albeit contested – branch of the literature points to climate change as a driver of conflict. Novel analysis of armed conflict events over the last 30 years finds that countries tend to be more conflict-prone when natural resources, especially agricultural lands, are less available or less productive, when countries are more dependent on natural resources, or when drought is prevalent.

These relationships shed light on a suite of potential policy options that can simultaneously conserve nature and promote peace. Many of these revolve around strengthening natural resource governance through inclusive decision-making, stabilising land tenure and resource rights, improving accountability and transparency, recognising the rights of indigenous peoples and women,

and advancing coordination within countries, to name a few. Improved natural resource management is also important for example, through protected area establishment and management, sustainable land and water use, adherence to standards and safeguards for environmental and social sustainability, and the greening of military and humanitarian operations. Finally, mechanisms for environmental peacebuilding between countries encompass both legal instruments (e.g. international agreements and enforcement of obligations in international courts) and transboundary management arrangements (e.g. through hydro-diplomacy, management of shared marine resources, and establishment of *Parks for Peace*).

The implications of these analyses, syntheses and policy options vary across different sectors:

For natural resource governance, conservation, and management agencies, the overarching implication, given the positive relationship between biodiversity and conflict, is that **conservation must continue even in war-torn regions**, with the safety of frontline environmental defenders, as well as the environment they are defending, as paramount considerations. **Conservation engagement in post-conflict situations** is also essential to mitigate what are often extremely severe pressures on nature following the cessation of hostilities in war-stricken regions. Most proactively, conservation practice should recognise that **effective conservation and restoration of nature can contribute to mitigating and pre-empting armed conflict**. That the converse is also true underscores the importance of socially-inclusive conservation, and of equitable sharing of the benefits that it provides. Moreover, conservationists must stay vigilant to ensure that the process of conservation itself does not trigger or exacerbate armed conflicts.

For international agreements and law, urgent implications of the relationships between conflict and nature include the establishment of **explicit protections for protected area staff and other conservationists**, and **sanctions against**

those who commit environmental war crimes. Mechanisms to establish such sanctions could include enhancing the United Nations Compensation Commission and ensuring prosecution of environmental war crimes through the International Criminal Court, strengthened by the ongoing deliberations by the International Law Commission. In addition, more effective, even-handed means are needed to **coordinate law enforcement efforts across sectors and scales** to strengthen prevention and mitigation of both conflict and environmental degradation, for example between protected area staff, police and military personnel, and engagement between wildlife agencies, and immigration and customs at border crossings.

For humanitarian and development agencies, contributions towards environmental peacebuilding through strengthening equitable and transparent governance are already substantial. However, beyond these contributions there is considerable scope for recognition of the benefits that **strengthening management of natural resources can make towards environmental peacebuilding** through the management of protected areas, lands and waters for example. Moreover, it is important for humanitarian and development agencies to implement actions to **address the footprints on nature resulting from their own activities** (including their impacts through procurement processes), drawing from established standards and safeguards as well as best practice approaches such as the United Nations High Commissioner for Refugees' Environmental Guidelines.

For military interventions, the most proximate implication is a simple one: **military investment should actively mitigate**

harm to living nature, both during and after conflict. This is relevant for reducing direct environmental harm as well as avoiding inadvertent impacts. Also important is natural resource management and governance training for soldiers, humanitarian workers, and peacekeeping forces, and the promotion of conservation and sustainable resource use in post-war recovery policies. In the longer-term, though, the most important implication is that **investment in conservation increases the chances of peace.**

Future IUCN flagship reports will treat interlinkages between nature conservation and other socio-economic areas in a similar fashion, with the inclusion of a Part II as a consistent thread linking the reports, and providing headline indicators for nature conservation across the world. These indicators draw upon knowledge products built on IUCN standards (such as the IUCN Red List of Threatened Species™, the World Database on Key Biodiversity Areas and the World Database on Protected Areas) as well as external data where appropriate, across the widely-used State-Pressure-Response-Benefits framework.

This flagship report was written by 27 specialists from across the network of independent experts in IUCN Commissions (including the *Theme on Environment and Peace* of the Commission on Environmental, Economic and Social Policy; the *Peace, Security, and Conflict Specialist Group* of the World Commission on Environmental Law; and the *Transboundary Conservation Specialist Group* of the World Commission on Protected Areas), members of the IUCN Secretariat, and beyond. It was peer reviewed by eight independent specialists. The Governments of France and Italy funded the report.

ACKNOWLEDGEMENTS

The lead editors and authors of this report were Juha Siikamäki and Thomas Brooks, and all analyses were conducted by Juha Siikamäki (Section 1.a & 3.e), and Nicholas Macfarlane and Hannah Wauchope (Section 2.b). Jonathan Adams served as technical editor and Hannah Moosa as copy-editor. The following experts served as contributing authors: Eleanor Bors (Section 4.d.ii), James Dalton (Sections 3.b, 4.b.iii & 4.d.i), Jonathan Davies (Section 3.c), Nigel Dudley (Section 4.b.i), Swati Hingorani (Section 3.a), Marianne Kettunen (Section 4.b.i), Mirjam Kuzee (Section 4.b.ii), Nicholas Macfarlane and Hannah Wauchope (Section 2.b), Seline Meijer (Section 4.a), David O'Connor (Section 4.c.i), Cate Owren (Section 4.a), Lydia Slobodian (Section 4.c), Jenny Springer (Section 4.a), Conor Strong (Section 4.c.i), and Kevan Zunckel (Section 4.d.iii). The following experts contributed the boxes in the report: Raquibul Amin and Thiri Shwesiin Aung (Box 9), Carl Bruch (Box 10), James Dalton and Camille Jepang (Box 3 & 7), Felix Glenk (Box 11), Carla Gómez-Creutzberg (Box 2), Mark Halle (Box 4), Mirjam Kuzee (Box 5), David O'Connor & Conor Strong (Box 1), Anita Tzec (Box 6), and Kevan Zunckel (Box 8).

Data for Part II come from: IUCN (2019) as SDG indicator 15.5.1 (Status of biodiversity); Isaac Peterson updating Lenzen et al. (2012) (Threats to biodiversity); UNEP-WCMC & IUCN (2020) and BirdLife International (2020) as SDG indicator 15.1.2 (Conservation actions); and the World Bank data from Lange et al. (2018) (Benefits from conserving nature). The following colleagues supported the conceptualisation and development of, and fundraising for the report: Grethel Aguilar, Inger Andersen, Giuditta Andreaus, Charles Bonhomme, Lucy Deram, Aban Marker Kabraji, Marc Magaud, Stewart Maginnis, Fauzia Bilqis Malik, Damien Mittempergher, Bruno Oberle, Nathalie Olsen, Matías Piaggio, Philippe Puydarrieux, Cyriaque Sendashonga, Jane Smart, and Ricardo Tejada. Geoffrey Dabelko, Andrea Dekrout, Janet Edmond, Thor Hanson, Elaine Hsiao, Richard Matthew, Jeffrey McNeely, and Erika Weinthal conducted independent peer reviews. The Governments of France and Italy funded this report, and we are particularly grateful to Santa Mole (L'Agenzia Italiana per la Cooperazione allo Sviluppo), Romain Chabrol, Guillaume Chiron, Naig Cozannet, Christophe du Castel, Arthur Germond, Nelly Reliet, and Charles Tellier (Agence Française de Développement) for their detailed contributions to the finalisation of the report.

PART 1

1. Introduction

The imperative to safeguard nature on land and at sea, and to address war and conflict, is reflected at the highest level as United Nations Sustainable Development Goals 14 (Life below water), 15 (Life on land) and 16 (Peace, justice and strong institutions). Understanding how these fundamental goals interact is crucial to informing how they can each be best achieved and what circumstances may hinder their pursuit.

Some 40 per cent of civil wars between 1950 and 2010 were associated with natural resources, and armed conflicts of all kinds have had significant impacts on the natural world.¹ However, the linkages between conflict, nature, and natural resources vary and remain widely debated and imperfectly understood.² Moreover, the linkages are not unidirectional but go both ways, with nature and natural resources playing a role in conflict, and conflict in turn affecting them. For example, natural resources have provided income to help finance many conflicts, contributing not only to their onset but also to lengthening them.³ Poor governance, scarcity, and unequal distribution of natural resources are other common connections

to conflict.⁴ Although evidence on their specific impacts is incomplete and continues to be debated, difficult environmental conditions such as extreme climatic events are often associated with conflict, including local violence and the onset of civil war, as well as migration decisions and asylum applications.⁵ Sometimes the conditions that may drive conflict in one place do not do so in another seemingly similar location subject to the same environmental drivers. Explaining what causes peace is thus the flip side of, and equally challenging as, assessing what causes conflict. Global climate change adds further complexity to the situation, with the data confirming increasing trends for climate change and conflict alike.⁶ Moreover, geographic correspondence emerges between regions beset by conflict and those rich in biodiversity.⁷ As such, conflict also generally puts nature at risk,⁸ driving a so-called 'treadmill of destruction'.⁹ While there may be occasional, incidental benefits of conflict for nature, these are often temporary and overwhelmed by post-conflict development.¹⁰

Although numerous correlations between natural resources, environmental conditions, and conflict have been confirmed, a substantial debate remains as to what they imply. For example, are natural resource availability and degradation key drivers of conflict, or do they primarily just correlate with other drivers such as the underlying social, economic and political conditions?¹¹ Moreover, current understanding concentrates on the role of high-value non-

renewable resources¹² such as oil, gas and minerals, as well as climate. Researchers have a much more limited understanding about the linkages between *conflict* and *living nature and renewable resources*, the focus of this report.

Here, IUCN explores the complex relationships between natural resources and conflict in order to inform policies to better predict, avoid and manage conflicts. A key question is whether conservation investments may yield dividends in peace. Can well-managed and well-governed natural resources improve the livelihoods and well-being of individuals, households and communities in areas susceptible to, or impacted by conflict, and thereby serve as building blocks towards peace and security?

While the report considers different forms of conflict and also touches on fragility (see Box 4 on Pakistan), our primary focus is on armed conflict, as discussed below. The report uses the conservation of nature and natural resources as the entry point to the discussion; all issues considered here are linked to nature conservation. Geographically, the report has a global reach, with different scales of analysis including sub-national, national and international.

The empirical parts of the assessment draw from the Uppsala Conflict Data Program, the world's primary provider of data on armed conflict. The program compiles event-level data on armed conflicts, including their date, location and number of fatalities (deaths). A conflict event is defined as: "An incident where armed force was used by an organised actor against another organised actor, or against civilians, resulting in at least one direct death at a specific location and a specific date."¹³ This report refers to these incidents as 'armed conflict events' and they form the primary unit of analysis in the empirical assessments that follow. Each individual armed conflict event is typically part of a broader armed conflict such as a war, or less extensive armed conflict. The data from the Uppsala Conflict Data Program is geocoded at approximately village-level spatial resolution and has worldwide coverage going back to 1989. Figure 1 maps

the geographic distribution of armed conflict events in the database.

In Part I of this report, Section 1 defines 'conflict' and 'nature', and highlights key data on both. Section 2 examines how conflict influences nature, including synthesising findings from the literature and presenting empirical results to examine the relevant relationships. Section 3 focuses on how nature and natural resources are linked to conflict, including evidence on natural resource scarcity, climate change, natural disasters, natural resource degradation, natural resources as a source of funding for conflict, and issues related to transboundary natural resources, specifically water. Section 3 also includes an empirical assessment of the key relationships between these factors. After combining evidence on the inter-linkages between nature and conflict in Sections 2 and 3, Section 4 surveys policy options for conserving nature and building peace, including through more equitable natural resource governance, improved natural resource management, the protection of nature in areas of conflict, and transboundary resource management and international agreements. Each of these categories involves multiple specific policy options. Section 5 concludes the assessment by discussing the implications of the findings on natural resource governance, conservation and management; international agreements and law; and humanitarian and military interventions. Throughout the report, local specialists provide their perspective through case studies from the field (Figure 1).

In Part II, IUCN draws from data based on IUCN standards and those of other key organisations to provide indicators of the status of biodiversity, threats to biodiversity, conservation actions, and benefits from protecting nature, across countries, regions and the world. The first and third of these indicators are generated through IUCN's role as a custodian agency that provides indicators to support countries around the world in tracking progress towards the Sustainable Development Goals.¹⁴

Figure 1. Individual armed conflict events through the 1989–2017 period. The size of each dot corresponds to the number of fatalities in the armed conflict event recorded. The map also shows the locations of the nine country or regional case studies included in boxes in this report (Boxes 5 and 10 are global case studies)

Source: Map compiled by report authors using data from the Uppsala Conflict Data Program³⁴⁶

a. What is ‘conflict’?

Conflicts are complicated and driven by many motivations and values. They exist in many forms, ranging from outright war between states, to skirmishes of contesting factions to subtler underlying social, economic and military tensions. Conflicts also encompass unarmed combat or ‘soft war’, including unarmed coercion and cyberwarfare.¹⁵ This assessment considers multiple dimensions and forms of conflict, but our main focus is on violent conflict involving armed force, which itself comprises a number of elements and stages (Figure 2).

The number of armed conflicts is currently at its highest point in 30 years. A key development over recent decades has been the increased prevalence of internal conflicts, including those that are internationalised (an internal conflict in which one or more third-party governments are involved with combat personnel in support of the objectives of

either side).¹⁶ Figure 3 graphs the number of individual armed conflict events and associated fatalities per annum from 1989 to 2017. The number of armed conflict events has been steadily rising, from around 4,000–5,000 at the turn of the century to more than 7,000 every year since 2014. Meanwhile, the number of direct conflict-related fatalities, aside from their catastrophic peak in 1994 during the Rwandan civil war, has remained relatively stable, though high, with 50,000 or more fatalities typical in recent years.

While nearly every part of the world experiences some degree of conflict, the map in Figure 1 shows that a few regions dominate. From 1989 to 2017, 61 per cent of all fatalities from armed conflict events occurred in Africa. West Asia, and South and East Asia were the other two main regions of armed conflict during this time period, resulting in 17 per cent and 12 per cent respectively, of all fatalities worldwide (Table 1).

Key element	Stage of warfare		
	Preparations	War	Postwar activities
Civilian	Propaganda, security alerts, civil defense training, militias	Rationing, refugees, casualties, loss of shelter and employment	Relocation, rehabilitation, illness, mortality, civil resistance
Military	Recruiting, conscription, training, mobilization	Campaigns, engagements, battles, casualties, prisoners of war, rehabilitation and treatment	Demobilization, occupation, reintegration, illness, mortality, peacekeeping
Materiel	Research and development, testing, manufacturing, strategic materials, stockpiling, positioning	Bombing, small-weapons firing, missiles, mines, supplies (petrol, ammunition, spare parts)	Unexploded ordnance, weapons disposal, cleanup, factory conversion
Infrastructure	Planning, energy and raw material supply, construction, maintenance, homeland security	Ports, supply depots, forts, bases, camps, hospitals, roads, emplacements	Reconstruction and recovery, decommissioning, base closures, economic restoration
Governance	Propaganda, policy, strategy, defense treaties, economic sanctions	Propaganda, civil control, alliances	Treaties, territorial exchange, reparations, war-crime trials
Diplomacy	Espionage, alliances, negotiations, sanctions, peacekeeping	Espionage, alliances and coalitions, negotiated surrender, cessation	Prisoner-of-war exchanges, occupation treaties, economic assistance treaties

Figure 2. A taxonomy of warfare, expanded to depict environmental opportunities and risks across the conflict life cycle

Sources: Machlis and Hanson, 2011 (Taxonomy of warfare)³⁴⁷; Bruch et al. 2019 (Conflict life cycle)³⁴⁸

Figure 3. Number of individual armed conflict events and associated fatalities per annum, for the 1989–2017 period

Source: Compiled by authors using data from the Uppsala Conflict Data Program ³⁴⁹

Table 1. Fatalities from armed conflict, including their total number and percentage of the global total, for the period 1989–2017, by IUCN Statutory Region

IUCN Region	Fatalities, total	% of global total
Africa	1,242,457	61%
East Europe, North and Central Asia	87,195	4%
Meso and South America	68,030	3%
North America and the Caribbean	3,968	0%
Oceania	585	0%
South and East Asia	233,224	12%
West Asia	350,142	17%
West Europe	36,628	2%
Grand Total	2,022,229	100%

Source: Compiled by authors using data from the Uppsala Conflict Data Program.¹⁷

Forced displacement is an immediate and often persistent and permanent consequence of armed conflict.¹⁸ Almost 70.8 million people are now forcibly displaced, including refugees, asylum seekers and internally displaced people.¹⁹ Refugees are people who have sought and received refugee status for being forced to flee their country because of conflict, war or persecution. In 2018, their number reached 25.9 million worldwide, 500,000 more than in 2017. Asylum seekers

are people who are seeking refugee status and are waiting for a decision about their status. Their number in 2018 was 3.5 million globally. Internally displaced people are the largest group among all forcibly displaced people. According to the Internal Displacement Monitoring Centre, 41.3 million people lived in internal displacement due to conflict and violence in 2018, the highest figure ever recorded.

Photo 1. Shan displaced persons during their relocation ©Rvwang Refugee Committee

Figure 4. Internal displacement by conflict, 2012–2018

Sources: Compiled by authors using data from the Uppsala Conflict Data Program³⁵⁰ and the Internal Displacement Monitoring Centre³⁵¹

Figure 4 maps internal displacement due to conflict since 2012, showing in red all countries where internal displacement due to conflict and violence took place. The pie charts indicate the number of displaced people by year. The map shows that in recent years, most internal displacement has taken place in the Syrian Arab Republic, the Democratic Republic of the Congo, Iraq and Ethiopia. About two-thirds of internally displaced people – more than 30 million – lived in only ten countries.²⁰

b. What is ‘nature’?

The term ‘nature’ is elusive and contested.²¹ To some, nature is only ‘natural’ if it is free from human influence; to others, nature encompasses the entire global environment, including all of humanity, along a continuum from ‘natural’ to ‘artificial’. This report focuses on the relationships within the ‘natural’ side of this continuum. This is not to deny that there are relationships between conflict and those elements of nature which exist in cities, intensively farmed landscapes, laboratories and indeed, in ‘human nature’ itself. Rather, this report concentrates on the elements of nature which typically comprise the focus of conservation.

Moreover, while nature encompasses both non-living (abiotic) and living (biotic) elements, the focus here is on the latter: ‘living nature’. This is treated as equivalent to ‘biological diversity’ (or ‘biodiversity’), defined by the Convention on Biological Diversity²² as comprising genetic diversity, species and ecosystems. While the report touches on questions regarding non-living nature, this treatment is restricted to abiotic factors such as soils (or land), hydrology (or water), and climate which interact with living nature over ecological timescales.

All three dimensions of living nature – genetic diversity, species and ecosystems – vary dramatically around the world. Typically, diversity reaches its peak in tropical forests, especially on mountains and islands (Figure 5). However, this diversity of life is severely imperilled by human impacts, with around 25 per cent of species (in comprehensively assessed taxonomic groups) documented as facing a high risk of extinction in the medium term, according to the 2020 IUCN Red List of Threatened Species^{TM 23} (Figure 6). IUCN is developing equivalent documentation for the world’s ecosystems.²⁴

This report does not restrict its coverage to any particular values ascribed by humanity to living nature. Rather, it encompasses a range

Figure 5. Global distribution of living nature including (a) geographic distribution of genetic diversity of mammal and amphibian species, (b) geographic distribution of bird species, and (c) terrestrial biomes of the world encompassing 14 biomes across eight biogeographic realms

Notes: Global distribution of living nature shows the highest concentrations of diversity in tropical forests, especially on mountains and islands; lowest levels in high northern latitudes in Eurasia and North America, and in deserts.

Sources: *Miraldo et al. (2016)*³⁵²; *Pimm et al. (2014)*³⁵³; *Olson et al. (2001)*³⁵⁴

of values, from intrinsic to utilitarian. A wide variety of terminology is used to describe living nature under different utilitarian perspectives, including ‘renewable resources’ (or ‘biological resources’), ‘ecosystem services’ ‘nature’s contributions to people’, and ‘nature-based solutions’; all of these are within our scope.

Finally, this report defines ‘conservation’ as the human activity dedicated to averting the

loss of nature and advancing its recovery. Here, conservation therefore encompasses a range of concepts including both ‘protection’ (‘preservation’) and ‘sustainable use’, as well as ‘restoration’. It is considered part of the broader concept of sustainable development, consistent with the United Nations 2030 Agenda for Sustainable Development, especially Goals 14 (Life below water) and 15 (Life on land).

