Mainstreaming biodiversity into priority economic sectors

Lessons from the assessment of main threats in 16 BIODEV2030 pilot countries

Antonin Vergez

With contributions from Esther Bessis, Neil Cox, Florence Curet, Bousso Dramé, Devon Dublin, Frank Hawkins, Ben Jobson, Alice Maestracci, Laura Poyer, Philippe Puydarrieux, Mariana Saba, Ingrid Weyland

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Foreword

The sixth mass extinction is underway, and threatens every aspect of life as we know it. Such profound risks require transformational solutions across society, politics and economics.

But to transform our economies to benefit biodiversity, we must know where to start. What are the main threats to tackle? What are the key economic sectors causing these threats? Despite the increasingly high profile of nature conservation on the global agenda, the answers to these questions are not as clear as they should be. This is why IUCN and WWF-France embarked on the BIODEV2030 project, with the key support of the French Development Agency, Expertise France, and the French Ministry for European and Foreign Affairs.

Through a science-based and multi-stakeholder approach, BIODEV2030 aimed to integrate biodiversity into the prevailing practices of key economic sectors in 16 countries in Africa, America, Asia and Oceania. From 2020 to 2022, these countries performed robust national assessments that identified and ranked the main threats to biodiversity. The methodologies used – global data review, the STAR metric and national experts' knowledge – were combined to work together effectively. The assessments were performed despite limited availability of data, and could be done at high speed; taking five to seven months to finalise and less than a year to discuss and approve the results with stakeholders.

These assessments are now used in decision-making processes that are aligned with the Sustainable Development Goals, and which are carried out by economic actors in sectors as diverse as agriculture, livestock farming, mining, aquaculture and forestry.

This publication presents our analysis of three years of BIODEV2030 data, and proposes recommendations and tools that will give a range of actors – such as governments, public development banks and civil society – a scientifically robust way to bring biodiversity into the mainstream. We trust that this publication will contribute to more sustainable production systems. It is only through decoupling economic progress and the degradation of nature that we can hope to halt the loss of biodiversity by 2030, and achieve recovery and restoration by 2050.

Dr Bruno Oberle
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The Betsimboka River in Madagascar taken from space

Executive summary

The BIODEV2030 project was supported by the French Ministry for European and Foreign Affairs, funded by the French Development Agency, coordinated by Expertise France and implemented between 2019 and 2022 by IUCN and WWF-France. The project aimed at reconciling biological (BIO) diversity and economic development (DEV) by fostering ambitious mainstreaming actions in key economic sectors of 16 pilot developing countries (13 of which are in the African continent). BIODEV2030 implemented a '3D' approach: a scientific diagnosis of main threats to biodiversity, an inclusive dialogue with relevant stakeholders and the dissemination of good practices.

What lessons have we learned from the experiences of the 16 BIODEV2030 countries?

In this publication, we take stock of the knowledge and know-how induced by the project's first step, which is to assess the main threats to biodiversity and provide elements to address the following specific questions: how were main threats to biodiversity identified and ranked and associated sectors selected in each country? Were the different methods converging in identifying top threats? What are their respective strengths, limitations and complementarities? What recommendations can we make to other actors (governments, NGOs, donors such as multilateral or bilateral development banks) wanting to follow similar approaches with the private sectors at national level?

In each BIODEV2030 country, three main methods were typically combined to identify and rank main threats to biodiversity and then select (sub-)sectors: literature and data sources review, Species Threat Abatement and Restoration (STAR) metric and national experts' elicitation.

At the stage of the literature review, a number of tools, databases and key references were brought to bear. These include The IUCN Red List of Threatened Species™, the version 3.2 of the IUCN-CMP system of classification of threats (IUCN, 2022b) (first published by Salafsky et al. (2008), the article by Mair et al. (2021a) on the STAR metric, the Integrated Biodiversity Assessment Tool (IBAT), the IUCN Global Ecosystem Typology (Keith et al., 2020), The Nature Conservancy's Threat Ranking System (2007), the World Database on Key Biodiversity Areas, and the UNEP-WCMC and IUCN World Database on Protected Areas.

Regarding the STAR metric, estimated STAR scores (both for threat abatement and restoration) at national level, as well as single threat STAR scores, and maps of those scores were used. As per the national experts' interviews, a range of techniques was used to challenge or complement results arising from the other two methods. We find that the three main methods did not necessarily converge in each country when identifying and/or ranking main threats to biodiversity at national level.

Strengths, limitations and complementarities of the three methods were analysed, and proposals to strengthen and make every single method more complementary one to another were made. In each pilot country, the scientific assessment of the main threats to biodiversity was discussed with stakeholders (private sector actors, government, civil society). These science-fed dialogues allowed to identify the economic sectors on which the voluntary commitments will be built for the next steps of BIODEV2030, with a focus on five main sectors:

- Agricultural sector was selected in each of the 16 countries (different food and cash crops);
- Mining sector was selected in 10 countries;
- Fisheries sector was selected in five countries;
- Forestry sector (logging and wood harvesting) was selected in five countries; and
- Livestock sector was selected in four countries.