Figure 6. Current global extinction risk in different species groups

Notes: The figure shows the proportion of species threatened with extinction in taxonomic groups that have been assessed comprehensively, or through a ‘sampled’ approach, or for which selected subsets have been assessed.
Source: IUCN (2020)³⁵⁵

2. Influences of conflict on nature and natural resources

The impacts of conflict on nature are overwhelmingly negative, but vary widely in detail, as evidenced both by the published literature and by analyses of data from the Uppsala Conflict Data Program²⁵, as well as by biodiversity and conservation data mobilised according to IUCN standards.²⁶ Variation includes differences in impact across levels of ecological organisation (e.g. on species relative to ecosystems), spatial scales (where there appears to be high spatial congruence between warfare and nature at coarse scales, and lower congruence at fine scales), and mode of impact (from direct and intentional use of environmental degradation as a tactic; to direct but unintentional consequences of war for nature; to indirect impacts such as the loss of human conservation capacity and the persecution of environmental defenders). In a few cases, conflict has also been observed to yield some positive impacts on nature, but these are often short-lived and overwhelmed by the waves of unconstrained development that can follow conflict.

a. Synthesis of current evidence

Warfare affects nature through both direct (military and supporting activities) and indirect (changing institutional dynamics, movement of people, and altered economies and livelihoods) pathways.²⁷ Armed conflict erodes the rule of law by facilitating illegal plunder and driving unsustainable use of natural resources, variously by corrupt officials, criminal gangs and impoverished or displaced people who are faced with few other options for subsistence.²⁸ Of 30,178 species assessed as threatened on the IUCN Red List of Threatened Species^{TM 29} (see Section 2.b), only 219 are classified as threatened by 'war, civil unrest & military exercises', but this figure includes iconic species such as the Critically Endangered Eastern Gorilla *Gorilla beringei*.³⁰ However, this might also be an underestimate of the real figure.

For example, the total does not include the Critically Endangered fish *Oxyrinchops galilaeus*, which is now extirpated from Hula Lake in Israel, and threatened by uncontrolled well-drilling during the recent Syrian conflict which appears to have dried out Muzairib, the last lake in which it survived.³¹

War impacts nature through direct killing of individual organisms, modifications of natural ecosystems, and reduced capacity for conservation implementation. At the organismal level, most impacts relate to deliberate killing for food; this may be particularly the case for primates and other large mammals.³² During the 1994 war in Rwanda for example, 90 per cent of the large mammals in Akagera National Park were killed for food or trade, and poaching of ungulates in the Parc National des Volcans also increased.³³ The genocide sent thousands of people walking through protected areas, either to reach safety or to join the conflict, often killing animals for food and clearing trees along the way.³⁴ The Vietnam War almost certainly accelerated the slide into extinction of the Critically Endangered Javan Rhinoceros *Rhinoceros sondaicus* in mainland Asia, as the Viet Cong shot them to supplement a meagre diet.³⁵ During the 1996–1997 war in the Democratic Republic of the Congo, there was a fivefold increase in poaching in Garamba National Park;³⁶ while in Nepal, the 1996–2006 Maoist insurgency forced troops guarding rhinoceroses and tigers to move to other duties, allowing a similar spike in poaching.³⁷ Increased availability of guns has been shown to have been a major driver of large mammal decline during the Angolan Civil War, which took place in the last quarter of the 20th century.³⁸ In Cambodia, there were marked declines in the relative abundance of animals during the country's periods of conflict from the 1950s to the 1990s³⁹; in the Sahara-Sahel, conflict has contributed significantly to the killing of the region's threatened species and the resulting population declines (Figure 7).⁴⁰ Such effects are not universal, however; for

Figure 7. Conflict and declining populations of threatened Sahelian species. Graphs show a) the population size of Addax Addax nasomaculatus (Critically Endangered) in Termit/Tin-Toumma, Niger; b) the cumulative number of Dorcas Gazelle Gazella dorcas (Vulnerable) illegally killed in Libya; and c) the number of African Elephant Loxodonta africana (Vulnerable) illegally killed in Mali, respectively, and the number of armed conflict events in each country. Black horizontal lines represent periods of increased conflict

Sources: Brito et al. (2018)³⁵⁶

example, hunting decreased during the 1997–2002 civil war in Sierra Leone, and increased after the war.⁴¹ Other pathways by which warfare impacts species are also possible, with, for instance, incidental killing of large mammals by landmines also an issue.⁴²

At the ecosystem level, environmental degradation is both a tactic and a consequence of war.⁴³ Its use as a tactic is perhaps most infamously exemplified by the use of defoliants in the Vietnam War⁴⁴, leaving a legacy of environmental devastation felt to this day⁴⁵; and the deliberate setting ablaze of oil wells and related oil spills during the 1991 Gulf War.⁴⁶ There is some evidence that the increasing prevalence of intra-state warfare and territorial occupation (Figure 2) has come hand-in-hand with the direct targeting of environmental infrastructure, resources and ecosystems in conflict settings. In the Middle East for example, agricultural land has been bombed and burned, and water has been contaminated in the recent conflicts.⁴⁷ Organisations such as the Conflict and Environment Observatory in the UK, and PAX in the Netherlands have been established to raise awareness of such environmental harm.⁴⁸

Ecosystem-level consequences of conflict are common. For example, war may force soldiers, refugees and local people to overexploit forests for fuelwood.⁴⁹ There was a substantial presence of armed groups in Colombian forests from 1985 to 1997, and 2000 to 2015; while in some cases this generated “gunpoint conservation”, more often, both guerrillas and paramilitaries cleared forests for cultivation of coca.⁵⁰ Pollution is another ecosystem-level impact of conflict, for example the noise from naval sonar – the use of which extends from war into peacetime – severely impacts cetaceans that depend on echolocation.⁵¹ The ecosystem impacts of war also include indirect costs imposed on people through the degradation of ecosystem services, for example through changes in hydrology and associated water management and irrigated agriculture (Box 1).⁵² It is also possible that broad-scale relationships between zoonotic disease outbreaks and armed conflict – as documented for Ebola in the Democratic Republic of the Congo in 2018–2019⁵³ – may be influenced by the environmental deterioration concomitant with both.

Box 1: Effects of the Syrian conflict and refugee migration on water flow and use

David O'Connor & Conor Strong (IUCN)

Since 2013, hundreds of thousands of refugees have migrated southward to Jordan to escape the Syrian civil war. A Stanford University/Brookings Institution study, using spatial and statistical analyses of satellite imagery for the 2013–2015 Syrian refugee mass migration, provided evidence of rapid changes in water flow, resulting from and causing changes to water use management in the Yarmouk-Jordan river watershed shared by Syria, Jordan and Israel.⁵⁴

The study found 50 per cent decreases in both irrigated agriculture in Syria and retention of winter rainfall in Syrian dams, which gave rise to unexpected additional stream flow to downstream Jordan, one of the most water-poor countries in the world, during the 2013–2015 refugee migration period. This suggests that the Syrian conflict and subsequent refugee migration caused downstream flow to increase, primarily due to the reduction in irrigation demand and changes in reservoir management. Recovery from the 2006–2008 drought was also a factor in this increasing river flow (see Section 3.d).

Figure 8. Yarmouk river flow increase coincides with refugee migration. (A) Map of the Yarmouk basin upstream of the Al-Wehda dam, showing the Syrian part of the basin in green and Jordanian parts in red. (B) Time series of annual precipitation spatially averaged over the Yarmouk basin (top), annual discharge volumes measured at Al-Wehda (middle), and cumulative number of registered refugees from the Syrian part of the basin (bottom)

Source: modified by authors from Muller et al. (2016)⁵⁵

However, this inadvertent ‘spillover’ increase in transboundary water flow to Jordan only minimally offset the immediate freshwater needs of hundreds of thousands of Syrian refugees received by Jordan. The Yarmouk River inflows are conveyed from the Al-Wehda dam and consumed for irrigation in the Jordan Valley rather than in the eastern highlands, where the vast majority of Jordan’s urban population, including the Syrian refugees, reside. Moreover, the increased volume is also still substantially below the volume expected by Jordan under its 1953, 1987 and 2001 agreements with Syria, and is likely temporary, highlighting the ongoing major challenges facing the freshwater ecosystems, hydrological ecosystem services and people of the region.

Another severe impact of war on nature is the cost of conflict on human and institutional capacity, and hence the ability to conserve nature. Conflict typically drives a reduction in the number of people working in conservation, and conservationists can even be direct targets of persecution. In Sierra Leone, conservation capacity reached a low point during the 1997–2002 civil war and did not rebound in subsequent years.⁵⁶ The 1994 Rwandan civil war had similar impacts.⁵⁷ While not warfare per se, this indirect impact of violence on nature is also reflected in a disturbing broader rise in assault on environmental defenders, exemplified by the murder of Mexican butterfly conservationists Homero Gómez González and Raúl Hernández Romero in early 2020.⁵⁸

There may also be some positive relationships between the state of warfare and the state of nature: “gunpoint conservation”. For example, war zones may have represented sources of wild game in North America up until 1800, but this effect has become much less apparent over the last two centuries due to the scale, intensity and technology of modern warfare.⁵⁹ Other positive impacts may result from the cessation of economic activities during war, such as the reduction of unsustainable forestry during the war in the Democratic Republic of the Congo in the late 1990s, or the reduction of unsustainable fisheries in the Second World War.⁶⁰ The benefits to nature of military bases have been widely reported, and similar benefits may accrue from peacekeeping missions (especially when these include dedicated environmental professionals), although retaining biodiversity on military lands can also conflict with military objectives.⁶¹ Military investment in technology that can subsequently be deployed for conservation, is a potential indirect benefit.⁶² In addition to positive relationships between warfare and nature,

the converse can also occur, where, for example, conflicts are driven by the poaching of rare species and efforts to protect them (Section 3.c).

However, these positive relationships may be temporary (Box 2), with the wave of often-unconstrained development which can follow conflict, potentially overwhelming any short-term reduction in pressures on biodiversity during warfare.⁶³ Similarly, while the remediation of previous military facilities can provide environmental opportunities, these may be restricted by low public trust.⁶⁴ The concept of *Parks for Peace* (Section 4.d.iii) offers opportunities to overcome such pressures through synergy between peace and conservation.

b. Empirical assessment of co-occurrence between conflict and biodiversity

Over the last 70 years, humans have waged war almost continuously in many of the world’s most important places for biodiversity, including regions that hold many species found nowhere else, and which are severely imperilled.⁶⁵ Here we show that species in general, and threatened species in particular, are more likely than expected to occur in areas that have experienced armed conflict. A mapping of all the birds, mammals and amphibians that are classified as threatened (Critically Endangered, Endangered or Vulnerable) on the IUCN Red List of Threatened Species™,⁶⁶ overlaid with armed conflict events since 1989 from the Uppsala Conflict Data Program, illustrates this co-occurrence (Figure 9), with the obvious caveat that co-occurrence does not necessarily imply either impact or causation. See Appendix for methods used in this section.

Box 2: Armed conflict, peace and conservation in Colombia

Carla Gómez-Creutzberg (IUCN)

Colombia's armed conflict dates back to the 1950s, when agrarian disputes led to the formation of Marxist-oriented guerrilla groups, some of which acquired control over large portions of the country.⁶⁷ During the 1980s, illegal paramilitary groups were formed to counter guerrilla operations.⁶⁸ In 1997, these groups coalesced into the Autodefensas Unidas de Colombia (AUC) whose fortification, along with increased military actions from the Colombian Army, resulted in one of Colombia's most violent decades.⁶⁹

Areas of natural forest cover, high biodiversity and weak state presence overlap with most epicentres of Colombia's armed conflict.⁷⁰ The forced internal displacement of over 7.8 million people from these areas led to land abandonment and spontaneous regeneration in some regions.⁷¹ However, the conflict has also caused deforestation. Paramilitary groups deployed forced displacement to seize valuable land for extensive cattle ranching, mining, palm oil and illegal coca plantations.⁷² In the Central Andes, forest fragmentation and degradation increased the vulnerability of the country (and its energy-producing watersheds) to climatic oscillations such as El Niño.⁷³

Both guerrillas and paramilitaries have financed their operations through illegal crops and the drug trade.⁷⁴ Crop eradication efforts have resulted in shifting patterns of deforestation throughout conflict areas.⁷⁵ Guerrillas also introduced illegal mining (primarily of gold) to fragile ecosystems, including national parks.⁷⁶ At the same time, anecdotal evidence suggests that guerrillas enforced "gunpoint conservation" by using land mines to restrict hunting, logging, land clearing and settling in areas where these activities were contrary to their interests.⁷⁷

The AUC and the Fuerzas Armadas Revolucionarias de Colombia (FARC, the largest guerrilla organisation) demobilised after signing peace agreements in 2005 and 2016, respectively. However, former paramilitary factions (reorganised into drug-trade and organised crime groups), FARC dissidents, and two other groups of guerrillas still remain active.⁷⁸ The FARC peace agreements brought the promise of addressing the land concentration and rural marginalisation problems that originally sparked the conflict.⁷⁹ These issues and violence persist to this day. Land grabbing, fostered by armed groups, has increased deforestation and illegal road clearing in and around protected areas and elsewhere.⁸⁰ Meanwhile, areas formerly controlled by FARC have experienced a surge in the systematic killing of activists and community leaders.⁸¹ To protect its globally important biodiversity, Colombia will need to pioneer rural development models that integrate conservation with social and economic objectives. Clarifying land tenure, strengthening state institutions, and implementing participative land use planning will be key in this process.

Overall, 70 per cent of all birds, mammals and amphibians (the three largest taxonomic groups that have been comprehensively assessed against the IUCN Red List) have current ranges that overlap with armed conflict events. For example, the symbol of peace, the Vulnerable European Turtle Dove (*Streptopelia turtur*), has a current range that overlaps with 41,061 armed conflict events.

Across all species, the average number of armed conflict events contained in a species range is 2,169. This varies between 3,535 for birds, 1,739 for mammals, and 272 for amphibians, reflecting the fact that amphibians have much smaller range sizes than do mammals, which in turn have smaller ranges than birds.

Figure 9. Global distribution of threatened birds, mammals and amphibians (in green) with armed conflict events since 1989 (overlaid in red)

Source: Compiled by the authors using data from the IUCN Red List of Threatened Species^{TM 357} and the Uppsala Conflict Data Program³⁵⁸

In fact, species are even more likely to co-occur with armed conflict events than would be expected based on their spatial extent (Figure 10). Two components contribute to the number of conflict events observed to overlap with a species distribution – the size of the species range and the geographic location of the species. The first component is easy to explain: a larger range is more likely to contain conflict, simply because it captures more of the earth’s surface area. The second component is less well understood and reflects the relative

distribution of biodiversity and conflict around the world. Using a quantitative simulation approach, the assessment below separates the expected proportion of conflicts in a species range based on its range size alone, from the proportion stemming from where it lives.

These analyses show that current biodiversity and conflicts occur in the same regions more frequently than would be expected at random, regardless of a species’ extinction risk category. At a broad level, the spatial

Figure 10. Average number of conflict events in species’ ranges, subdivided by IUCN Red List Category. Numbers of conflicts expected based on the size of species’ ranges are shown in dark blue (with 95 per cent error bars derived from 1,000 randomizations), with additional conflicts observed resulting from where species live, shown in red

Source: Compiled by the authors using the IUCN Red List of Threatened Species^{TM 359} and the Uppsala Conflict Data Program.³⁶⁰

correlation between species and conflict goes beyond range size: where armed conflict events occur, many species are likely to live, and vice versa.

Moving from coarse species range maps to the high resolution of Key Biodiversity Areas – defined as sites contributing significantly to the global persistence of biodiversity⁸² – provides a complementary perspective. While species ranges contain more conflict than would be expected at random, the opposite is true for Key Biodiversity Areas. They contain 5 per cent of armed conflict events, which is only half the percentage expected if conflict were distributed randomly, given that Key Biodiversity Areas cover 9 per cent of terrestrial land area (Table 2).⁸³ However, nearly a third of armed conflict events occur within 0.1 decimal degrees (about 10 km at the Equator) of a Key Biodiversity Area, and more than half within 0.25 decimal degrees (about 25 km at the Equator). This suggests that while fewer armed conflict events than expected may occur within the boundaries of Key Biodiversity Areas themselves, a large proportion of conflict takes place in the same regions as these important sites, even if not in the sites themselves.

Similar patterns emerge for protected areas. Protected areas are valuable conservation tools, particularly if they are protecting Key Biodiversity Areas.⁸⁴ Protected areas and protected Key Biodiversity Areas both contain less conflict than would be expected based on land area, but are co-located in the regions where armed conflict events are more frequent. Specifically, protected areas cover more than 15 per cent of terrestrial land⁸⁵ but only contain 2,371 or 3 per cent of the 85,083 armed conflict events that

can be geocoded to a geographic precision of 25 km. However, nearly a third of armed conflict events are located within 0.1 decimal degrees of a protected area and nearly half are within 0.25 decimal degrees. The same pattern holds true for the parts of Key Biodiversity Areas that are included within protected areas. In each case, therefore, the protected site contains less conflict within its bounds than would be expected based on the extent of terrestrial area covered, but a significant proportion of conflict occurs near the protected areas. This is consistent with the coarser resolution result that the distributions of birds, mammals and amphibians contain many more conflicts than would be expected if conflicts were distributed at random.

Although there is a lack of definitive empirical evidence, a plausible explanation for this clustering could stem from the nature or location of warfare, if combatants are hiding from state forces in remote areas that are near areas of high biodiversity. Another possibility could stem from population distribution patterns, but full exploration of that hypothesis would require data on the number of people who live inside Key Biodiversity Areas. Likewise, there might be some intrinsic aspect to the governance of Key Biodiversity Areas and protected areas that leads to a lower rate of conflict than expected, which minimises armed conflict events within their territories, but not necessarily nearby.

Regions alongside political boundaries are another type of area that could be particularly relevant, since nature conservation could be impacted within countries or territories that are at war, even if the number of armed conflict events is low.

Table 2. Distribution of conflicts relative to Key Biodiversity Areas and protected areas

Sites	% of land area	% of conflicts (inside)	% of conflicts (0.1 decimal degrees)	% of conflicts (0.25 decimal degrees)
Key Biodiversity Areas	9	5	31	55
Protected Areas	15	3	30	48
Protected Key Biodiversity Areas	4	1	13	30

Source: Compiled by authors based on data from Protected Planet, an online interface for the World Database on Protected Areas⁸⁶; the World Database on Key Biodiversity Areas⁸⁷; and the Uppsala Conflict Data Program⁸⁸.

3. Influences of nature and natural resources on conflict

Conflicts are seldom, if ever, driven by one cause. While evidence for the geographic correlations between the state of the environment and factors affecting violence and social disruption is exceedingly robust, debate continues about the relative importance of different drivers of conflict. Together with the condition of the environment and natural resources, other factors driving conflict include geographical, institutional, political, economic and social issues. A changing climate adds further complexity.⁸⁹ Moreover, the relationship runs in both directions: nature and environmental conditions can contribute to conflict; and conflict in turn, can have direct impacts on nature (Section 2).

Some researchers suggest that these relationships result from causal linkages, for example that environmental degradation drives conflict.⁹⁰ Others contend that the spatial congruence of conflict, and the availability and condition of nature do not reflect causation, as conflicts have structural and historical causes and these, along with socio-economic factors, are sufficient to explain most conflicts.⁹¹ This section examines the evidence for a variety of causal relationships that have been proposed between conflict and nature, and includes new empirical analyses of these relationships.

a. Wildlife and conflict

Sparse but increasing evidence indicates that exploitation of wildlife for illicit trade is funding and prolonging armed groups and insurgencies, as well as organised crime and designated terrorist groups such as the Lord's Resistance Army, the Janjaweed, Al Shabaab, Al Qaeda and the Taliban.⁹² Generating US\$ 7–23 billion per year, the illegal wildlife trade is increasingly

lucrative due to low rates of detection and conviction,⁹³ and may be particularly prevalent where armed conflict disrupts formal economies. Such exploitation of wildlife to fuel conflict sits alongside the long history of exploitation of non-living natural resources (diamonds, minerals, oil etc.) to fund conflict, and disputes over the allocation of such resources to drive conflict.⁹⁴

The UN Secretary General has called attention to the 50–90 per cent decrease in elephant populations in the Central African Republic and the Democratic Republic of the Congo, emphasising that ivory is an important funding stream for the Lord's Resistance Army.⁹⁵ According to the United Nations Office on Drugs and Crime, Sudanese militia were responsible for the deaths of 2,000 elephants in 2007 alone.⁹⁶ In Afghanistan and Pakistan, the Taliban benefits from the trade in highly prized falcons.⁹⁷ These examples underscore the urgency of viewing the wildlife trade not only through an environmental lens but also from the perspective of national security.⁹⁸ In response, a recent UN resolution escalated the severity of wildlife crime to that of arms and human trafficking, and the Global Environment Facility has allocated US\$ 168 million to projects tackling wildlife trafficking and trade.⁹⁹

The strength of the relationship between wildlife trade and armed conflict has been questioned, however. The evidence that ivory sales finance Al Shabaab consisted of a few confidential interview sources, and there is little evidence that wildlife poaching provides revenue for Boko Haram.¹⁰⁰ While the Lord's Resistance Army was indeed responsible for ivory poaching, other groups, including military units deployed to combat the insurgents, were also implicated.¹⁰¹ This critique is important because the purported connection between wildlife trade and

conflict has been the basis for directing increased flows of financing to combating wildlife crimes, including for the purchase of weapons, surveillance technologies, and special military training for rangers – in other words, it has led to the emergence of “green militarisation”.¹⁰² While some consider militarised conservation as an appropriate response to wildlife crime,¹⁰³ especially where such crime involves threatened species, high technology armaments, and a broader context of societal conflict; others highlight the risk that a militarised approach could generate coercive, unjust and counterproductive outcomes for conservation.¹⁰⁴

Indeed, there is some evidence that nature conservation itself may serve as a driver of conflict or state-sanctioned violence (“green militarisation”), especially in and around protected areas (“fortress conservation”). This is not a new phenomenon, having been deployed historically, for example, in colonial Africa.¹⁰⁵ However, there are also contemporary examples of violence being used as a conservation tool. For instance, in Kenya and Indonesia¹⁰⁶ violence has been used in response to perceived connections between poaching and security.¹⁰⁷ Such militarisation of conservation may also go beyond response to wildlife crime, with, for example, ranger forces being called upon by the state as military reserves or paramilitary forces in some countries, typically to undertake operations against armed groups in conservation areas. Conversely, in other situations, green militarisation may emerge in response to violence from local communities, for example where local expectations of conservation benefits have not been fulfilled. In either instance, human rights training and robust recruitment and vetting processes for rangers and eco-guards are important responses to reduce the risk of such violence.

b. Water and conflict

Water scarcity currently affects around 700 million people in 43 countries worldwide.¹⁰⁸ Historically, variability in water supply, high population density, economic dependency on agriculture, and prolonged periods of water insecurity have been key factors for migration. This can lead to both temporary and permanent movements, depending on the duration and severity of water stress as well as the coping capacity of populations.¹⁰⁹ For example, communities such as the nomadic pastoralists in Western and Eastern Africa migrate seasonally to ensure access to water resources. Climate change also functions as a multiplier of water scarcity; and can exacerbate water scarcity caused by exploitation and lack or mismanagement of water and related ecosystem services.¹¹⁰ Given the uncertain impact that climate change and socio-economic trends will have on water infrastructure, there is a risk that, in deciding resource allocation, some interests are privileged over others; in turn, this can give rise to conflicts between water users.

Transboundary water management is concerned with highly competitive resource management access issues. Water is needed to grow food and to generate electricity – it is a conflict multiplier if mismanaged.¹¹¹ Transboundary water management therefore needs to look to new approaches to water allocation through benefit sharing, multi-level governance, and management structures and agreements, to find solutions that respond to stakeholders’ needs at multiple institutional scales and hierarchies.¹¹² While water is often a catalyst for local tension, at the broader basin scale, the peaceful governance of transboundary waters are essential for the integrity of nature, the wellbeing of humans, the economic development of society, and the peaceful relationship between states.

Box 3: Transboundary governance and conflict around Lake Chad

James Dalton & Camille Jepang (IUCN)

Poor governance of shared resources and a lack of knowledge of transboundary management mechanisms can impact social relations between communities along shared bodies of water, and increase the risk that unarmed conflict will escalate into something far worse. Considered to be one of the most fragile areas in the world, Lake Chad is shared by Niger, Nigeria, Cameroon and Chad. Since 2009, a large-scale security crisis has affected the Lake Chad area, around which multiple stressors converge, including unemployment, limited government presence, poverty and population growth. These stressors heighten existing competition for resources, in turn exacerbating tensions between pastoralists, farmers and fishers.¹¹³ This impacts people whose livelihoods depend on Lake Chad; in addition, it is threatening peace and security, compounding poverty and unemployment, as well as fuelling intra-regional migration, with some 2.5 million people, most of whom are women and children, forcibly displaced. Compounding these factors is the rise of ethnic militia and organised militant groups such as Boko Haram, as well as a vulnerable environmental situation, specifically the region's susceptibility to extreme weather and climate change.¹¹⁴

The size of the lake is highly variable, reflecting multi-decadal patterns of climate change. After a period of contraction, Lake Chad has recently started to slowly expand again, but the main challenge facing people dependent on the lake is increased fluctuation and uncertainty. Now, more than ever before in its recorded history, the timing and duration of the rains vary erratically. The future impacts of climate change upon the lake are still poorly understood. As the number of people depending on the lake for their livelihoods continues to increase, it is clear that any further disruption to this fragile ecosystem will have profound negative implications for peace and security in the region.

In the Chari-Logone, a sub-basin of Lake Chad shared between Chad and Cameroon, Village and Canton Chiefs (Sultans) impose taxes on crossing of the Logone River in their respective zones. The taxes were first imposed by Chiefs on the Chadian side; their Cameroonian counterparts then followed suit. This affected local communities' interaction with each other, as by crossing the river to trade or visit family members, they would be taxed up to FCFA 60,000 (approximately US\$ 110). In response to Boko Haram, waterway traffic restrictions have also been added.¹¹⁵

Many development organisations have responded to the Lake Chad crisis, including the Sahel Alliance, a coalition launched by France, Germany and the European Union; which was later joined by the World Bank, the African Development Bank, and the United Nations Development Programme, together with Italy, Spain, the United Kingdom, Luxembourg, Denmark and the Netherlands. The Alliance's Inclusive Economic and Social Recovery Project for Lake Chad (RESILAC) aims to: i) strengthen social cohesion by supporting territorial development and providing assistance to victims of violence; ii) contribute to the economic recovery of the region by creating jobs on sites to rehabilitate community facilities and supporting agricultural micro-entrepreneurship and apprenticeship; and iii) improve the governance of municipalities for a more effective management of territories and natural resources.¹¹⁶

The Lake Chad Minka Initiative of the Agence Française de Développement focuses on infrastructure redevelopment, hydro-agricultural installations, labour-intensive projects, and activities focusing on social outreach and the promotion of peace.¹¹⁷ Focusing specifically on transboundary water governance, IUCN's Building River Dialogue and Governance (BRIDGE) project, supported by the Swiss Agency for Development Cooperation, aims to reduce the risk of conflict in the Chari-Logone while strengthening natural resource governance. The project highlights the joint management and use of the river and its resources, and works with local water institutions, the Lake Chad Basin Commission, and national management structures to identify sustainable institutions, and encourage sharing of benefits from the river rather than competition for its resources.¹¹⁸

c. Natural resource scarcity and conflict

Natural resource scarcity was the focus of much of the early research on environment and conflict.¹¹⁹ The fundamental hypothesis is that scarcity of natural resources such as agricultural lands, forests, freshwater, oil and minerals, leads to overuse and degradation of natural resources, as well as conflicts, due to competition over limited resources. The scarcity and degradation of these natural resources is further increasing in many parts of the world due to population and economic growth, as well as inequitable distribution of economic growth and wealth, including access to land. While many examples indicate a positive relationship between resource scarcity and conflict, hence supporting the neo-Malthusian approach, the argument and the robustness of empirical evidence to support it remains controversial.¹²⁰

One line of criticism maintains that while institutions, property rights systems, economic factors and social relations play crucial roles in the emergence of conflict, the complexity of their associations with conflict make it difficult to conclude direct causation.¹²¹ Moreover, while seemingly intuitive, the evidence does not support resource deprivation and competition as key predictors of conflict. Another line of criticism has focused on the limitations of empirical methods to support the argument, with re-assessments finding limited proof of environmental scarcity as a driver of conflict. The role of natural resource degradation is a possible exception in this regard.¹²²

In addition to its possible linkages to conflict, evidence has shown that environmental

decline also plays a role in migration, for example in causing people to leave their homes and move elsewhere, even to other countries.¹²³ Environmental deterioration drives migration by reducing the availability and reliability of ecosystem services and increasing the exposure to hazard. However, human migration decisions are also influenced by economic, political, social and demographic factors.¹²⁴

d. Changing climate, weather and conflict

Assessments of the linkages between conflict and natural resource scarcity and degradation have grown in research prominence, with the added dimension of rapid climate change, generating entire special issues of the *Journal of Peace Research*, *Geopolitics*, and *Political Geography* over the last decade alone.¹²⁵ High-profile studies have sought to identify causal linkages between climate change and violent conflict. One study found a positive relationship between conflict and temperature across sub-Saharan Africa since 1960, and combined this with climate projections to anticipate a 54 per cent increase in armed conflict (equivalent to 393,000 deaths) by 2030, in the absence of climate change mitigation.¹²⁶ Another study similarly showed that the conflict in Syria, which began in 2011, could be attributed to climate change, together with poor governance and unsustainable agricultural and environmental policies.¹²⁷ As discussed

in the Pakistan case study (Box 4), rather than introducing an altogether new set of threats to security, climate change amplifies the challenges of conflict and conservation. Therefore, it is important to consider how climate change affects both, and to see if there are places where the effects intersect.

A 2013 synthesis of the literature concluded that “amplified rates of human conflict could represent a large and critical social impact of anthropogenic climate change in both low- and high-income countries.”¹²⁸ A broad range of conflict-related endpoints have been found to be associated with climate, with data suggesting that an increase in temperature is associated with an increase in conflict probability.¹²⁹

These findings are heavily contested, however. For example, ethno-political exclusion, fragile economies, and the end of the Cold War may explain conflict in Africa better than climate change.¹³⁰ The purported causal linkages between climate change, drought, migration and conflict in Syria over the past decade are also in dispute.¹³¹ Literature reviews and meta-analyses find that evidence is not yet robust enough to offer conclusive insight into the effects that climate variability and change have on conflict.¹³²

One important criticism of the climate-conflict link is that some of the evidence draws from select cases where conflict is present and data are available, rather than subjecting to similar scrutiny, cases where no conflict has emerged, even if comparable environmental conditions are at play.¹³³ A recent assessment of the conflict literature supports this notion: evidence on the climate-conflict connections comes disproportionately from countries that are already experiencing conflict.¹³⁴ Syria is a case in point: research has examined the role the multi-year drought has played in the onset of the war in Syria in 2011, but assessments of the impacts of the same drought in Jordan and Lebanon, where such conflict did not emerge, are rare.¹³⁵

Ignoring evidence on peaceful responses to changing environmental conditions also

overlooks the role of complex political, economic and institutional factors that are often key to maintaining peace, as opposed to falling into conflict.¹³⁶ Critics have also cautioned that overstating the role of climate change serves to ‘naturalise’ violence as an explicable human and social response to climate change, as if it were outside the control of people making decisions within that context. This could suggest an almost deterministic relationship between the environment and armed conflict, thereby excusing belligerents of their direct responsibility for violence.¹³⁷

However, alongside evidence regarding specific locations, a substantial literature has emerged that uses data from many locations and over a long time period to assess the climate-conflict link.¹³⁸ Combining data on conflict, weather and other potential drivers of conflict, these studies use statistical approaches to empirically examine, test and quantify the interlinkages between climate and conflict. Most studies scrutinise short-term (typically annual, but sometimes monthly or even more frequent) variations in temperature and precipitation for potential signals of the impacts of climate. While powerful for examining issues such as the impact of weather shocks within crop-growing seasons, it is clear that the impacts of short-term variations in weather on conflict could be altogether different from that of long-term climate change. For example, in the short-term, options to adapt to changing environmental conditions because of weather shocks are minimal in comparison to long-term climate change. On the other hand, the cumulative impacts of climate change may be altogether more pressing than short-term temperature or precipitation variations. Nevertheless, these studies have strengthened the evidence suggesting a positive relationship between temperature extremes, weather shocks and conflict.¹³⁹

While evidence on the specific linkages between climate change and conflict is subject to ongoing debate and research, broad agreement exists that these linkages are relevant. For example, a 2019 Intergovernmental Panel on Climate Change

Special Report on Climate Change and Land concludes that extreme weather and climate may lead to increased displacement and conflict.¹⁴⁰ Seeking to synthesise current knowledge, a recent study systematically elicited expert judgment data from some of the leaders in the field.¹⁴¹ In that study,

experts considered that 3–20 per cent of conflict risk over the 20th century was influenced by climate. However, they also identified the specific mechanisms of climate–conflict linkages as a key uncertainty, and recognised that a better understanding of such linkages is needed.

Box 4: Climate change, water and fragility in Pakistan

Mark Halle (IISD)

Climate change does not so much introduce a new set of threats to security; rather it exacerbates existing concerns. A country where these threats are especially pertinent is Pakistan. A recent index designates Pakistan as the planet's fifth most vulnerable country to the impacts of climate change. In light of the fact that Pakistan lies in a zone that is already highly volatile, with long-running militarisation along both its eastern and western borders, and that it has a population of over 200 million people, many of whom live in poverty, the additional stresses resulting from changing climate patterns represent a particularly severe threat.¹⁴²

Chief among the concerns is the issue of water. Pakistan is entirely dependent on water stemming from its glacier reserves and rivers, whose upstream courses lie in neighbouring countries with whom Pakistan has a tense relationship. Pakistan has the third largest glacial reserves in the world, after the Arctic and Antarctic, but as the climate warms, the disappearance of water reserves in glaciers puts the country under severe stress. As river flow-rates begin to diminish, diversion or increased water off-takes by India or Afghanistan could be a dangerous source of cross-border tension and a spark for further conflict.

In addition to diminishing water reserves, the melting of glaciers is a concern, with glacier lake outburst floods already a reality in Pakistan, bringing repeated large-scale floods that destroy human lives along with infrastructure, crops and livestock.

Matters are made worse by poor management of water resources within Pakistan, including crumbling irrigation infrastructure, inadequate irrigation management, and over-exploitation of groundwater, exacerbated by perverse policies that offer incentives to waste water. Much of the impact of climate change is made manifest through natural disasters, exacerbated by the low quality of the infrastructure, little of which is 'climate-proofed', even at modest levels.

Climate change also threatens agricultural output, and thereby both food security and the export potential of key agricultural commodities such as cotton. The annual pattern of monsoon rains has become more volatile and unpredictable, with late rains often delaying the sowing season so that crops emerge from the soil at times of peak heat. Given the importance of agriculture and agri-business to Pakistan's economy, climate change represents a threat to the economy and to employment, driving migration to urban areas. These areas are poorly equipped to receive or productively employ the burgeoning stream of migrants, many of whom then pursue illegal migration, taking on the associated risks, to seek opportunities in other parts of the world. This in turn may add to the factors undermining social and political stability, and possibly even the security of the receiving countries.

Photo 2. Trango Towers in Gilgit-Baltistan, Pakistan. ©Shutterstock

All this exists in an environment of weak public institutions and in what can, at best, be described as a policy vacuum. Further, many public policies undermine disaster preparedness and response, and hamper efforts to build resilience and adapt to the pressing threats of climate change. The absence of incentives to make efficient use of water is just one of many examples. Given Pakistan's limited capacity for response, the risk is that climate-induced stressors might rapidly overwhelm institutions and capacities, increasing the risk of state-failure and a rise in conflict – including trans-frontier conflict in the worst-case scenarios.

e. Empirical assessment of influences of nature and natural resources on conflict

As noted in Section 3.c, empirical testing of the linkages between natural resources and conflict, especially regarding the role of natural resource scarcity, has yielded mixed results.¹⁴³ Here, we revisit this topic by compiling and assessing a globally comprehensive country-level dataset on armed conflict and its potential key drivers for the period 1989–2017. The purpose of the assessment is to examine the most recent globally comprehensive data on armed conflict and natural resources, in order to shed further light on the linkages between armed conflict, and nature and natural resources. When constructing data on natural resources, we sought information

that was consistently available on a global scale and on a country basis throughout the period 1989–2017, to match data on armed conflict. Four factors stand out as particularly interesting here: natural resource availability, natural resource productivity, natural resource dependency, and long-term drought. The data are compiled annually as follows:

Natural resource availability is measured separately for three key resources: agricultural land, forests, and freshwater, each on a per capita basis.¹⁴⁴ We note that lack of data on the availability of marine resources, especially fish, is a limitation. As such, the results are pertinent primarily in the context of terrestrial and freshwater systems.

Natural resource dependency is measured simply as the percentage rural population per country.¹⁴⁵

Natural resource degradation is a form of scarcity because it reduces the productivity of natural resources on a per-unit area basis. We measure natural resource productivity by the Normalized Difference Vegetation Index (NDVI), which uses satellite images to assess local vegetation using globally consistent criteria.¹⁴⁶ The index ranges from -1 to 1, with healthy and dense vegetation producing high values.¹⁴⁷ Values near or below zero indicate non-vegetated features, such as barren rock and soil.¹⁴⁸ As such, the NDVI offers information on the primary productivity of natural resources such as agricultural lands, pastures and forests.

Drought conditions are measured using the Standardized Precipitation-Evaporation Index (SPEI), calculated over four years.¹⁴⁹ The SPEI is a multiscalar drought index based on climatic data. It can be used to determine the onset, duration and magnitude of drought conditions with respect to normal conditions in a variety of natural and managed systems such as crops, ecosystems, rivers, water resources, and so forth.

The indices (NDVI & SPEI) allow examination of *natural resource condition* as a potential driver of conflict. Climate and weather affect the greenness and moisture of the environment, but so do management and use of the resource. For example, as ecosystems degrade, their greenness (and productivity) as measured by the NDVI likely declines, whereas ecosystem restoration has the potential to increase the index, by increasing productivity.

We also examine the role of natural resources relative to other drivers of conflict, including the level of economic development and oil-dependency of countries.¹⁵⁰ Economic development and oil-dependency are measured using Gross Domestic Product (GDP) per capita and the amount of oil rents (the difference between the total value of crude oil production at world prices and the total costs of production) relative to national GDP, respectively.

Figure 11 shows the geographic patterns of the four environmental factors (using map colours) relative to the number of conflicts in 1989–2017 (using pie charts). Countries where conflict is prevalent tend to have a relatively low availability of agricultural land per capita (Figure 11.a) and high percentage of rural populations (Figure 11.b), hence low natural resource availability but high natural resource dependency. Patterns of conflict relative to productivity (Figure 11.c) and drought (Figure 11.d) are less distinct, but show some concurrence, noting that coincidence of conflict and various environmental conditions does not necessarily indicate that one is causing the other.

Figure 12 illustrates correlations of natural resources and conflict by plotting the rate of conflict fatalities (number of conflict-related fatalities per capita per year, on average) against agricultural land per capita, forestland per capita, freshwater resources per capita, the Normalized Difference Vegetation Index (natural resource productivity), and the Standardized Precipitation-Evaporation Index (drought). The figure also plots the rate of conflict against GDP per capita (level of economic development). Each graph shows data by country, on average per year, for the period 1989–2017.

There appears to be a pronounced negative relationship between armed conflict and agricultural land area per capita (Figure 12.a), with conflict prevalent in areas where agricultural land is relatively scarce. Similar, although less distinct relationships also emerge between armed conflict and the availability of forests (Figure 12.b) and freshwater resources (Figure 12.c).

Correlations of conflict with the Normalized Difference Vegetation Index and the Standardized Precipitation-Evaporation Index are less distinct, though Figure 12.e suggests possible linkages between drought and armed conflict. For natural resource productivity (Figure 12.d), the correlation does not seem strong, and if anything, potentially suggests that both negative and positive deviations from mid-range

productivity may be associated with greater armed conflict. The level of economic development, as measured by GDP, appears quite strongly and negatively correlated with armed conflict, with conflict most prevalent in low-GDP countries (Figure 12.f).

Statistical regression modelling techniques allow examination of the data on armed conflict relative to the above data on natural resources as potential drivers of conflict.¹⁵¹ In these models, we also included GDP per capita and oil-dependency of the country as regularly considered potential drivers of conflict.¹⁵² We estimated two complementary predictive models by examining two alternative dependent variables: frequency of conflict, and the number of fatalities associated with conflict (both measured on an annual basis by country and normalised

per 100,000 population to make data comparable between countries of different sized populations). The estimations provide the following key results (see Table A2 and Table A3 in the Appendix for detailed methods and results):

- Scarcity of natural resources, particularly agricultural land, is positively linked to armed conflict: the greater the amount of agricultural land per capita, the less prevalent both the number of armed conflicts and fatalities. The findings regarding the availability of forest and freshwater resources are statistically not as unequivocal, though the forest area per capita is statistically significant and negatively associated with the number of armed conflicts per capita. In other words, the greater the area of forest per

Figure 11. Geographic patterns of the four environmental factors relative to the number of conflicts for the period 1989–2017. Pie charts indicate the number of conflicts, per annum and total, for the period 1989–2017; (a) agricultural land per capita (natural resource availability); (b) rural population as a percentage of the total population (natural resource dependence); (c) Normalized Difference Vegetation Index (natural resource productivity); and (d) Standardized Precipitation-Evapotranspiration Index (drought)

Source: Compiled by authors using data explained in the text.

capita, the lower the number of conflicts per capita.

- Natural resource degradation, as measured by the Natural Difference Vegetation Index, is consistently and robustly associated with both the number of armed conflicts and fatalities associated with them.
- Natural resource dependency, measured as percentage rural population of the total population, is also consistently and robustly associated with both the

number of armed conflicts and fatalities associated with them.

- Drought is positively and robustly associated with the number of fatalities associated with armed conflict. The relationship between droughts, as measured by the Standardized Precipitation-Evaporation Index, and the number of armed conflicts, is qualitatively similar but not statistically significant.

Figure 12. Graphs conflict fatalities per capita and their relation to (a) agricultural land per capita, (b) forestland per capita, (c) freshwater resources per capita, (d) Normalized Difference Vegetation Index, (e) Standardized Precipitation-Evaporation Index, and (f) GDP per capita by country, on average per year, for the period 1989–2017

Source: Compiled by authors using data described in the text

- Economic conditions in a country are a key linkage to armed conflict. The association of GDP per capita with armed conflict is negative and robust for both measures of armed conflict. As GDP per capita rises, the frequency of armed conflict decreases, and so does the number of fatalities associated with armed conflicts. The opposite also holds true: declining GDP pushes a country towards more armed conflict and fatalities.
- Oil-dependency is not statistically significantly associated with conflict. Note that this result represents a relationship evaluated across the globe; the situation may be different in a specific country with specific political, economic and institutional conditions.

Taken together, these empirical findings provide support for the notion that natural resources, especially agricultural lands, including their availability and degradation,

and countries' dependency on them, are associated with armed conflict. While these results represent almost three decades of data on armed conflict and its potential drivers across the globe, they also necessarily represent general, global tendencies. Therefore, the dependencies examined and revealed here may differ in a particular location and at a particular time. Moreover, even the use of longitudinal country-level data across the globe over a long period of time, combined with statistical assessments aiming for robust results, cannot ensure that the relationships uncovered will completely represent causality between conflict and its drivers. However, while further understanding of the causal linkages between natural resources and armed conflict is needed, the results here suggest that investing in natural resource conservation and restoration to improve the condition and productivity of the landscape has the potential to reduce pressures that drive armed conflict.

4. Policy options for conserving nature and building peace

Following the debates on environmental scarcity and security over recent decades, an important line of work has emerged on *environmental peacebuilding*.¹⁵³ By taking a step beyond consideration of the drivers of conflict alone, environmental peacebuilding assesses options for environmental protection, conservation and cooperation as a means to create peaceful relations between and within states. Environmental peacebuilding encompasses improved natural resource governance, improved natural resource management, protecting nature in times of conflict, and transboundary resource management and international agreements. The peacebuilding context may involve post-conflict situations, but conservation opportunities may also emerge in areas threatened by conflict. More generally, environmental cooperation can promote peace by sustaining dialogue and bringing together adversaries (see, for example, Box 11). This section examines a few key policy options for harnessing a conservation dividend through collectively safeguarding both nature and peace, particularly in the context of the global mandate for safeguarding nature (Sustainable Development Goals 14 & 15) and peace (Sustainable Development Goal 16).

a. Improved natural resource governance

Natural resource governance refers to the norms, institutions and processes that determine how power and responsibilities over natural resources are exercised, how decisions are taken, and how citizens – including women, men, youth, indigenous peoples and local communities – effectively participate in, and benefit from the management of natural resources.¹⁵⁴

Improved natural resource governance should in turn improve both long-term prospects for the conservation of nature, and the extent to which environmental sustainability contributes to human well-being. Good governance is generally associated with reduced conflict, and strengthening natural resource governance can contribute to improving governance overall.¹⁵⁵

Improved natural resource governance should enable all actors with natural resource rights, roles and responsibilities to engage in positive actions to sustain nature in ways that help advance social equity and human rights. It also allows for the effective operation of appropriate accountability and redress mechanisms to address failures and negative environmental or social impacts.¹⁵⁶ The following characteristics of improved governance provide the basis for preventing or resolving conflicts related to the use and management of natural resources.¹⁵⁷

Inclusive decision-making

Inclusive decision-making involves the full and effective participation of groups with rights and interests in land and natural resources, including individuals and groups at risk of marginalisation. Participation enhances the effectiveness of natural resource governance by bringing multiple interests, perspectives and associated knowledge to bear on decision-making. The need for inclusive decision-making concerns interactions between local communities and the state, but it is also relevant within communities – e.g. in relation to the views and interests of women, youth and other groups – and between local people and businesses, non-governmental organisations and other non-state actors.¹⁵⁸

Box 5: Restoration Opportunities Assessment Methodology to promote inclusive decision-making

Mirjam Kuzee (IUCN)

Where natural resource degradation has occurred and may be associated with conflict, the Restoration Opportunities Assessment Methodology (ROAM) can help identify restoration opportunities that re-establish ecosystem function and improve human well-being.¹⁵⁹ ROAM is an inclusive decision-making process that convenes all stakeholders to identify appropriate landscape-level restoration interventions that provide multiple benefits for a diverse group of stakeholders. For example, in Indonesia's Gorontalo Province, 40 per cent of coastal mangroves in Tanjung Panjang Nature Reserve have been lost to illegal aquaculture expansion by settlers from South Sulawesi in the last 10 years.¹⁶⁰ ROAM was used to convene all local stakeholders for an inclusive decision-making process on sustainable coastal management, thereby easing social tensions and resolving existing natural resource conflicts.

In Colombia, ROAM was used to identify landscape restoration and livelihoods opportunities for internally-displaced people affected by years of conflict in the eastern department of Antioquia, following the peace agreement between the government and several guerrilla groups.¹⁶¹

Photo 3. Participatory mapping of landscape degradation in Zigida, Wonegizi, Liberia
© Kilime S. Gweekole

In Rwanda, the ROAM process assessed the potential contributions of landscape restoration to the country's key national development targets relating to forest cover, energy production, access to clean water, food production, poverty reduction and per capita GDP. While some of the objectives of restoration could benefit from the use of non-native species – an often-criticised aspect of forest restoration¹⁶² – the assessment in Rwanda showed that objectives such as the protection of soil and water is best achieved by establishing mixed stands of native species rather than monoculture of non-native species.¹⁶³

In Ghana, dialogue and inclusive decision-making during the ROAM process led farmers to better understand their role in social-environmental challenges caused by degradation, and how they can be their own agents of change, individually and by working together as a community. Across West Africa, the ROAM process continues to be used to identify landscape restoration opportunities that will mitigate elephant-people conflict by improving livelihoods of local people, while conserving the rich biodiversity of the region's forests.

Inclusive decision-making helps prevent or resolve conflicts by avoiding results that infringe on rights and interests, either due to a lack of information about what these are, or due to power dynamics that privilege rights and interests of certain groups. Ideally, inclusive decision-making is implemented proactively, as it can be problematic when decisions have to be made quickly, for example, under conditions of war.

Policy options for improving outcomes for peace and nature through inclusive-decision making include:

- Establish, maintain and strengthen platforms to enable rights-holders and stakeholders, including women, men, indigenous peoples and local communities, to engage in dialogue and consultation on natural resource management decisions;
- Ensure that diverse groups are represented in decision-making platforms and processes, with particular attention to ensuring that potentially-marginalised groups have the resources and support needed to participate effectively;
- Provide rights-holders and stakeholders with access to the information they need to participate effectively in their languages, and contribute their own knowledge to decision-making; and
- Verify that decisions take into account the systems, knowledge and traditional norms of rights holders, and integrate them into natural resource governance and management.

Land tenure and resource rights

Land tenure and resource rights refer to the social relations and institutions governing access to land and resources, including who is allowed to use which resources, how and for how long, and under what conditions.¹⁶⁴ Land and resources are fundamental livelihood assets for local people and form the basis for social and political organisation, cultures, traditions and identities. Strong evidence shows that when communities have secure rights to forest land and resources,

deforestation rates decrease and carbon storage is improved.¹⁶⁵

A lack of secure tenure can lead to competition over resources and, in some cases, exclusion or displacement of individuals or communities. Contested rights to land and resources are a driver of conflict in many rural, high-biodiversity areas around the world.¹⁶⁶ Many conflicts occur due to unresolved overlaps between customary/traditional and government claims to land. Acute conflict may be triggered when outside investment in natural resources ignores local resource rights. For instance, an examination of 32 cases of land tenure-related conflict of natural resource investments in Africa showed that the most significant driver of dispute was the displacement of local people, followed by issues around financial compensation and the destruction of the environment.¹⁶⁷ Increasing resource scarcity, either due to a decline in the resource or an increase in the number of users, has been linked to increasing conflict and political tension, which has been a particular concern for water resources (see for example, Box 4).¹⁶⁸ Furthermore, the increased value of land and resources such as minerals and petroleum are also associated with tenure insecurity and conflict.¹⁶⁹

Clarifying and securing land and resource tenure reduces conflict by enabling people to defend their claims, and by avoiding multiple conflicting claims and activities. Clear and secure tenure is also important for maintaining peace in post-conflict periods.

Policy options to improve outcomes for peace and nature by increasing tenure security include:

- Securing legal recognition, reflecting the full spectrum of existing tenure rights, including customary and informal rights, and integrating these rights within the formal national lands system;¹⁷⁰
- Empowering community and civil society organisations to secure and defend tenure rights;
- Supporting capacities and processes for enforcing tenure rights against encroachment;

- Documenting rights and ensuring accurate information is available, including to avoid overlapping allocations;
- Ensuring that changes in tenure are sensitive to conflict and include capacity building for conflict management and resolution;
- Avoiding policies that drive conflicting land uses and undermine tenure security (e.g. from large-scale infrastructure, large-scale land acquisitions for agriculture, or resource extractions such as petroleum and mining); and¹⁷¹
- Acknowledging and redressing conflicts caused by dislocation or violation of traditional rights, and establishing processes for compensation.¹⁷²

Accountability and transparency

Accountability can be defined as the requirement to accept responsibility and answer for actions, and is widely recognised as a fundamental principle for good governance, including in natural resource contexts.¹⁷³ Accountability is closely related to transparency, because open and accessible information regarding the actions of natural resource authorities is critical to holding them to account. Accountability mechanisms include structures and capacities to hold governments, the private sector and other powerful actors responsible for their actions, and to take corrective action when these actors do not uphold their responsibilities.¹⁷⁴

A lack of accountability and transparency in the governance of natural resources can result in conflict between different groups of resource users, for instance when local communities are not provided with sufficient and detailed information regarding a new development, including information about both the location and duration of the project, as well as transparency of governance processes.¹⁷⁵ In addition, conflict can arise when local users or guardians are not actively consulted before and during resource extraction or use, when local actors do not have the capacity or opportunity to negotiate contracts and terms of use, and when no mechanisms are in place to report illegal use of resources.

Policy options to improve outcomes for peace and nature through accountability and transparency include:

- Establish and maintain capacities and mechanisms to hold natural resource governance authorities responsible for their actions, across multiple levels;
- Ensure institutions responsible for natural resource governance operate transparently, and share open and accessible information on their actions and plans;
- Ensure that rights-based social and environmental safeguards are adopted and implemented by natural resource authorities;
- Provide access to justice and grievance mechanisms, including through support for existing traditional or informal justice systems; and
- Strengthen laws, regulations and institutions to fight corruption in the governance of natural resources.

Rights of indigenous peoples

As highlighted by the UN Permanent Forum on Indigenous Issues, indigenous peoples have been frequently impacted by, and remain particularly vulnerable to armed conflict.¹⁷⁶ Current conflicts often relate to indigenous lands, territories and resources, as tenure insecurity issues (as described in the previous section) are often particularly acute for indigenous peoples. For example, it is estimated that indigenous peoples and local communities hold 65 per cent of the world's land area through customary, community-based tenure systems; indigenous peoples alone manage or have tenure rights to over a quarter of the land area, yet national governments only formally recognise legal tenure rights for a small proportion of these lands.¹⁷⁷ Even when their rights are respected by statutory laws, indigenous peoples often still face insecurities on the ground.¹⁷⁸ Conflicts also impact the civil, political, cultural, social, economic and spiritual rights of indigenous peoples.¹⁷⁹ Implementation of the right to free, prior and informed consent is key to reducing the risk of such insecurities and conflicts (Box 6).

Box 6: Free, prior and informed consent of the Salitre and Térraba indigenous peoples

Anita Tzec (IUCN)

In 2007, the United Nations General Assembly adopted the United Nations Declaration on the Rights of Indigenous Peoples, recognising their rights and specifically mentioning the right to free, prior and informed consent (FPIC) as a prerequisite for any activity affecting their ancestral lands, territories and natural resources. However, progress towards FPIC implementation has been slow and uneven. For an FPIC process to be effective in generating consent or refusal, the manner in which the process is conducted is crucial. The time allocated for discussions among indigenous peoples, the cultural appropriateness of the ways in which information is transmitted, and the involvement of the entire community, including key groups such as women, elders, youth and children, are essential. A comprehensive and well-developed FPIC process helps to guarantee the right of all community members to self-determination, allowing them to participate in decisions that affect their lives, their territories and the governance of their resources, thus minimising the potential for environmental conflict.

Photo 4. Consultation and FPIC process to strengthen the capacity of the indigenous territories of Térraba and Salitre in Costa Rica for their negotiation, integration, and representation in the National REDD+ Strategy. © IUCN-Milena Berrocal

In Costa Rica, IUCN, working with the government, has brought together various indigenous peoples to discuss the process of Reducing Emissions from Deforestation and Degradation (REDD+) in a culturally adapted way, to advance the REDD+ process in the country while minimising the possibility of environmental conflicts. The capacity building processes that were implemented in the territories of Salitre and Térraba in southern Costa Rica are an element of the information stage that must be carried out as part of the right to consultation and free, prior and informed consent, in line with Costa Rica's National REDD+ Strategy.¹⁸⁰ As a result, environmental governance strategies were created that must be implemented in indigenous territories, hand-in-hand with their traditional authorities, and based on their traditional uses and customs.

Indigenous peoples face systemic problems that hinder the full enjoyment of their rights. Writing about Honduras, the United Nations Human Rights Council Special Rapporteur on the Rights of Indigenous Peoples noted that, “The lack of protection for their lands, territories and natural resources, together with impunity and inadequate access to justice, are fundamental problems that leave them totally defenceless in the face of acts of violence by various parties.”¹⁸¹ Indigenous peoples are often on the front lines with limited support for their efforts to defend the lands and resources. These environmental defenders have been particularly susceptible to conflict and violence (see Section 2.a), which has led to numerous reported cases of assault on, and murder of indigenous peoples around the world.¹⁸²

Policy options for reducing conflicts impacting indigenous peoples and promoting peace include:

- Formally recognise and respect the rights of indigenous peoples to their lands, territories and resources (see above for actions on land rights issues);
- Ensure that free, prior and informed consent is secured and maintained for any actions on or affecting indigenous lands, territories, resources and rights;
- Support the development of territorial governance plans (based on self-determined cultural values, norms and systems) and capacities for monitoring and enforcement;
- Recognise and include indigenous and local knowledge systems, and the customary institutions that sustain this knowledge, to improve natural resource management and help avoid or reduce conflict over scarce natural resources;¹⁸³
- Collaborate with indigenous peoples to design and implement early warning systems to prevent conflict and ensure peace, security and good governance on indigenous peoples’ lands and territories;¹⁸⁴
- Ensure that indigenous peoples can freely document and report abuses in conflict and post-conflict situations, without risk of reprisal; and¹⁸⁵
- Support and promote processes of dialogue and consensus-building, guided by the principles of the UN Declaration on the Rights of Indigenous Peoples.¹⁸⁶

Gender equality and women’s empowerment

Gender equality refers here to women’s and men’s equal rights, freedoms, conditions and opportunities to access and control land and other natural resources. Recognising the rights of both men and women, regardless of background, age, race, sexual orientation, gender identity, ethnicity or religion, is important for avoiding conflict over natural resources.

In situations where resources become scarce, it is often women and children who are disproportionately affected, depending on the type of resources. Women and girls tend to be the primary water and energy managers for many rural households around the world, and when these resources become less reliable, women and girls bear the burden of spending increased time collecting water and fuel.¹⁸⁷ The time and energy spent completing these tasks takes time away from other income-generating, care-giving or leisure activities, and exposes them to the potential risks of gender-based violence, including sexual violence.¹⁸⁸ When conflict and environmental degradation results in forced migration, women again are among the first affected, even in locations such as refugee camps, where they are increasingly vulnerable to violence and experience rape, kidnapping and trafficking.¹⁸⁹

As discussed in Section 3.c, conflict and war are often associated with illegal wildlife trafficking, which in turn is often linked to other criminal activities.¹⁹⁰ The destructive and disruptive impacts of such illegal activities can lead to an increase in gender-based violence in nearby communities.¹⁹¹ Both men and women can be perpetrators of illegal activities as well as victims of violence and gender-based violence, with women making up the vast majority of victims.

Box 7: Women as change-makers in the governance of the Mano River, Guinea and Liberia

James Dalton & Camille Jepang (IUCN)

The Mano River is shared between Guinea and Liberia, and was heavily impacted by the civil war that took place in Liberia in the 1990s and early 2000s. Fishing on the river is traditionally carried out by women and is essential to the livelihoods of the families in the region. In some communities, on both sides of the border, there has been a perception that the other side was not respecting the national boundaries, and both sides accused the other of fishing in their waters.

Photo 5. Activities on the Mano River, including fishing and agriculture (in the back)
©Yanquoi Gornor Pewu

Rather than escalating into full armed conflict in an area that had already seen so much fighting, women fishers set up a system for a cross-border information exchange, agreeing on the division of days for fishing for each community and coordinating their activities so that each side could fish without impeding the other. In this case, these communities recognised that cooperation was more effective than conflict, as the women found solidarity with each other in feeding their families and generating income. Such cooperation reduces the risks of conflict and promotes a more peaceful coexistence between transboundary communities.

Women also have unique opportunities to act as agents of change in conflict mitigation and peacebuilding. There is strong evidence showing that strengthening gender equality and women's empowerment

related to natural resource management can contribute to building effective and lasting peace.¹⁹² Failure to take advantage of the opportunities presented by women's unique knowledge and roles in managing

natural resources can perpetuate inequality and ultimately undermine post-conflict recovery.¹⁹³

Addressing gender equality can improve outcomes for peace and nature, including through the following policy options:

Legally recognise equal rights for men and women to inherit, own, rent and sell land, and to access, use and manage other natural resources;

- Prioritise women's empowerment and help women realise their tenure and resource rights by providing them with access to information, credit and services;
- Facilitate and support women's leadership and equal participation in decision-making on natural resource governance at all levels, especially in local government and natural resource governance bodies, but also in conflict mitigation and peacebuilding processes, including women as, for example, leaders, mediators, delegates, signatories, witnesses, observers and gender advisors;
- Ensure that research, analysis, programme development, and project design and execution include and employ data disaggregated by gender and gender-responsive strategies, in order to identify gender gaps and advance gender equality in natural resource management and conflict mitigation;
- Engage women's groups – from informal cooperatives to formal unions and organisations – in peacebuilding and conflict resolution processes, plans and actions;
- Recognise the unique roles and situations of men and women with regards to illicit wildlife-related exploitation during conflict, and provide gender-oriented policy interventions to address this; and
- Pay special attention to gender-based violence ensuring prevention and response efforts are available, accessible and supported for all populations who might be at risk, particularly women and girls, but also men, boys and individuals

who may already be vulnerable due to factors including age, race, ethnicity, sexual orientation, gender identity, disability and educational status.

Coordination within countries

Coordination highlights the need for actors involved in natural resource governance to come together around a coherent set of strategies and management practices. Coordination can be 'vertical', comprising links across multiple levels of actors with some role in the governance of the same ecosystem or resource; or it can be 'horizontal', characterised by collaboration and consensus across different sectors operating in, or impacting the same geographical space.¹⁹⁴

Coordination of actors within countries contributes to effective natural resource governance by ensuring that actors responsible for natural resources are working in harmony, or at a minimum, not undermining one another.¹⁹⁵ When coordination mechanisms are not in place or fail, natural resource governance actors' different objectives, strategies and activities might damage the resource base and cause conflict.

Policies for improving outcomes for peace and nature through coordination to reduce conflict include:

- Ensure that legal and policy frameworks across sectors responsible for natural resource governance are aligned; and
- Establish and maintain mechanisms for horizontal and vertical coordination across multiple actors and multiple levels of natural resource governance.

b. Improved natural resource management

While natural resource *governance* is concerned with which actors make decisions regarding nature, and how these decisions are made (Section 4.a), natural resource *management* concerns the actions implemented through these decisions, and their intended outcomes. A variety of natural

resource management tools are available; of these, protected areas, sustainable land use, water management, standards and safeguards through tools such as Environmental Impact Assessment, and greening military and humanitarian operations are explored in more depth below. Sustainable harvest of wild species also has the potential to contribute towards environmental peacebuilding, for example, through well-managed local fisheries.¹⁹⁶ Implemented equitably and effectively, each of these may contribute simultaneously to peacebuilding and to nature conservation. Application of such management approaches at broad scales (e.g. landscapes, catchments, etc.) may be important in conflict situations, but often require implementation through a bottom-up, decentralised approach to avoid inadvertently triggering further conflict.

Protected areas

Serious civil unrest and armed conflict is usually detrimental to nature even in protected areas (see Section 2.a).¹⁹⁷ However, protected areas are not simply powerless recipients of the impacts of conflict. Protected area managers and staff have opportunities to promote the role of peace and cooperation by supporting livelihood security and wellbeing before conflict breaks out, as well as by actions both during conflict, and following a serious outbreak of unrest, through the process of rebuilding trust and institutions.

Successful conflict prevention, mitigation or recovery is a multi-sectoral process best achieved through cooperation between humanitarian, development and conservation interests, all working with local communities and indigenous peoples.

Conflict prevention: By maintaining ecosystem services, protected areas in any IUCN management category can help to minimise risks of conflict during times of stress by direct contributions to wellbeing or subsistence. Protected areas contribute directly to food and water security through disaster risk reduction, and by providing safe places for people to exercise and relax,¹⁹⁸ thereby helping to reinforce domestic security. Djibouti's Day Forest Reserve, for example,

protects one of the last areas of native forest in the country and is of prime importance to biodiversity; it also provides a source of food for local people during periods of drought.¹⁹⁹ In Cambodia, Tonle Sap Lake, a Biosphere Reserve, provides 60 per cent of the country's freshwater fish catch, supplying vital food to local people.²⁰⁰ Such multi-use areas involve a trade-off between conservation and community, which itself requires careful management; however, these areas can also provide a vital lifeline for people with few other options.

Conflict risk reduction as a benefit derived from protected areas is not a foregone conclusion, and indeed, poorly managed or governed protected areas can be a source of conflict²⁰¹ (Section 3.c). That noted, effectively managed and equitably governed protected areas can also help reduce tensions between or within countries by encouraging cooperation in addressing issues of mutual concern, sharing information and building trust.

Conflict mitigation and resolution: If conflict breaks out, protected area managers can respond in many ways through direct peacebuilding, and by restoring economic opportunities to places that have suffered from civil war or other conflict. In situations of conflict within or between countries, protected area staff are often unofficial go-betweens, occupying a grey area between a militarised state and rebel forces, and negotiating even at times when the state is officially not negotiating. This has happened many times during the long-running conflicts in Colombia, for instance. Such cooperative efforts spill over into international conflicts as well. For example, gorilla experts in Ugandan and Congolese protected areas have continued collaborating on transboundary conservation irrespective of the state of relations between the two countries. Sometimes protected area staff can play a more active role in addressing conflict, by maintaining the law in areas where other government institutions are failing.²⁰² Given the considerable overlap between insurgency and poaching, rangers may need to address them simultaneously, as was the case in Zakouma National Park in Chad and

Garamba National Park in the Democratic Republic of the Congo.²⁰³ Such issues affect non-state protected areas as well. One of the motivations for local people to form conservancies in northern Kenya has been to improve security and reduce cattle theft, for example from cross-border raids from Somalia.²⁰⁴

The security crisis in the Central African Republic has seen a dozen armed groups and multiple local militias usurp control of most of the country.²⁰⁵ The Chinko Nature Reserve, a 50-year public-private partnership involving the Central African Republic's Environment Ministry, USAID, the African Parks Network and the Walton Family Foundation, is bringing some security to 1.8 million ha of a territory where legal norms and processes have generally broken down.²⁰⁶ Chinko is the largest employer in the region, providing jobs to some 400 local people, and funding dozens of nurses and teachers. In 2017, 380 internally displaced people, mainly women and children, fled to Chinko seeking sanctuary from civil unrest and were protected by the rangers.²⁰⁷ This is not ideal as conservationists are not trained to provide security or humanitarian aid; but in practice, such contributions are commonplace, and have also been reported to occur in Virunga National Park in the Democratic Republic of the Congo.²⁰⁸

Post-conflict rebuilding: In the aftermath of conflict, conservation can help to bring back stability, security, and economic opportunities to people who may have lost everything. As a result, protected areas have been used as 'safe spaces' for development in regions worldwide, from the former Yugoslavia to the Congo Basin. The Norwegian Agency for Development Cooperation, Norad, funded a three-year project to increase cooperation between protected area managers across the new national borders in the area of the former Yugoslavia.²⁰⁹ The use of projects to reduce greenhouse gas emissions from deforestation and degradation (REDD+) is seen as a way to help rebuild peace and economic opportunities in the fragile political climate in the Democratic Republic of Congo.²¹⁰ The UN Environment Programme has charted the importance of including consideration of natural resources in peace treaties, although

research suggests this is often not followed in practice.²¹¹

Since the catastrophic 1994 ethnic killings in Rwanda, the government has prioritised its national park system to attract high-paying foreign tourists. Gorilla tourism virtually disappeared from 1994 to 1998, but has boomed since; by 2008, there were 20,000 protected area visits, of which 17,000 were for gorilla viewing,²¹² and growth has continued. With gorilla permits costing US\$ 1,500 each, tourism earned Rwanda US\$ 400 million in 2016²¹³ and US\$ 438 million in 2017,²¹⁴ making it the largest earner of foreign exchange. Although protected area revenues have helped support broader development goals such as infrastructure development, economic benefits have not always trickled down to the local communities and some tensions (including poaching) remain,²¹⁵ highlighting the need to include conservation within wider social goals.

Lastly, and more subtly, conserving or restoring nature are important parts of nation-building, and the ethical values inherent in conservation may be particularly important after periods of instability.²¹⁶ For example, in places where the military becomes directly involved in conservation management, protected areas provide opportunities for governments to build a different role for army and navy personnel, as well as a different relationship with civil society. Conservation can also be a viable line of employment for ex-combatants.²¹⁷ However, such approaches carry risks; in the past, the army has been closely involved in large scale poaching in places such as Madagascar and Thailand, and militarisation of conservation can increase domestic conflict.²¹⁸ But if well-managed, the military can provide positive role models and bring new actors into an understanding of conservation. The role of the navy in protecting marine reserves in Colombia is one such example, along with the army's anti-poaching remit in Nepal, where nature conservation is actually written into the mandate of the armed forces, and the Botswana Defence Force, which plays a similar anti-poaching role in the country.²¹⁹ By providing a peaceful, positive example

of cooperation, well-planned and managed protected areas can thus help parties prevent and recover from armed conflict within nations.

Policy options to improve outcomes for peace and nature through improved protected areas management include:

- Reduce conflict risk, for example by maintaining local food and water security, providing safe opportunities for relaxation and exercise, and encouraging cooperation among communities;
- Mitigate active conflict and its impacts through, for example, supporting negotiation and ceasefire in disputed areas, capacity building for conflict sensitive conservation, and maintaining law and peace in and around the protected area; and
- Generate opportunities to support economic rebuilding post-conflict (for example, through ecotourism), advancing nation building, and refining productive and peaceful roles between the military, civil society and nature.

Sustainable land use

When land is not managed sustainably and equitably – possibly leading to natural resource degradation, natural resource conflict, and migration – restoration of natural resources can serve as a nature-based solution to the social, economic and environmental challenges faced by people across the globe. In particular, forest landscape restoration aims at restoring whole landscapes to meet present and future needs, and offers multiple benefits to a diverse group of stakeholders over time.²²⁰ Intervening at the landscape level is more effective in balancing ecological, social and economic priorities rather than simply at the site level, as it embraces a mosaic of interacting land uses and management practices at a greater scale. Implemented effectively, forest landscape restoration can actively engage stakeholders in planning and decision-making

regarding restoration goals and interventions. Convening, negotiating and agreeing on restoration interventions that will benefit a range of stakeholders, including vulnerable groups, is therefore key to successful conflict resolution, and restoration of degraded lands into productive landscapes that meet livelihood and economic needs.

Degradation affects people's vulnerability and resilience in many different ways, and varies geographically. While droughts severely impact some communities, floods, sea-level rise and other extreme weather events pose serious challenges to others. If forest landscape restoration is tailored to local conditions, it can significantly increase biodiversity and resilience in agricultural landscapes, through for example, the planting of species that restore functional aspects of the landscape, as well as by increasing forest patches.²²¹ Trees and forest patches in agricultural landscapes serve to increase agricultural productivity and resilience, and do not displace agricultural land-use, a commonly held misconception. This is particularly important considering that land degradation now affects over 3 billion people globally, and by conservative estimates, close to 30 per cent of arable land,²²² which could exacerbate natural resource conflict and migration. Conservation can help in places where families are trying to survive on smaller and smaller parcels of land; for example, where people are displaced by war and forced into unsustainable coping strategies.

Forest landscape restoration should be more than just planting trees. For example, the predominant strategies (87 per cent) of the Bonn Challenge pledges which focus on restoring the forests of Brazil, El Salvador, Mexico, Rwanda and the United States, consist of the management of degraded forestlands through silviculture and natural regeneration, as well as the improvement of agricultural lands through agroforestry. Only 2.2 per cent of the restoration strategies of the Bonn Challenge are plantations.²²³

Box 8: Protected areas and peace in the Southern African Development Community

Kevan Zunckel (IUCN World Commission on Protected Areas)

The Southern African Development Community (SADC) consists of 12 southern African countries that collaborate on many issues through 27 legally binding protocols. Its 1999 Protocol on Wildlife Conservation and Law Enforcement recognises transfrontier conservation areas as mechanisms that can realise regional growth through conservation.²²⁴ In 1997, South African President Nelson Mandela, Prince Bernhard of the Netherlands, and South African businessman and conservationist Anton Rupert created the *Peace Parks Foundation* to help establish transfrontier conservation areas in southern Africa, with the vision of linking protected areas and ecosystems across international borders in order to create jobs, conserve biodiversity, and promote regional peace and stability. President Mandela was instrumental in securing the support of the heads of state for each of the 12 Southern African Development Community countries. Through the sustained efforts of dedicated officials in Mozambique, South Africa and Zimbabwe, the Great Limpopo Transfrontier Park has evolved into a transfrontier conservation area with additional areas being added to the core protected areas of the Limpopo, Kruger and Gonarezhou National Parks.

Today, the Southern African Development Community has a number of transfrontier conservation areas across the region at various levels of establishment, as well as a formal network of transfrontier practitioners who meet regularly to learn from each other. Many challenges remain, including the perceived exclusion of local peoples from governance and resource capture by elites, as well as escalating poaching of rhinoceroses and the implementation of 'green violence' in response.²²⁵ Nevertheless, the growing body of experience in managing *parks for peace* in the region inspires optimism that over time, the Southern African Development Community's protected areas can indeed deliver both conservation and peace.

Photo 6. President Mandela officiates at the establishment of the Great Limpopo Transfrontier Park © Piet Theron, Great Limpopo TFCA

Policy options to improve outcomes for peace and nature through improved land management include:

- Restore landscapes to offer multiple benefits to a diverse group of stakeholders over time;
- Manage degraded lands through sustainable agriculture, silviculture and agroforestry;
- Tailor conservation and restoration interventions to local scale and specific conditions;
- Focus on species that restore functional aspects of the landscape; and
- Actively engage stakeholders in planning and decision-making regarding restoration goals and interventions.

Water management

Traditional water management through built infrastructure development is increasingly unlikely to provide future water security and resilience against predicted climate change impacts, with the possible exception of desalination.²²⁶ Harnessing the water-related services of natural infrastructure, which are provided by sustainably managed forests, wetlands and floodplains, has a major role to play as a nature-based solution to combating the risk of water crisis and resulting conflict, particularly in the face of future climate stresses.²²⁷

In the case of flood-risk management for example, flood-control infrastructure such as levees and dams often degrade aquatic habitats by altering the natural river flow regime and cutting off floodplains from rivers. Preserving floodplains or reconnecting them to rivers can instead provide flood management benefits, while also conserving ecosystem values and functions.²²⁸ Both built and natural infrastructure are needed for efficient and effective management of water resources,²²⁹ but it is essential that the built infrastructure is designed to high environmental standards. Therefore, future water management approaches need to provide mixed portfolios of investment and planning of both built and natural infrastructure, in order to reduce the risk of conflict while also tackling social and

economic development, environmental sustainability and the impacts of climate change.²³⁰

Policy options to improve outcomes for peace and nature through improved water management include:

- Develop and implement nature-based solutions for flood risk management, such as sustainably managed forests, wetlands and floodplains; and
- Ensure that built infrastructure is designed to high environmental standards, as both built and natural infrastructure are needed for efficient and effective management of water resources.

Standards and safeguards

Public finance institutions have increasingly important potential to support environmental peacebuilding. Perhaps the leader in this field has been the International Finance Corporation, the private sector lending arm of the World Bank, which maintains eight *Environmental and Social Performance Standards* or safeguards designed to ensure that its investments do not negatively impact either the environment or society. For example, Performance Standard 6 on *Biodiversity Conservation and Sustainable Management of Living Natural Resources*, requires clients to safeguard a 'critical habitat' by ensuring that projects do not negatively impact populations of Critically Endangered or Endangered species, or a range of other biodiversity values.²³¹ It also maintains less stringent safeguards for 'natural habitats' and 'modified habitats', as well as for protected areas (see Section 4.b.iv) and for managing invasive alien species.

Performance Standard 3 on *Resource Efficiency and Pollution Prevention* is also oriented to environmental benefits. In addition, Performance Standards 4 (*Community Health, Safety and Security*), 5 (*Land Acquisition and Involuntary Resettlement*) and 7 (*Indigenous Peoples*) all contribute to improved governance (see Section 4.a), thereby helping to

avoid conflict. Prospective borrowers are required to demonstrate adherence to these standards through application of tools such as Environmental Impact Assessments. The World Bank itself now also uses a similar system of Environmental and Social Standards to guide its public sector lending, and many other international financial institutions, notably the Equator Principles banks,²³² have adopted comparable mechanisms. A key challenge in the implementation of such standards and safeguards is capacity. These standards require extensive localisation to the specific context in question, which places them out of reach for many financial institutions in numerous conflict-afflicted and environmentally-sensitive regions.

Policy options to improve outcomes for peace and nature through implementation of standards and safeguards include:

- Ensure robust compliance by both public and private sector borrowers with environmental and social performance standards established by international financial institutions and other lenders;
- Promote uptake of similar environmental and social standards by financial institutions beyond the Equator Principles banks; and
- Build capacity of borrowing governments and companies for the implementation of standards and safeguards.

Greening military and humanitarian operations

Much of the assessment on options for the simultaneous delivery of positive outcomes for both peace and nature has focused on actions by the conservation and environmental sectors. However, despite the fact that military, peacekeeping and humanitarian activities are often highly constrained by having to operate in challenging conditions over rapid timeframes, there is great scope for building consideration of nature into these activities as well. While the governance, organisation and operations of military and humanitarian activities are clearly distinct, the policy options through which they can deliver

conservation as well as peace goals, are generally rather similar.

The discussion around greening the military has focused on the reduction of pollution caused by military activities (e.g. through destruction of chemical weapons), and the management of natural resources on military lands (e.g. through military compliance with environmental legislation).²³³ Analyses from both the United States and Europe suggest that drivers of military greening are diverse and complex, with political pressure (and resistance to it) complemented by momentum from civil society interest groups, advances in technology, and consideration of environmental factors within militaries themselves.²³⁴ Only more recently have options to reduce the environmental impact of military consumption, as mediated through global supply chains, begun to be considered.²³⁵

As with options for reducing military environmental impacts, the focus of such discussions in the humanitarian sector has long been on assessing and ameliorating the *in situ* impacts of displaced persons.²³⁶ Over the last three decades, this has developed to include formal environmental impact assessment procedures and application of remote sensing technology.²³⁷ Since 1996, the United Nations High Commissioner for Refugees has maintained formal environmental guidelines.²³⁸ The humanitarian sector has not only paid increasing attention to local impacts, but also those embodied in supply chains for food and materials.²³⁹

Policy options to improve outcomes for peace and nature through greening military and humanitarian operations include:

- Build cross-sectoral support (from political decision-making, civil society and from within the military itself) for reducing the environmental 'boot-print' within lands managed by the military;
- Maintain best practice application of environmental impact assessments and United Nations High Commissioner for Refugees environmental guidelines to reduce impacts of displaced persons on nature; and

- Apply life cycle assessment techniques to document and reduce the remote impacts of the military and humanitarian sectors on nature through improved management of supply chains.

c. Protecting nature in areas of conflict

International agreements

Intentional attacks against the natural environment during war are prohibited under international law. Protocol I to the Geneva Conventions, adopted in 1977, requires states in warfare to protect the natural environment against “widespread, long-term and severe damage,” and prohibits methods or means of warfare “which are intended or may be expected to” cause such damage.²⁴⁰ The 1976 Environmental Modification Convention prohibits manipulation of weather and other environmental forces as a weapon of war.²⁴¹ In addition, several international agreements prohibit specific weapons or techniques that have a significant impact on the environment.²⁴² These include instruments addressing biological weapons, incendiary weapons, explosive remnants of war and weapons with excessively injurious or indiscriminate effects.²⁴³ These Conventions and agreements address conduct during war, and do not create rules to protect the environment in the pre-conflict period, or in the time of economic, social and political rebuilding following conflict.²⁴⁴ The provisions relating to environmental harm were designed for international armed conflict and do not necessarily apply to internal conflicts.²⁴⁵

In 2013, the United Nations International Law Commission started work on protection of the environment in relation to armed conflict, developing draft principles on the topic in 2019 with adoption anticipated in 2021.²⁴⁶ These principles integrate multiple bodies of international law, and include both established norms and emerging concepts. They are notable for three reasons. First, the principles address protection of the environment before, during and after

conflict, extending the time horizon from a historical focus on wartime environmental harm. Second, by incorporating diverse bodies of international law, the principles address protection of the environment in relation to both international and internal armed conflicts, filling a gap in international humanitarian law. Finally, the principles address not only damage to the environment, but also the illegal exploitation of natural resources, whether as conflict resources (to finance armed conflict) or by an occupying power.

Other branches of international law, and particularly environmental and human rights law, are relevant to the protection of the environment during and after conflict, including internal conflict. Human rights, and particularly property and resource rights, can be severely affected by environmental destruction or exploitation during or after times of war.²⁴⁷ The International Court of Justice has suggested that environmental obligations – in particular the obligation of States to ensure that activities within their jurisdiction or control do not adversely affect the environment of other States – apply in the context of armed conflict, at least insofar as they are not inconsistent with the law of war.²⁴⁸

The concept of ecocide has been discussed since the 1970s, particularly in connection with intentional damage to the environment during conflict. A draft ecocide convention was submitted to the United Nations in 1973, but was never adopted. In recent years, jurists and activists have called for an amendment of the Rome Statute (which created the International Criminal Court) to include ecocide as a fifth core crime.²⁴⁹ Others argue for the negotiation of a Fifth Geneva Convention to protect nature during armed conflict.²⁵⁰

Policy options to improve outcomes for peace and nature through international agreements include:

- Commit to finalisation, formal adoption and implementation of the International Law Commission Draft Principles on

- protection of the environment in relation to armed conflict; and
- Support international discussions on revision of existing agreements or development of new agreements to protect the environment from harm connected to internal and international conflict.

Box 9: Conflict, Rohingya refugees and elephants – towards peaceful coexistence

Raquibul Amin (IUCN) & Thiri Shwesiin Aung (Harvard University)

Myanmar has suffered from decades-long conflicts between the military government and armed groups in ethnic areas, especially in the Rakhine, Shan and Kachin states. In Rakhine, on the border with Bangladesh, inequitable access to natural resources, increasing environmental pressures, unsustainable infrastructure development, religious and ethnic differences, and political marginalisation are among the factors that have led to over 14,000 deaths and the displacement of nearly one million Rohingya since 2012. In late 2017, more than 700,000 displaced Rohingya settled in camps in Cox's Bazar in Bangladesh, near the Myanmar border. The settlements, hurriedly set up in response to this overwhelming influx of people, inadvertently blocked the only elephant migration corridor between Bangladesh and Myanmar. As a result, this brought the Rohingya people into conflict with a herd of approximately 40 Asian Elephants (*Elephas maximus*), which are globally Endangered as well as Critically Endangered in Bangladesh.²⁵¹ In less than six months, 12 Rohingya people and one host community member died in the resulting encounters with elephants.

Photo 7. Asian Elephants, Sherpur ©IUCN-Rajib Mahmud

Photo 8. Rohingya refugee children with elephant puppets ©IUCN-Sheeladitya

Equipped with elephant expertise and a strong local presence, IUCN and the United Nations High Commissioner for Refugees have been working to achieve a peaceful coexistence between elephants and people (both the Rohingya and the host communities). Every night, a total of 616 volunteers (579 of whom are Rohingya) organised into 51 *tusk force* teams keep a watch from 99 watchtowers set up around the camps. The teams communicate with each other once they spot any approaching elephants, and put up a synchronised, non-violent drill to guide the elephants back into the forest. Elephants are still making attempts to traverse through the camp to reach their migration corridor – to date, this has occurred 140 times. The *tusk force* has successfully handled each occurrence, and there have been no fatalities since the intervention began. The *tusk force* members have also become the camps' environmental conscience; they help to rescue wildlife, lead environmental awareness programmes and support an ongoing camp greening effort.

Implementation and enforcement of obligations in international courts

International obligations are implemented through national law and conduct. While individual compliance with legal obligations can be compelled through national law enforcement and judicial systems, compliance by States with international obligations is normally driven by a combination of internal and external political pressure, incentives, transparency and relationships.²⁵² On relatively rare occasions, international disputes related to environmental damage during and after conflict come before international tribunals.²⁵³

Damage to the environment has been described as a form of international crime,²⁵⁴ but has proven difficult to prosecute under the jurisdiction of the International Criminal Court, which covers “the most serious crimes of concern to the international community as a whole” specifically genocide, crimes against humanity, war crimes, and the crime

of aggression.²⁵⁵ War crimes include attacks that cause “widespread, long-term and severe damage to the natural environment”, but only where all three conditions are met and the damage is “clearly excessive” in relation to the anticipated military advantage.²⁵⁶ This creates a high threshold for criminal liability; as a result, this provision has never been successfully used for prosecution in cases of environmental harm.²⁵⁷

Environmental issues can be implicated by other crimes. In 2008, the International Criminal Court prosecutor brought charges of genocide in a case of deliberate poisoning of water resources, and in 2014 an International Criminal Court case was filed for illegal land-grabbing.²⁵⁸ In 2016, the International Criminal Court Prosecutor announced that it would “give particular consideration” to cases “that are committed by means of, or that result in, *inter alia*, the destruction of the environment, the illegal exploitation of natural resources or the illegal dispossession of land.”²⁵⁹

Box 10: IUCN’s role in international law and policy on nature and conflicts

Carl Bruch (*Environmental Law Institute*)

In recent decades, IUCN has played a leading role in global efforts to formulate international law to address protection of the environment both during armed conflict and in post-conflict peacebuilding. For example, IUCN’s Members have established a robust body of policy on conflict and conservation. Among the key IUCN Resolutions are: *Conservation and peace* (GA-1981-Res-002²⁶⁰); *Armed conflict and the environment* (GA-1994-Res-041²⁶¹ and WCC-1996-Res-075²⁶²); *Natural resource security in situations of conflict* (WCC-2000-Res-040²⁶³); *Liability and compensation mechanisms for environmental crimes during armed conflicts* (WCC-2008-Res-097²⁶⁴); and *Prevention, management and resolution of social conflict as a key requirement for conservation and management of ecosystems* (WCC-2016-Res-068²⁶⁵). In addition, regionally specific resolutions on the issue cover Panama & Colombia (WCC-2000-Res-083²⁶⁶ and WCC-2016-Res-095²⁶⁷), West Asia (WCC-2004-Res-046²⁶⁸), Darfur (WCC-2004-Res-043²⁶⁹), and Georgia and Russia (WCC-2008-Res-071²⁷⁰).

The IUCN World Commission on Environmental Law together with the International Council of Environmental Law developed a Draft Convention on the Prohibition of Hostile Military Activities in Protected Areas in 1995. The Draft Convention provides for the designation of international protected areas which would be marked as demilitarised zones. Though it was never adopted, the Draft Convention influenced later developments, including the work of the International Law Commission.²⁷¹

The International Court of Justice has recognised legal liability for environmental damage in relation to military activity. In 2005, the International Court of Justice ordered Uganda to pay reparations to the Democratic Republic of the Congo for damage caused by pillaging and exploiting its natural resources.²⁷² In 2018, the Court determined that loss of ecosystem services resulting from an illegal military incursion was compensable under international law, though its method for calculating compensation resulted in a low award.²⁷³

Special criminal tribunals set up for specific conflicts may also be able to consider natural resource crimes, but normally only in the context of other criminal activity, such as forced labour, pillage or terrorism (e.g. the Special Court for Sierra Leone, and the International Criminal Tribunal for the former Yugoslavia).²⁷⁴ In some cases, compensation tribunals set up following international armed conflict have addressed questions of environmental damage.²⁷⁵ While withdrawing from Kuwait at the end of the first Gulf War in 1991, Iraqi troops intentionally set fire to over 600 oil wells south of the Iraq border, causing an unprecedented environmental disaster for the region. Subsequently, over ten million cubic metres of soil, 40 per cent of Kuwait's entire freshwater reserve, and 1,500 km of coastline were contaminated, and average air temperatures fell by 10 °C due to reduced sunlight. Because Iraq was not party to Protocol I to the Geneva Conventions, it could not be held accountable for a violation of those provisions. Instead, the Security Council held Iraq responsible for engaging in aggressive war, and thus violating Article 2 of the United Nations Charter, and set up the United Nations Compensation Commission to process claims for loss and damage.²⁷⁶ This case set a precedent for compensation for environmental harm.

International human rights tribunals have played a role in enforcing protection of the environment during and after armed conflict.²⁷⁷ For example, the African Commission on Human and Peoples' Rights found that Nigerian military involvement in oil exploitation projects, which resulted

in contamination of the environment and military attacks on homes, crops and livestock of communities that were opposing the oil exploitation, constituted a violation of the human right to property. The Court found that environmental damage constituted forced eviction, recognising that "pollution and environmental degradation to a level humanly unacceptable has made living in the Ogoniland a nightmare."²⁷⁸

Policy options to improve outcomes for peace and nature through international courts include:

- Support amendment or reinterpretation of the Rome Statute to facilitate prosecution of cases involving environmental harm in the International Criminal Court;
- Push human rights commissions and other regional and global organisations to continue to acknowledge the connections between environmental harm and human rights; and
- Work through the United Nations to hold countries accountable for environmental damage in times of war, and ensure appropriate compensation.

d. Transboundary resource management and agreements

Environmental and social challenges such as natural resource scarcity and conflict often have multiple causes and transcend the borders of single countries.²⁷⁹ Water scarcity can be natural due to climatic conditions, or driven by competition for human use. Consequently, regional and international collaboration on strategies and policies by donors, development agencies and international institutions are key to addressing water security challenges. This is particularly the case for aquatic resources, both in freshwater and in coastal and delta areas, which frequently transcend national boundaries. Species in these areas rely on the correct volume, quality and seasonality of surface water flows, including what the water carries, such as sediment.

It is also often argued that the establishment of transfrontier conservation areas can contribute to both conservation and security, through stabilisation of governance by *parks for peace*; at least 169 such parks have been established,²⁸⁰ although the actual evidence for conservation and security benefits is rather sparse.

Hydro-diplomacy

Water does not recognise political borders. Latest figures suggest that there are approximately 310 transboundary river basins in the world spanning 150 countries and disputed areas, home to over 2.8 billion people, providing almost 56 per cent of the global river discharge and covering nearly half the Earth's land surface.²⁸¹ Only 106 of these basins are governed by cooperative frameworks, and the majority of existing agreements do not include all the riparian states.²⁸² In these basins, the lack of appropriate legal and policy instruments to address water scarcity, pollution and climate change impacts on water resources might aggravate these challenges, as well

as exacerbate existing political tensions that may lead to conflicts.²⁸³ In such conditions, it is essential to promote an integrated and cooperative vision of water resource management that considers the economic, social, environmental and political aspects of a transboundary river basin. This integrated and cooperative vision needs to be reflected in water agreements to be effective.²⁸⁴ As transboundary waters cross multiple levels of governance, water diplomacy might be reflected in different ways, from local water arrangements where communities regulate irrigation, to binational or multilateral treaties to monitor the water quality of a river, to regional and global instruments to regulate the uses of transboundary watercourses. All of these agreements anchor cooperation across different countries and levels of governance, and serve as building blocks of stable and peaceful transboundary water governance.

Policy options to improve outcomes for peace and nature through improved hydro-diplomacy include:

Photo 9. A South Korean security post on the edge of the Imjingang River and the Korean Demilitarized Zone ©Kevan Zunckel

- Promote an integrated and cooperative vision of hydro-diplomacy into agreements, that takes into account the economic, social, environmental and political aspects of a transboundary river basin; and
- Consider water diplomacy from multiple levels of governance i.e. from local water arrangements where communities regulate irrigation, to binational or multilateral treaties to monitor the water quality of a river, to regional and global instruments to regulate the uses of transboundary watercourses.

Marine resource management

Conservation and management of resources across political borders is also a challenge in the marine environment,²⁸⁵ as reflected in Sustainable Development Goal 14. For example, the management of shared fish stocks demands cooperation through multilateral institutions. The umbrella term 'shared fish stocks' includes (i) transboundary stocks, which exist or migrate across multiple exclusive economic zones; (ii) straddling stocks, which are found in one or more exclusive economic zones and the high seas; and (iii) highly migratory species, which often travel great distances, crossing through various jurisdictions.²⁸⁶ International interactions related to shared stock exploitation and management, especially when exploitation by one country has a real or perceived effect on exploitation by another, can build peace or exacerbate conflict depending on biological and political contexts.

Shared fish stocks often require the development of multilateral policy solutions and the creation of cooperative management authorities. When successful, transboundary fisheries management can simultaneously help build or maintain peace, and conserve nature. The Joint Norwegian-Russian Fisheries Commission is an example of a successful transboundary fisheries management body. It was created during the Cold War by the 1975 Treaty on Cooperation in the Fishing Industry between Norway and the Soviet Union.²⁸⁷ The Commission has weathered political

tensions and transformations, including the fall of the Soviet Union and, more recently, sanctions on Russia. By its very existence, the Commission helps to ease conflict over an ongoing territorial dispute in the Barents Sea, in a region known as the 'Grey Zone' that is claimed by both Norway and Russia.²⁸⁸

However, transboundary fisheries management does not always function as a tool that can be leveraged to build peace. Marine resource disputes can exacerbate existing tensions or create new ones, particularly when a country's foreign policy or national financial interests do not align with a peaceful resolution to a marine resource conflict, or where profound disagreements on jurisdiction prevent any communication or cooperation on marine resource issues. One such example is the South China Sea, where disputes over competing territorial and jurisdictional claims have led to militarised standoffs and, in 2013, incited the Philippines to initiate an arbitration against China based on two Articles of the United Nations Convention on the Law of the Sea. One of the findings of the 2016 Tribunal was that China had violated its obligation to protect the marine environment by allowing harmful fishing practices, fishing threatened species, and destroying coral reefs at a large scale through land reclamation projects. While the South China Sea dispute is unresolved, the Tribunal may well set a precedent for the United Nations Convention on the Law of the Sea to be read as a legal obligation to conserve and protect the marine environment.²⁸⁹

Climate change will further complicate the already difficult task of shared stock management by redistributing fish species. Under business-as-usual projections, up to 80 per cent of fish stocks are predicted to change their distribution across exclusive economic zone lines by the year 2100.²⁹⁰ Other models estimate that by 2060, 54 to 64 exclusive economic zones will have at least one new transboundary stock.²⁹¹ This large-scale redistribution of marine resources has the potential to lead to increased conflict unless adaptive, effective management is put in place.

Policy options to improve outcomes for peace and nature through improved marine resource management include:

- Proactively develop multilateral institutions (e.g. fisheries commissions) to coordinate the management and conservation of transboundary and straddling stocks, and highly migratory species (this is of particular importance when management actions taken by one country have a real or perceived effect on another);
- Explore application of the United Nations Convention on the Law of the Sea as a legal obligation towards marine conservation; and
- Ensure internationally coordinated adaptive management of fish stocks to minimise new tensions, as species redistribute in response to climate change.

Parks for Peace

It is increasingly recognised that the establishment of transboundary conservation areas can contribute to both conservation and security, through stabilisation of governance by 'peace parks'. A *Park for Peace* is a "designation that may be applied to any Transboundary Conservation Area, and is dedicated to the promotion, celebration and/or commemoration of peace and cooperation."²⁹² The designation was first given in 1932 to the transboundary complex of Waterton National Park in Alberta, Canada, and Glacier National Park in Montana, USA, and has subsequently been extended to a wide variety of transboundary protected areas throughout the world.²⁹³ Another well-known transboundary conservation area is the European Green Belt, a 12,500 km long strip of land and coastal sea area that stretches from the Barents Sea to the Adriatic and Black Seas, and comprises more than 3,200 protected areas.²⁹⁴ Major parts of the European Green Belt's pristine landscapes were developed along the former Iron Curtain,

marking the political separation between the former Eastern and Western Blocs. The European Green Belt Initiative²⁹⁵ is therefore building upon the fact that the past conflict limited use of the areas along the former Iron Curtain, thus ensuring the persistence of biodiversity and intact ecosystems. Another example of where this has occurred is the Korean Demilitarized Zone (Box 11).

The European Green Belt and the Korean Demilitarized Zone reflect the retrospective application of the concept of a transboundary conservation area in the hopes that peace will be sustained; the proactive application of the concept holds immense potential for both transboundary conservation as well as sustained peace (see Section 4.b.iv). Such transboundary conservation initiatives are further pursued in the long-term through the establishment and maintenance of cross-border governance structures and cooperative mechanisms.²⁹⁶ While some, such as the Cordillera del Condor peace park between Ecuador and Peru,²⁹⁷ have proven challenging to maintain over time; such arrangements however, can sustain harmonious relations by utilising the governance structures and mechanisms to address any negative dynamics that may threaten to evolve into conflict, thereby retaining peaceful relationships between the participating nations. In addition, applying the designation of peace park to a transboundary conservation area can help promote both social and conservation gains.

Policy options to improve outcomes for peace and nature through *Parks for Peace* include:

- Retrospectively apply the concept of *Parks for Peace* to maintain peace while conserving nature; and
- Proactively establish *Parks for Peace* to sustain harmonious relations, and avoid any negative dynamics that could otherwise evolve into conflict.

Box 11: Transboundary wetlands conservation on the Korean peninsula

Felix Glenk (Hanns Seidel Foundation)

Nature transcends man-made borders. This becomes particularly obvious when migratory birds cross the border at the Demilitarized Zone between the Republic of Korea in the south and the Democratic People's Republic of Korea in the north. The Korean Peninsula is of great importance to the biodiversity in the region, due to its central location on the East Asian-Australasian Flyway. But while globalisation has created bridges between many places – often also between formerly hostile states – the Democratic People's Republic of Korea has remained isolated. In this context, and despite development pressures, the idea of a Demilitarized Zone Peace Park has been mooted for some time.²⁹⁸

Photo 10. Migratory birds in the Korean Demilitarized Zone © Felix Glenk, The Hanns Seidel Foundation

In 2015, an initiative was established to strengthen engagement between the DPRK and international environment organisations. The Hanns Seidel Foundation has been supporting these efforts to bring the key actors in the North, specifically the Ministry of Environment and Land Protection, together with representatives of international organisations and national governments. At the same time, training activities in the Democratic People's Republic of Korea and abroad, conferences, and practical environmental surveys in the country are being conducted, in order to improve the expertise of decision-makers in the environmental sector. This will be beneficial for the environment, as well as the local population in the Democratic People's Republic of Korea. A large part of the project therefore focuses on how people can benefit from the conservation of wetlands.

Pilot projects in the country are now raising awareness of the links between environmental protection, the improvement of the living conditions of the rural population, and sustainable development. In 2017, the Ministry of Land and Environment Protection of the Democratic People's Republic of Korea became an IUCN Member. In 2018, the Democratic People's Republic of Korea acceded to the Ramsar Convention and designated the bird reserve in Rason and the Mundok Migratory Bird Reserve as Ramsar Sites. In addition, in 2018, the Democratic People's Republic of Korea became the 36th Partner of the East Asian-Australasian Flyway Partnership. Representatives of the country also participated in the 13th Conference of the Parties to the Ramsar Convention in 2018, and the IUCN Asia Regional Consultation Forum in 2019.

5. Conclusions

As the preceding analyses and syntheses show, the relationships between nature and conflict are many, varied, complex and scale-dependent, so evidence on them is often based on correlation rather than causation. Nevertheless, several high-level themes emerge from considering these relationships, which, between them, facilitate identification of implications for conservation and natural resource governance, international agreements and law, and humanitarian and military interventions.

a. Implications for natural resource governance, conservation and management

It has been long-recognised, albeit often overlooked, that “conservation even in wartimes is an absolute essential.”²⁹⁹ Given the strong positive relationship between biodiversity hotspots and conflict,³⁰⁰ and the fact that conflicts tend to be situated in areas rich in species, it is clear that **conservation must continue even in war-torn regions**. Some mitigating factors may make this less challenging than it appears. Importantly, the relationship between biodiversity and conflict may change at fine geographic scales, as shown by the findings that fewer conflicts than expected occur in Key Biodiversity Areas and protected areas. This may explain why few threatened species – less than 1 per cent overall – are threatened directly by war.³⁰¹ Nevertheless, the challenge of undertaking conservation in regions suffering from conflict cannot be overstated, and must be implemented with the safety of

frontline environmental defenders, as well as the environment they are defending, as paramount considerations. Additional key lessons include the importance of integrating conflict sensitivity and conflict resolution mechanisms into conservation programmes; and ensuring appropriate support and training for conservation staff members who are on the frontline in conflict situations³⁰².

A second key implication of the complex interconnections between nature and conflict is the importance of **conservation engagement in post-conflict situations**. In some cases, warfare may alleviate threats to biodiversity, for example through the cessation of economic activities such as agricultural development, forestry, and fishing, as well as through the role military bases may serve as de facto protected areas. However, any such benefits tend to be temporary, with waves of unconstrained development that often follow warfare quickly overwhelming any short-term reduction in pressures on nature. Natural resources such as wildlife and timber can often be the most easily available sources of revenue for reconstruction efforts, and so pressures on nature can be extremely high in post-conflict situations. Therefore, redirecting conservation action in the post-conflict context, for example through the application of nature-based solutions, is a key determinant of the long-term persistence of living nature in war-stricken regions.

Third, and most proactively, conservation practitioners should be alert to the fact that **effective conservation and restoration of nature, including equitable natural resource governance, can contribute to pre-empting and mitigating some armed conflict**. Effective and fair conservation implemented in regions of social, political or economic instability can reduce the risk of actual conflict, provide benefits to both nature and people, and offer a ‘lifeline for dialogue’ through environmental peacebuilding.³⁰³ That the converse is also true – natural resource degradation and poor natural resource governance may increase the

risk of conflict – underscores the importance of socially inclusive conservation, and of equitably sharing the benefits it provides. Moreover, conservationists must stay vigilant to ensure that the process of conservation itself does not trigger or exacerbate armed conflicts.

b. Implications for international agreements and law

With attacks on environmental defenders increasing in many parts of the world, an urgent implication of the relationship between conflict and nature for international agreements and law is the establishment of **explicit protections for protected area staff and other conservationists**. While IUCN already recognises the importance of such protections,³⁰⁴ mechanisms to strengthen them – such as the Escazú Agreement, currently undergoing ratification by Latin American countries – are welcome.³⁰⁵ More generally, it is necessary to tackle the root causes of attacks on environmental defenders, support and protect environmental defenders, and ensure accountability.³⁰⁶

At a more fundamental level, and aligned with the initiatives of countries such as Ecuador to recognise the rights of nature in national law, is the possibility of **sanctions against those who commit environmental war crimes**. Such crimes could include tactical destruction of forests or other ecosystems, poaching of wildlife or timber to finance conflict, or inadvertent impacts of pollution from chemicals, oil or noise. Mechanisms to establish sanctions could include enhancing the United Nations Compensation Commission's powers and ensuring prosecution of environmental war crimes through the International Criminal Court, strengthened by the ongoing deliberations on the subject by the United Nations International Law Commission (which currently includes protection of the environment in relation to armed conflicts on its agenda). Other proposals have included an ecocide convention, an amendment to the Rome Statute to include ecocide as a core crime, or the negotiation of a Fifth Geneva Convention to protect nature during conflict.

Given the growing prevalence of internal conflicts, these instruments for environmental protection during interstate warfare should also be complemented by the development of approaches to safeguard nature both during, and following internal conflict.

In the near-term, more effective, even-handed means are needed to **coordinate law enforcement efforts across sectors** (e.g. wildlife and security agencies) **and scales** (e.g. local, national and international), in order to strengthen prevention and mitigation of both conflict and environmental degradation. This could include, for example, collaboration between protected area staff, police and military personnel on the ground, (and collaboration between marine protected area staff, fisheries agencies and naval personnel at sea), as well as engagement between wildlife agencies, and immigration and customs officials at border crossings. In some cases – for example, where there are suspected connections between wildlife crime, human trafficking, emerging infectious diseases, and other abuses on the one hand; and the generation of illicit revenue to finance warfare, on the other hand – such collaboration will need to extend to the commercial and financial sectors. These collaborations, which harness the appropriate roles and strengths of different sectors, are also important in averting the militarisation of conservation.

c. Implications for humanitarian and development agencies

Given the extensive synergies between the agendas of humanitarian and development agencies, and those of conservation and natural resource management agencies, the contributions of the former towards environmental peacebuilding are already substantial. These centre around investment in strengthening equitable and transparent governance through, for example, explicit considerations of gender and indigenous peoples. What other lessons, though, can be drawn from the efforts of humanitarian and development agencies to contribute more strongly to both conserving nature and maintaining peace?

First, there is considerable scope for **humanitarian agencies to recognise the key contributions that strengthening management of natural resources can make towards environmental peacebuilding**, together with strengthening governance, and the value of investing in these efforts accordingly. This includes, for example, strengthening the management of protected areas, lands and waters, with particularly important opportunities to advance these efforts in disputed border areas and transboundary contexts.

Second, it is important for humanitarian and development agencies to **implement actions that address their footprints on nature**. The standards and safeguards established by the International Finance Corporation, the World Bank and the Equator Principles Financial Institutions provide valuable models for how these footprints can be reduced, as do best practice approaches such as the United Nations High Commissioner for Refugees' Environmental Guidelines.³⁰⁷ Moreover, growing transparency in supply chains provides an opportunity for humanitarian and development organisations to ensure environmental sustainability, not just in their local operations, but also in their procurement processes.

d. Implications for the military

Clearly, actions to address the implications of nature-conflict relationships need to be implemented in cooperation with the military sector. What, then, are the key implications for the military?

The most immediate implication is a simple one: **military investment should actively mitigate harm to living nature**, both during and subsequent to conflict. This is necessary to both reduce direct environmental harm, and avoid indirect negative impacts. Application of the kinds of safeguards now widely utilised by the international financial institutions could provide a valuable model.³⁰⁸ Other possible mechanisms to implement could include the training of military personnel and peacekeeping forces on themes such as natural resource management, community

engagement, rights-based approaches, and the promotion of conservation and sustainable use of natural resources in post-war recovery policies.³⁰⁹ In addition, natural resource managers should be trained in how to most effectively support national security policies.

Longer-term, and perhaps even more important, is the prospect that **investment in conservation increases the chances of peace**. While options to invest in conservation and restoration of nature to mitigate pressures that drive conflict are particularly opportune in this context, a causal relationship between the degradation of nature and warfare (or between intact nature and peace), is not even necessary for environmental peacebuilding. The application of peace parks and other conservation initiatives as explicit tools for environmental peacebuilding provide further evidence. One researcher summed up such a recommendation for the case of Afghanistan, noting that, "If Afghanistan is to develop into a vibrant nation with secure sustainable agricultural development, it must first halt the loss of its biodiversity, which requires international support and collaboration in national reconciliation, job creation, capacity building, raising of public awareness, and law enforcement."³¹⁰

In sum, what are the prospects for the simultaneous achievement of Sustainable Development Goals 14, 15 and 16? Certainly, the relationships between them are not all straightforward. They can include some counter-intuitive feedback loops (such as the potential for conflict to reduce environmental degradation in the short term, only to have such gains eroded post-conflict), and scale and temporal dependencies (such as the tendency of improved vegetation to increase conflict in the short-term). Overall, though, poor governance tends to drive both environmental degradation and war, while activities that contribute towards delivering good governance tend to benefit conservation and peace simultaneously.

Respectful and peaceful treatment of people and the environment alike will yield a positive future for both humanity and the diversity of life that shares the Earth, our only home.

PART 2

Sustainability indicators of nature and conservation

This section presents data on a set of indicators to assess national performance in environmental sustainability. While many such indicators are available,³¹¹ this report focuses on one core indicator from each of the four components of the widely-used State-Pressure-Response-Benefits framework, with particular attention to indicators based on global IUCN standards.³¹²

As the indicator of the **State** of living nature, specifically for the species level of biodiversity, this report uses the Red List Index.³¹³ IUCN works with the Red List Partnership to maintain this indicator of the aggregate extinction risk of species across taxonomic groups (specifically, those which have been assessed multiple times for the IUCN Red List).³¹⁴ Specifically, data used here reflect all species of mammals, birds, amphibians, corals and cycads, comprising approximately 25,000 species in total. National policy responses to the Red List Index could encompass the establishment of science-based targets for species, typically within the context of revising National Biodiversity Strategies and Action Plans, in order to identify which actions are needed in which places, to deliver the country's contributions to a global target of saving and recovering biodiversity at the species level.

As the indicator of the **Pressure** facing living nature, this report documents the impact of imported goods for consumption in one part of the world, on species extinction risk

elsewhere in the world.³¹⁵ The impacts are derived by linking detailed data on trade across commodities between all pairwise combinations of countries, to the IUCN Red List.³¹⁶ Thus, for example, the import of palm oil into Switzerland from Indonesia contributes towards the extinction risk of the Critically Endangered Sumatran Orangutan *Pongo abelii*.³¹⁷ The same approach can also be used to derive indicators of the impacts of exported and domestic goods on extinction risk. National policy responses to the imported biodiversity footprint could include instruments such as sustainability certifications, tariffs, taxes or bans, depending on the circumstances.

As an indicator of the **Response** used to safeguard living nature, IUCN works with the Key Biodiversity Areas Partnership and the UN Environment Programme World Conservation Monitoring Centre to maintain an indicator of coverage of Key Biodiversity Areas by protected areas,³¹⁸ recognising that safeguarding important sites is one of a suite of complementary conservation actions.³¹⁹ Data on Key Biodiversity Areas (sites contributing significantly to the global persistence of biodiversity) are maintained by the Key Biodiversity Areas Partnership,³²⁰ while data on protected areas are maintained on Protected Planet, an online interface for the World Database on Protected Areas.³²¹ National policy responses relevant to this indicator will typically involve spatial planning, with a view to the establishment of new protected areas or other effective area-based conservation measures to safeguard as-yet-unprotected Key Biodiversity Areas.

As an indicator of the **Benefits** provided by living nature to people, this report uses World Bank data to document the percentage of the total capital in the economy associated with living nature within a country (this includes forests, both

wood and non-wood wealth, croplands, pastures and protected areas).³²² National policy responses to the indicator could include increasing sustainable local production of natural resources (e.g. through restoration and sustainable management of forests and agricultural lands), encouraging

environmental education and nature-based recreation, etc.

The below table presents the list of states by IUCN Statutory Region, for each of the indicators detailed above.³²³

Region & country	Status of Biodiversity: Red List Index	Biodiversity Footprint: Imported	Conservation Action: Coverage of Key Biodiversity Areas by protected areas	Benefits from nature: Natural capital as % of total capital
AFRICA				
Algeria	0.91	-	16.6	-
Angola	0.93	-	28.1	-
Benin	0.91	-	66.7	-
Botswana	0.97	36.5	51.1	0.23
Burkina Faso	0.99	41.8	66.7	0.41
Burundi	0.89	15.2	56.8	0.35
Cabo Verde	0.90	-	12.0	-
Cameroon	0.84	19.4	35.3	0.41
Central African Republic	0.94	7.8	74.2	0.85
Chad	0.92	10.1	67.3	0.30
Comoros	0.74	-	8.3	0.33
Congo	0.97	23.8	56.5	0.22
Côte d'Ivoire	0.91	13.1	71.2	0.42
Democratic Republic of the Congo	0.89	89.4	52.7	0.43
Djibouti	0.81	6.7	0.8	0.24
Egypt	0.91	114.8	39.4	0.18
Equatorial Guinea	0.82	-	100.0	-
Eritrea	0.89	-	13.3	-
Eswatini	0.81	18.8	30.6	0.13
Ethiopia	0.85	17.4	18.1	0.40
Gabon	0.96	31.1	61.7	0.22
Gambia (Republic of The)	0.97	5.8	34.6	0.27
Ghana	0.85	26.9	80.6	0.27
Guinea	0.90	13.4	71.2	0.70
Guinea-Bissau	0.91	-	52.6	-
Kenya	0.79	198.3	34.5	0.35
Lesotho	0.95	-	16.4	-
Liberia	0.91	8.7	15.8	0.45
Libya (State of)	0.97	-	0.0	-
Madagascar	0.76	26.2	25.0	0.52

Malawi	0.81	33.0	73.7	0.54
Mali	0.98	22.8	8.1	0.59
Mauritania	0.97	22.2	11.2	0.25
Mauritius	0.41	123.7	9.6	0.03
Morocco	0.89	54.0	53.8	0.25
Mozambique	0.81	24.4	21.7	0.49
Namibia	0.97	25.9	86.1	0.20
Niger	0.94	26.2	33.1	0.71
Nigeria	0.86	140.5	80.4	0.14
Rwanda	0.88	48.8	51.7	0.30
Sao Tome and Principe	0.80	-	79.5	-
Senegal	0.94	25.2	37.8	0.26
Seychelles	0.68	-	28.6	-
Sierra Leone	0.93	17.8	57.3	0.43
Somalia	0.90	-	0.0	-
South Africa	0.77	352.8	32.5	0.09
South Sudan	0.93	-	33.6	-
Sudan	0.92	-	17.8	-
Togo	0.86	19.5	75.0	0.21
Tunisia	0.97	55.3	40.1	0.15
Uganda	0.75	67.2	70.6	0.38
United Republic of Tanzania	0.70	30.8	62.9	0.44
Zambia	0.87	37.4	45.5	0.29
Zimbabwe	0.79	25.1	81.2	0.35

MESO AND SOUTH AMERICA

Argentina	0.85	168.0	31.8	0.10
Belize	0.84	6.2	41.5	0.48
Bolivia (Plurinational State of)	0.87	24.9	48.3	0.29
Brazil	0.90	554.8	42.8	0.15
Chile	0.76	127.8	34.2	0.05
Colombia	0.75	259.1	42.9	0.09
Costa Rica	0.83	81.1	39.8	0.14
Ecuador	0.65	59.1	30.2	0.15
El Salvador	0.83	112.6	25.0	0.10
Guatemala	0.73	95.4	30.0	0.19
Guyana	0.88	401.3	0.0	0.47
Honduras	0.76	71.0	59.0	0.23
Mexico	0.67	466.6	37.1	0.08
Nicaragua	0.85	35.1	70.4	0.35
Panama	0.74	62.4	34.4	0.10

Paraguay	0.95	27.6	36.3	0.25
Peru	0.73	109.7	29.1	0.16
Suriname	0.98	14.5	51.2	0.34
Uruguay	0.85	35.0	20.8	0.09
Venezuela (Bolivarian Republic of)	0.83	186.5	52.5	0.04

NORTH AMERICA AND THE CARIBBEAN

Antigua and Barbuda	0.89	-	8.2	-
Bahamas	0.70	-	29.2	-
Barbados	0.90	-	0.2	-
Canada	0.96	795.6	28.1	0.02
Cuba	0.66	-	54.5	-
Dominica	0.67	-	40.0	-
Dominican Republic	0.73	39.0	81.1	0.05
Grenada	0.67	-	34.5	-
Haiti	0.72	10.9	41.0	0.20
Jamaica	0.67	26.5	29.5	0.08
Saint Kitts and Nevis	0.73	-	56.8	-
Saint Lucia	0.84	-	45.6	-
Saint Vincent and the Grenadines	0.77	-	43.0	-
Trinidad and Tobago	0.81	-	32.0	-
United States of America	0.83	7930.8	51.2	0.02

SOUTH AND EAST ASIA

Bangladesh	0.75	56.3	43.7	0.17
Bhutan	0.80	-	47.3	-
Brunei Darussalam	0.86	-	41.7	-
Cambodia	0.79	30.8	39.5	0.45
China	0.74	4697.9	9.9	0.10
Democratic People's Republic of Korea	0.92	-	0.0	-
India	0.67	1351.1	21.0	0.20
Indonesia	0.75	572.4	26.1	0.13
Japan	0.77	4055.9	64.8	0.01
Lao People's Democratic Republic	0.83	13.5	44.0	0.48
Malaysia	0.77	585.1	28.5	0.09
Maldives	0.84	15.7	0.0	0.01
Mongolia	0.95	14.5	41.7	0.35
Myanmar	0.80	-	24.9	-

Nepal	0.83	24.9	50.7	0.39
Pakistan	0.86	61.9	34.8	0.26
Philippines	0.67	176.5	40.1	0.16
Republic of Korea	0.70	1145.5	37.5	0.01
Singapore	0.85	695.0	21.1	0.00
Sri Lanka	0.57	97.7	43.7	0.07
Thailand	0.78	594.2	70.7	0.15
Timor-Leste	0.85	-	39.5	-
Viet Nam	0.72	239.1	39.2	0.25

WEST ASIA

Afghanistan	0.84	-	5.7	-
Bahrain	0.75	19.0	0.0	0.00
Iran (Islamic Republic of)	0.84	-	43.6	-
Iraq	0.79	65.1	5.8	0.03
Jordan	0.97	94.3	13.5	0.13
Kuwait	0.83	264.7	51.6	0.00
Lebanon	0.92	88.3	12.3	0.06
Oman	0.89	75.0	11.8	0.02
Palestine	0.92	-	24.4	0.14
Qatar	0.82	58.6	40.0	0.00
Saudi Arabia	0.90	857.5	22.0	0.01
Syrian Arab Republic	0.94	-	0.0	-
United Arab Emirates	0.85	463.1	0.0	0.00
Yemen	0.86	30.6	19.4	0.17

OCEANIA

Australia	0.82	919.5	55.7	0.06
Cook Islands	0.77	-	5.7	-
Fiji	0.67	-	11.2	-
Kiribati	0.77	-	40.0	-
Marshall Islands	0.83	-	10.1	-
Micronesia (Federated States of)	0.69	-	0.0	-
Nauru	0.77	-	0.0	-
New Zealand	0.62	-	46.4	-
Niue	0.77	-	0.0	-
Palau	0.72	-	44.0	-
Papua New Guinea	0.83	19.7	6.9	0.57
Samoa	0.76	-	13.7	-
Solomon Islands	0.76	-	4.4	0.43

Tonga	0.72	-	26.1	-
Tuvalu	0.83	-	0.0	-
Vanuatu	0.66	-	2.8	-

EAST EUROPE, NORTH AND CENTRAL ASIA

Albania	0.83	29.8	57.2	0.21
Armenia	0.85	15.6	21.6	0.20
Azerbaijan	0.91	23.1	36.6	0.12
Belarus	0.97	6.5	47.1	0.21
Bosnia and Herzegovina	0.90	32.1	18.2	0.17
Bulgaria	0.94	52.0	87.5	0.16
Croatia	0.90	75.5	76.5	0.06
Czech Republic	0.97	-	94.7	-
Estonia	0.98	24.9	94.9	0.08
Georgia	0.87	41.7	40.3	0.14
Hungary	0.88	72.1	82.5	0.04
Kazakhstan	0.87	87.2	11.1	0.07
Kosovo	-	-	-	-
Kyrgyzstan	0.98	37.6	25.7	0.45
Latvia	0.99	32.1	97.2	0.08
Lithuania	0.99	55.0	91.1	0.07
Montenegro	0.80	-	11.1	-
North Macedonia	0.97	30.6	26.0	0.16
Poland	0.97	302.3	87.3	0.04
Republic of Moldova	0.97	4.4	0.0	0.14
Romania	0.93	122.7	76.0	0.14
Russian Federation	0.95	1309.3	25.1	0.05
Serbia	0.96	-	26.1	-
Slovakia	0.96	93.4	85.8	0.03
Slovenia	0.93	64.6	88.7	0.04
Tajikistan	0.99	28.0	16.8	0.17
Turkmenistan	0.98	40.0	14.0	0.14
Ukraine	0.93	211.8	21.7	0.15
Uzbekistan	0.97	-	10.1	-

WEST EUROPE				
Andorra	0.92	-	26.1	-
Austria	0.89	278.9	67.3	0.02
Belgium	0.99	349.4	84.2	0.01
Cyprus	0.98	-	74.1	-
Denmark	0.97	144.6	86.2	0.01
Finland	0.99	121.7	71.8	0.02
France	0.87	2226.8	80.4	0.02
Germany	0.98	2615.4	78.8	0.01
Greece	0.85	252.1	86.0	0.05
Holy See	0.94	-	0.0	-
Iceland	0.86	11.6	19.1	0.01
Ireland	0.91	118.2	86.0	0.02
Israel	0.72	-	20.3	-
Italy	0.90	1552.8	77.3	0.02
Liechtenstein	0.99	-	80.8	-
Luxembourg	0.99	71.0	81.9	0.01
Malta	0.88	17.4	84.5	0.01
Monaco	0.76	-	0.0	-
Netherlands	0.94	644.3	97.9	0.01
Norway	0.94	254.1	57.7	0.01
Portugal	0.87	288.8	73.3	0.03
San Marino	0.99	-	0.0	-
Spain	0.85	1286.5	57.6	0.03
Sweden	0.99	234.3	59.0	0.02
Switzerland	0.97	483.7	35.5	0.01
Turkey	0.88	491.0	2.3	0.26
United Kingdom of Great Britain and Northern Ireland	0.78	1924.4	82.8	0.01

Glossary

Agricultural land

Agricultural land refers to the share of land area that is arable, under permanent crops, and under permanent pastures. Arable land includes land defined by the Food and Agricultural Organization (FAO) of the United Nations as land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow. Land abandoned as a result of shifting cultivation is excluded.³²⁴

Armed conflict

Armed conflict in this report is considered as synonymous with violent conflict, encompassing both “international armed conflicts” and “non-international armed conflicts, between governmental forces and nongovernmental armed groups, or between such groups only”.³²⁵ The term *armed conflict* is used throughout this report to maintain consistency with the Uppsala Conflict Data Program, except on a few occasions where the conflict in question does not meet this definition.

Conflict event

A conflict event is “An incident where armed force was used by an organised actor against another organised actor, or against civilians, resulting in at least 1 direct death at a specific location and a specific date”. A conflict can be made up of multiple conflict events.³²⁶

Conservation

Conservation is defined as “human activity dedicated to averting the loss of living nature and advancing its recovery”, therefore encompassing a range of concepts including “protection” (or “preservation”) and “sustainable use”, as well as “restoration”.

Conservation capacity

Conservation capacity is the ability to perform functions, solve problems and set and achieve objectives in conservation,

encompassing policy, practice, collaboration, leadership and interdisciplinarity.³²⁷

Environmental defenders

Environmental defenders is used in this report as a synonym for “environmental human rights defenders”, defined as “individuals and groups who, in their personal or professional capacity and in a peaceful manner, strive to protect and promote human rights relating to the environment, including water, air, land, flora and fauna.”³²⁸

Forest area

Forest area is land under natural or planted stands of trees of at least 5 meters in situ, whether productive or not, and excludes tree stands in agricultural production systems (for example, in fruit plantations and agroforestry systems) and trees in urban parks and gardens.³²⁹

Green militarisation

Green militarisation is “The use of military and paramilitary personnel, training, technologies, and partnerships in the pursuit of conservation efforts”. In other words, green militarisation refers to conflict resulting from efforts to maintain nature.³³⁰

Gross Domestic Product (GDP)

GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.³³¹

Gross Domestic Product (GDP) per capita

GDP per capita is gross domestic product divided by midyear population.³³²

Gunpoint conservation

Gunpoint conservation is “Conservation carried out by means of armed coercion”. In

other words, gunpoint conservation refers to efforts to conserve nature resulting from conflict.³³³

IUCN Red List of Threatened Species™

The IUCN Red List of Threatened Species™, known as the IUCN Red List, is the world's most comprehensive inventory of the global conservation status of plant and animal species. It uses a set of criteria to evaluate the extinction risk of thousands of species and subspecies. These criteria are relevant to all species and all regions of the world. With its strong scientific base, the IUCN Red List is recognised as the most authoritative guide on the status of biological diversity.³³⁴

IUCN Regions

IUCN Regions refers to the regionalisation of countries in the IUCN Statutes.³³⁵

Key Biodiversity Areas

Key Biodiversity Sites are “Sites contributing significantly to the global persistence of biodiversity.”³³⁶

Living nature

Living nature is used in this report as a synonym for “biological diversity” or “biodiversity”, defined as “the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.”³³⁷

Natural resources

Natural resources are natural assets (raw materials) occurring in nature that can be used for economic production or consumption. They are often subdivided into four categories: mineral and energy resources, soil resources, water resources and biological resources. Another categorisation concerns renewable and non-renewable resources. Renewable natural resources are natural resources that can regenerate through natural processes, including living resources like forests or fish stocks, or non-living ones like water. Non-renewable natural resources such as mineral resources, are exhaustible and cannot be regenerated.

Natural resource degradation

Natural resource degradation refers to any damaging or undesirable change or disturbance to natural resources, for example, deterioration of natural resources through depletion, destruction or external factors such as climate change.

Natural resource governance

Natural resource governance refers to the norms, institutions and processes that determine how power and responsibilities over natural resources are exercised, how decisions are taken, and how citizens – women, men, indigenous peoples and local communities – participate in and benefit from the management of natural resources.

Natural resource management

Natural resource management refers to the management of natural resources such as land (including agricultural land, forests, wetlands, grasslands and other types of land), water, soil, plants and animals.

Normalized Difference Vegetation Index (NDVI)

The NDVI is a dimensionless index that can be used to estimate the density of green on an area of land. Unhealthy or sparse vegetation reflects more visible light and less near-infrared light. Very low values of NDVI (0.1 and below) correspond to barren areas of rock, sand or snow. Moderate values represent shrub and grassland (0.2 to 0.3), while high values indicate temperate and tropical rainforests (0.6 to 0.8). NDVI has been shown to be highly correlated with photosynthetic capacity and net primary production. NDVI can be interpreted as an indicator of vegetation health.³³⁸

Oil rents (% of GDP)

Oil rents are the difference between the value of crude oil production at world prices and the total costs of production. Oil rents (% of GDP) indicates how large oil rents are relative to Gross Domestic Product.³³⁹

Park for Peace

A Park for Peace is a designation that may be applied to Transboundary Protected Areas, Transboundary Conservation Landscapes and/or Seascapes, and

Transboundary Migration Conservation Areas, and “is dedicated to the promotion, celebration and/or commemoration of peace and cooperation”.³⁴⁰

Protected areas

A protected area is “a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values”.³⁴¹

Renewable internal freshwater resources per capita

Renewable internal freshwater resource flows refer to internal renewable resources (internal river flows and groundwater from rainfall) per person, in the country.³⁴²

Sustainable Development Goals

The Sustainable Development Goals are a universal call to action to end poverty, protect the planet and improve the lives and prospects of everyone, everywhere. The 17 Goals were adopted by all United Nations Member States in 2015, as part of the 2030

Agenda for Sustainable Development which set out a 15-year plan to achieve the Goals.³⁴³

Standardised Precipitation-Evapotranspiration Index (SPEI)

The SPEI is a multiscalar drought index based on climatic data. It can be used for determining the onset, duration and magnitude of drought conditions with respect to normal conditions in a variety of natural and managed systems such as crops, ecosystems, rivers, water resources, and so forth.³⁴⁴

Threatened species

Threatened species are species facing “a high risk of extinction in the wild”, that is, meeting the thresholds for assessment on the IUCN Red List of Threatened Species™ under the categories of Critically Endangered, Endangered, or Vulnerable.³⁴⁵

Transboundary resource management

Transboundary resource management refers to any process of cooperation across boundaries to facilitate or improve the management of natural resources.

Endnotes

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APPENDIX

EMPIRICAL METHODS

Empirical assessment: co-occurrence between conflict and nature (Section 2.b)

Conflict and species range

Summary:

These methods explored the co-occurrence of threatened species, biodiversity, and violent conflict. In Part A, the point location of violent conflict events was overlaid on the distribution of threatened species, showing that 70 per cent of all birds, mammals and amphibians have current ranges that overlap with conflict events. Part B dived deeper into this co-occurrence, using a randomisation simulation to show that biodiversity and conflict events occur in the same regions more frequently than would be expected at random, regardless of a species extinction risk category.

Input Data:

1. **Species data:** Species data have been drawn from the IUCN Red List of Threatened Species.¹ Birds, mammals and amphibians, which are the major comprehensively assessed taxonomic groups, are defined as groups where more than 90 per cent of species in the taxa have been globally assessed. The dataset

included the 23,188 species which have range maps and are members of those three taxonomic groups.

2. **Conflict data:** Conflict events have been drawn from the Uppsala Conflict Data Program.² A conflict event is defined as “*An incident where armed force was used by an organised actor against another organised actor, or against civilians, resulting in at least 1 direct death at a specific location and a specific date.*” The dataset here used all data between 1989 and 2018, but excluded the recent conflict in Syria due to data quality control issues. Conflict data that could only be georeferenced to a country level, or to ‘international waters’ were also excluded, leaving a dataset of approximately 120,000 conflict events. A conflict can be made up of multiple conflict events. Conflict events were chosen as the unit of analysis due to greater data and higher spatial resolution than conflicts.

1 International Union for Conservation of Nature (IUCN) (2019). *The IUCN Red List of Threatened Species. Version 2019-3*. Gland, Switzerland: IUCN. Available at: <http://www.iucnredlist.org>.

2 Sundberg, R. and Melander, E. (2013). ‘Introducing the UCDP Georeferenced Event Dataset’. *Journal of Peace Research* 50(4): 523-532. DOI: <https://doi.org/10.1177/0022343313484347>. Data downloaded at <https://ucdp.uu.se/>

Methods:

A. Determining conflict overlap with range:

- a. The number of conflicts in a given species range was determined using a points to polygon join in ArcGIS. Note: this calculation flattens across the conflict data to include both ongoing and past conflict events that occurred between 1989 and 2018.

B. Quantitative randomisation was conducted to determine the expected number of conflicts in a particular range, if they were distributed randomly, thus removing the effect of the spatial extent of species range. All simulations were carried out in R.

- a. Species data for all extant birds, mammals and amphibians with range maps to quarter degree grid cells were rasterised.
- b. Excluding Antarctica, and marine data, the raster cells were buffered out from the coast.
- c. The conflict data was then overlaid and spatially joined to the rasters. This gave us the observed values.

- d. We then used a randomised approach to simulate the expected values.
- e. Range maps were held constant, then the same number of observed conflict events were randomly distributed around the world and spatially joined to the species dataset.
- f. This randomisation was repeated 1,000 times to generate a distribution of the mean number of conflicts expected in a given species based solely on its range size.

Caveats:

1. Species distribution was flattened across the range maps which are naïve to migration and seasonal variation.
2. Conflict data was flattened across the temporal distribution between 1989 and 2019.
3. We were agnostic to the number of fatalities in a particular event, beyond the need for an event to be part of a larger conflict that contains at least 25 fatalities e.g. an event with 25 fatalities and one with 1000 fatalities were treated the same.

Conflict, Key Biodiversity Areas and protected areas**Summary:**

These methods move from coarse species range maps to the high resolution of Key Biodiversity Areas and protected areas to assess their co-occurrence with conflict events in a similar way as Part A of the conflict and species analysis did with a spatial join. Key Biodiversity Areas contain 5 per cent of conflict events, which is only a bit more than half the percentage expected if conflict were distributed randomly, given they cover 9 per cent of terrestrial land area (Table 2). However, nearly one third of conflict events occur within 0.1 decimal

degrees (about 10 km at the Equator) of a Key Biodiversity Area, and more than half occur within 0.25 decimal degrees (about 25 km at the Equator) of a Key Biodiversity Area, suggesting that, while fewer conflict events than expected may occur within the boundaries of Key Biodiversity Areas themselves, a large proportion of conflict takes place in the same regions as these important sites. Similar patterns emerge for protected areas, which contain less conflict than would be expected based on land area, but are co-located in the same regions as a much higher proportion of conflict events.

Input Data:

1. Key Biodiversity Area polygons from the World Database on Key Biodiversity Areas³
2. Protected area polygons from the World Database on Protected Areas⁴
3. Conflict data: Conflict events were drawn from the Uppsala Conflict Data Program. A conflict event is defined as “*An incident where armed force was used by an organised actor against another organised actor, or against civilians, resulting in at least 1 direct death at a specific location and a specific date*”. The dataset here used all data between 1989 and 2018, but excluded the recent conflict in Syria due to data quality control issues. Conflict data that could not be georeferenced to less than 25 km, was also excluded, leaving 85,083 conflict events in this dataset.

Methods:

Calculation of conflict overlap at various buffers:

- a. A proximity analysis was used between conflict points and Key Biodiversity Area or protected area polygons to count the observed number of conflicts within a set distance of a Key Biodiversity Area or a protected area. This function removed double counting. Analysis conducted in ArcGIS.
- b. The same analysis was repeated for Key Biodiversity Areas, for protected areas, and for the portion of Key Biodiversity Areas that are included in protected areas, at a distance of 0.1 decimal degrees and 0.25 decimal degrees.

3 BirdLife International (2020). *The World Database of Key Biodiversity Areas*. Available at: <http://www.keybiodiversityareas.org/>

4 United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC), International Union for Conservation of Nature (IUCN), and National Geographic Society (NGS). (2018). *Protected Planet Report 2018*. Cambridge, UK: UNEP-WCMC, Gland, Switzerland: IUCN and Washington, D.C., USA: NGS. Available at: <https://portals.iucn.org/library/node/48344>; Protected Planet (2014-2021). *Explore the world's protected areas*. Available at: <https://www.protectedplanet.net/en>; UNEP-WCMC and IUCN Protected Planet (2014-2021). *The World Database on Protected Areas (WDPA)*. Available at: <https://www.protectedplanet.net/en/thematic-areas/wdpa?tab=WDPA>; UNEP-WCMC and IUCN Protected Planet (2014-2021). *The Global Database on Protected Area Management Effectiveness (GD-PAME)*. Available at: <https://www.protectedplanet.net/en/thematic-areas/protected-areas-management-effectiveness-pame?tab=Results>

Empirical assessment: influences of natural resources on armed conflict (Section 3.e.)

Summary:

These methods describe the development of a predictive statistical (regression) modelling approach to empirically examine the influences of natural resources on armed conflict. The purpose of the approach is to examine and statistically test how natural resources such as agricultural land, forest land and freshwater resources, including their availability and degradation; as well as a country's dependence on natural resources, and the prevalence of drought conditions in a country, are linked to the pervasiveness of armed conflict.

The approach examines longitudinal country-level data annually for the period 1989–2017, globally. The unit of observation is a country-year pair, with all country-year pairs for the 1989–2017 period assessed using panel regression techniques. The geographic scope of the assessment is global, and the estimation datasets include data for all countries in the world for which data on both conflict and its potential drivers is available, as explained below.

Armed conflict is examined using two separate but related measures: (i) the number of armed conflict events per country per capita, per year, and (ii) the number of fatalities from armed conflict per country per capita, per year. Both measures are normalised on a per capita

basis to make data comparable across different countries. In addition to examining natural resources such as agricultural and forest land, and freshwater resources, the approach incorporates the level of income (gross domestic product per capita) and oil-dependency of the country as other commonly examined drivers of armed conflict.

Input data:

Conflict data

Conflict events were drawn from the Uppsala Conflict Data Program.⁵ A conflict event is defined as “*An incident where armed force was used by an **organised actor** against **another organised actor, or against civilians, resulting in at least 1 direct death** at a **specific location** and a **specific date.**”* The dataset here used all data between 1989 and 2017. We constructed two measures of the prevalence of conflict in a country in a given year, between 1989 and 2017:

- The number of armed conflict events per capita per year; and
- The number of fatalities from armed conflict per capita per year.

Normalisation of both measures on a per capita basis helps make data comparable across different countries.

5 Uppsala University. *Uppsala Conflict Data Program*. Department of Peace and Conflict Research. Available at: <https://ucdp.uu.se/>
Sundberg, R. and Melander, E. (2013). 'Introducing the UCDP Georeferenced Event Dataset'. *Journal of Peace Research* 50(4): 523-532. DOI: <https://doi.org/10.1177/0022343313484347>. Data downloaded at <https://ucdp.uu.se/>

Population

- Total population of a country is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. The values are midyear estimates. (Source: World Bank Development Indicators.)⁶

Natural Resource Availability

- **Agricultural land (sq. km).** Agricultural land refers to the share of land area that is arable, under permanent crops, and under permanent pastures. The data are collected by the United Nations Food and Agriculture Organization (FAO). Source: World Bank Development Indicators.⁷
- **Forest area (sq. km).** Forest area is land under natural or planted stands of trees of at least 5 meters in situ, whether productive or not, and excludes tree stands in agricultural production systems (for example, in fruit plantations and agroforestry systems) and trees in urban parks and gardens. The data are collected by the United Nations Food and Agriculture Organization. Source: World Bank Development Indicators.
- **Renewable internal freshwater resources per capita (cubic meters).** Renewable internal freshwater resources flows refer to internal renewable resources (internal river flows and groundwater from rainfall) in the country. Renewable internal freshwater resources per capita are calculated using the World Bank's population estimates, data collected by the United Nations Food and Agriculture Organization, and AQUASTAT data. Source: World Bank Development Indicators.⁸

Natural Resource Degradation

- **Normalized Difference Vegetation Index (NDVI).** The NDVI is a dimensionless index that can be used to estimate the density of green on an area of land.⁹ NDVI quantifies the density of vegetation from satellite imagery by measuring the difference between the visible and near-infrared light reflected by vegetation. Healthy vegetation absorbs most of the visible light that hits it, and reflects a large portion of the near-infrared light. Unhealthy or sparse vegetation reflects more visible light and less near-infrared light. Low values of NDVI (0.1 and below) correspond to barren areas of rock, sand or snow. Moderate values represent shrub and grassland (0.2 to 0.3), while high values indicate temperate and tropical rainforests (0.6 to 0.8). The NDVI has been shown to be highly correlated with photosynthetically active radiation absorbed by the plant canopy, photosynthetic capacity and net primary production. NDVI can be interpreted as an indicator of vegetation health, because degradation of ecosystem vegetation, or a decrease in green, would be reflected in a decrease in NDVI value¹⁰. We directly processed raw data for the world using data from the National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration (NOAA)¹¹.

Drought

- **Standardised Precipitation-Evapotranspiration Index (SPEI).** The SPEI is a multiscalar drought index based on climatic data. It can be used for determining the onset, duration

6 World Bank. *Population, total*. World Bank Open Data. Available at: <https://data.worldbank.org/indicator/SP.POP.TOTL>

7 World Bank. *Agricultural land (sq. km)*. World Bank Open Data. Available at: <https://data.worldbank.org/indicator/AG.LND.AGRI.K2>

8 World Bank. *Renewable internal freshwater resources per capita (cubic meters)*. World Bank Open Data. Available at: <https://data.worldbank.org/indicator/ER.H2Q.INTR.PC>

9 Weier, J. and Herring, D. (2000). 'Measuring vegetation' (NDVI & EVI). *NASA Earth Observatory*, 20. Available at: <https://earthobservatory.nasa.gov/features/MeasuringVegetation>

10 Meneses-Tovar, C. L. (2011). 'NDVI as indicator of degradation'. *Unasylva* 62(238): 39-46. Available at: <http://www.fao.org/3/i2560e/i2560e07.pdf>

11 Vermote, E., NOAA CDR Program. (2019). 'NOAA Climate Data Record (CDR) of AVHRR Normalized Difference Vegetation Index (NDVI), Version 5'. *NOAA National Centers for Environmental Information*. Available at: <https://doi.org/10.7289/V5ZG6QH9>

and magnitude of drought conditions with respect to normal conditions in a variety of natural and managed systems such as crops, ecosystems, rivers, water resources, and so forth. The Global SPEI database reports information about drought conditions at the global scale, with a 0.5 degrees spatial resolution and a monthly time resolution. It has a multi-scale character, providing SPEI time scales between 1 and 48 months. Currently, it covers the period between January 1901 and December 2018.¹² SPEI data have a zero mean and a standard deviation of one. Negative and positive SPEI values indicate dry and wet conditions, respectively. We directly processed SPEI data to calculate it for each country using 12, 24 and 48-month time scales.

Other potential drivers

- **GDP per capita (constant 2010 US\$).** GDP per capita is the gross domestic product divided by the midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes, minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets, or for depletion and degradation of natural resources. Data are in constant 2010 U.S. dollars. Source: World Bank Development Indicators.¹³
- **Oil rents (% of GDP).** Oil rents are the difference between the value of crude oil production at world prices and total costs of production. Estimates are based

on sources and methods described in the 2011 World Bank publication, “The Changing Wealth of Nations: Measuring Sustainable Development in the New Millennium”. Source: World Bank Development Indicators.¹⁴

Table A1 below shows the summary statistics for each key variable in the estimation dataset, including the number of observations available and the mean, standard deviation, minimum and maximum values in the dataset. The conflict data are complete for 205 country-year pairs, so the maximum number of observations possible equals 5,945 (29 years x 205 countries).

Estimation approach

The purpose of the estimation approach is to predict the *dependent variable* y (# of armed conflict events, or fatalities from armed conflict events, per capita in year t and country i) as a product of the *independent predictor* variables X (other variables in Table A1). The predictive model is determined as follows:

$$(1) \quad y_{it} = X_{it}\beta + v_i + \varepsilon_{it}$$

for $i = 1, \dots, n$ countries, where $t = 1, \dots, n_i$ (29 years in 1989-2017). The prediction is not deterministic, but it involves a stochastic error term ε_{it} . To account for potential country-specific factors not included in the model by the incorporation of the predictor variable X , the model also incorporates country-specific random effects, v_i . The stochastic terms ε_{it} and v_i are assumed to be independently and identically distributed random variables.

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- 12 Vicente-Serrano S.M., Beguería, S. and López-Moreno, J.I. (2010). 'A Multiscalar Drought Index Sensitive to Global Warming: The Standardized Precipitation Evapotranspiration Index'. *Journal of Climate* 23(7): 1696-1718. DOI: <https://doi.org/10.1175/2009JCLI2909.1>; Beguería, S., Vicente-Serrano, S.M., and Angulo-Martínez, M. (2010). 'A Multiscalar Global Drought Dataset: The SPEIbase: A New Gridded Product for the Analysis of Drought Variability and Impacts'. *Bulletin of the American Meteorological Society*. 91(10): 1351-1354. DOI: <https://doi.org/10.1175/2010BAMS2988.1>; Vicente-Serrano, S.M., Beguería, S., López-Moreno, J.I., Angulo, M. and El Kenawy, A. (2010). 'A new global 0.5° gridded dataset (1901-2006) of a multiscalar drought index: comparison with current drought index datasets based on the Palmer Drought Severity Index'. *Journal of Hydrometeorology* 11(4): 1033-1043. DOI: <https://doi.org/10.1175/2010JHM1224.1>
- 13 World Bank. *GDP per capita (Current US\$)*. World Bank Open Data. Available at: <https://data.worldbank.org/indicator/NY.GDP.PCAP.CD>
- 14 World Bank. *Oil rents (% of GDP)*. World Bank Open Data. Available at: <https://data.worldbank.org/indicator/NY.GDP.PETR.RT.ZS>

Table A1. Summary statistics of the variables examined

Variable	Number of observations (country-year pairs)	Mean	Std. Dev.	Min	Max
# of armed conflict events per capita	5,945	0.000030	0.0011	0	0.084
# of fatalities from armed conflict events per capita	5,925	0.000001	0.0000	0	0.000
Agricultural land per capita (km ²)	5,669	0.015161	0.0444	0	0.586
Forestland per capita (km ²)	5,395	0.013123	0.0332	0	0.379
Freshwater resources per capita (m ³)	5,022	36,573	406,399	0	10,700,000
Normalized Difference Vegetation Index, maximum monthly per year	5,945	0.2694	0.0985	-0.018	0.8900
Standardised Precipitation-Evapotranspiration, 48-month window	4,347	-0.0538	0.7707	-2.731	2.3590
GDP per capita	5,333	12,792	17,991	164	141,200
Oil rents (% GDP)	5,284	3.6517	9.4499	0.000	78.5411

For countries where armed conflict does not take place in a given year, data on the dependent variable y_{it} equals zero. This means that the dependent variable is censored at zero. We incorporate this feature of the data by estimating the predictive model as a censored regression model. The model works similarly to a linear regression model for observations for which $y_{it} > 0$. For observations for which $y_{it} = 0$, the model predicts the probability of $y_{it} = 0$ (similar to a probit model). The model described above is known as the random effects censored panel regression model, or random effects panel tobit model.¹⁵ We estimated the model using the software Stata 16.0.

In preliminary estimations, we examined what formulation of the variables measuring natural resource productivity (NDVI) and drought (SPEI) are best suited to predicting armed conflict. NDVI data come as monthly observations, and we examined the use of annual average, highest three months, and highest monthly NDVI per year. Annual average corresponds to average conditions throughout the year, where the highest three- and one-month NDVI values likely

better indicate conditions during the growing season. Empirically, the highest monthly NDVI per year is statistically the strongest predictor among the three alternatives considered, so we select it for the predictive models. For drought, measured by SPEI, a key question is the selection of the time window for measurement. We are primarily interested in relatively long-term conditions so we examined SPEI using 12-, 24-, and 48-month windows (the 12-month window corresponds to year-long observation, and the 24- and 48-month windows measure prevalence of drought within two and four years). Empirically, the four-year window for SPEI is statistically the strongest predictor, so we selected it for the predictive model.

Table A2 and A3 below list the estimation results for models predicting the number of conflicts and number of conflict-related fatalities, respectively. For both dependent variables, the table shows the estimation results for two model specifications; either excluding or including GDP per capita and oil-dependency as predictors of conflict. The estimation results are discussed in the main body of the report. Note that greater

15 Wooldridge, J.M. (2010). *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA, USA: MIT Press. ISBN: 9780262232586

values for NDVI indicate greater productivity (and lesser degradation). Thus, a negative coefficient for the NDVI variables indicates that increased productivity is associated with reduced prevalence of armed conflict. For SPEI, negative values indicate drought. Therefore, a reduction of drought implies an increase in SPEI, and a negative coefficient for the SPEI variable indicates that reduced drought conditions are associated with a reduced propensity of armed conflict. The

interpretation of other coefficient estimates is straightforward. For example, when agricultural land per capita increases, the availability of agricultural land as a natural resource increases. A negative coefficient estimate for agricultural land per capita indicates that increased availability of land reduces the prevalence of armed conflict. Log-likelihood values denote the value of the statistical likelihood function when estimating the predictive model.

Table A2. Predicting the number of armed conflicts (per capita per year). Statistically significant coefficient estimates are bolded

	Regression Specification A2.1			Regression Specification A2.2		
Predictor variable	Estimate	z-value	p-value	Estimate	z-value	p-value
Agricultural land per capita	-7.4E-05	-2.44	0.015	-3.6E-05	-1.97	0.049
Forestland per capita	1.0E-05	0.32	0.749	-4.1E-05	-1.76	0.078
Freshwater per capita	-5.4E-12	-0.51	0.613	-9.8E-12	-0.57	0.572
NDVI	-2.7E-05	-3.67	0.000	-3.1E-05	-7.33	0.000
SPEI	-1.8E-06	-4.51	0.000	-2.5E-07	-0.73	0.464
Rural population (%)	2.4E-07	5.63	0.000	2.2E-07	10.17	0.000
GDP per capita				-3.6E-10	-5.76	0.000
Oil rents (% GDP)				2.2E-09	0.08	0.940
Constant	-1.6E-05	-4.92	0.000	-5.5E-06	-3.20	0.001
Log likelihood	12286.86			11570.85		

Table A3. Predicting the number of fatalities associated with armed conflict (per capita per year). Statistically significant coefficient estimates are bolded

	Regression Specification A1.1			Regression Specification A1.2		
Predictor variable	Estimate	z-value	p-value	Estimate	z-value	p-value
Agricultural land per capita	-7.5E-04	-1.29	0.198	-9.2E-04	-1.66	0.096
Forestland per capita	6.5E-04	0.93	0.353	4.4E-04	0.52	0.601
Freshwater per capita	-7.5E-11	-0.47	0.641	-2.5E-10	-0.38	0.705
NDVI	-4.5E-04	-2.56	0.010	-4.2E-04	-2.55	0.011
SPEI	-3.4E-05	-3.40	0.001	-1.9E-05	-2.01	0.045
Rural population (%)	6.7E-06	6.68	0.000	3.6E-06	3.35	0.001
GDP per capita				-8.7E-09	-3.92	0.000
Oil rents (% GDP)				-1.9E-07	-0.15	0.878
Constant	-5.2E-04	-6.77	0.000	-2.7E-04	-3.07	0.002
Log likelihood	7934.80			7433.38

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HEADQUARTERS
Rue Mauverney 28
1196 Gland
Switzerland
Tel +41 22 999 0000
Fax +41 22 999 0002
www.iucn.org

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