The results of the assessment and its processes led to a list of 12 key recommendations:

1. Analyse and structure existing data sources and methods;
2. Consider a broad range of biodiversity values, adopt a conceptual framework and ensure its application;
3. Undertake a literature review using DPSIR framework and IUCN-CMP 3.2 (Level 2) classification of threats to biodiversity;
4. Apply The IUCN Red List of Threatened Species™ and the Red List Index;
5. Apply a National Red List of Threatened Species, where available;
6. Harness the full potential of STAR metric;
7. Use and produce maps, including STAR maps, to target specific areas and sectors.
8. Build a transition matrix of land-use changes between specific dates;
9. Enhance, challenge and/or substantiate literature and STAR results through experts' elicitation;
10. Strengthen the robustness of expert's elicitation process;
11. Combine criteria to select economic sub-sectors; and
12. Facilitate a participatory and inclusive governance.

Finally, we propose a step-by-step process accompanied by a set of tools that could be used in other countries or by other governments, NGOs, bilateral and multilateral development banks to follow a similar process of identification and ranking of main threats to biodiversity at national level, and linking them to key economic sectors.

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Acronyms

AFD	Agence Francaise de Développement
AFOLU	Agriculture, Forestry and Other Land Use
AOH	Area of Habitat
AOI	Area of Interest
CBD	Convention on Biological Diversity
COP	Conference of the Parties
CR	Critically Endangered
DPSIR	Drivers, pressures, state impact and response model of intervention
EN	Endangered
FAO	Food and Agricultural Organization of the United Nations
GBF	Global Biodiversity Framework
GIS	Geographic Information System
IBAT	Integrated Biodiversity Assessment Tool
ICRI	International Coral Reef Initiative
IMF	International Monetary Fund
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IUCN	International Union for Conservation of Nature
IUCN-CMP	IUCN Conservation Measures Partnership
IWMI	International Water Management Institute
KBAs	Key Biodiversity Areas
MEA	Multilateral Environmental Agreement
NbS	Nature-based Solutions
NBSAP	National Biodiversity Strategy and Action Plan
NCP	Nature's Contributions to People
NEA	National Ecosystem Assessment
NT	Near Threatened
RLI	Red List Index
SDG	Sustainable Development Goals
SEEA	System of Environmental Economic Accounting
STAR	Species Threats Abatement and Restoration
TNC	The Nature Conservancy
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UN-REDD	United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN-REDD)
USDA	United States Department of Agriculture
VCS	Voluntary Certification Standard
VU	Vulnerable
WCS	Wildlife Conservation Society
WDKBA	World Database of Key Biodiversity Areas
WRI	World Resources Institute
WDPA	World Database on Protected Areas
WWF	World Wide Fund for Nature

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1 Introduction

1.1 A sixth mass extinction is underway

Current extinction rates of species are between 100 and 1,000 times higher than the baseline rate, despite conservative assumptions regarding the normal background rate[1] of species extinction. A sixth mass extinction is under way (Ceballos et al., 2015; Cowie et al., 2022), whereas "(t)he most unique feature of Earth is the existence of life, and the most extraordinary feature of life is its diversity" (Cardinale et al., 2012, p. 59). Nature and the diverse forms of life (ecosystems, species and genetic diversity) are being seriously degraded.

The summary for policy makers of the 2019 Global Assessment of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), officially approved by more than 130 Governments at the seventh session of the IPBES Plenary, states:

> Human actions threaten more species with global extinction now than ever before. An average of around 25 per cent of species in assessed animal and plant groups are threatened, suggesting that around 1 million species already face extinction, many within decades, unless action is taken to reduce the intensity of drivers of biodiversity loss. Without such action, there will be a further acceleration in the global rate of species extinction (…) (IPBES, 2019, p.11).

This alarming global trend has continued[2] notwithstanding United Nations (UN) Conventions related to global environmental issues, such as biological diversity, climate change and desertification, as well as more specific or geographically targeted international agreements, protocols or conventions.[3]

1 See De Vos et al. (2014).

2 The trend has continued, but would likely be worse in some countries without certain conservation interventions.

3 Such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Ramsar Convention, the Tehran Convention (to protect the Caspian Sea), the Convention on the Conservation of Migratory Species of Wild Animals (CMS) or the World Heritage Convention.

Yet, a healthy nature underpins human well-being, prosperity and sustainable development. The World Economic Forum has estimated that half of global GDP depends on nature (Herweijer et al., 2020). Economies both depend on and impact nature. The *Dasgupta Review on the Economics of Biodiversity* (Dasgupta, 2021) pointed out that, according to global estimates from 1992 and 2014, produced capital per person doubled, human capital per person increased by about 13%, while the stock of natural capital per person declined by nearly 40%. The review further notes that:

> … in other words, while humanity has prospered immensely in recent decades, the ways in which we have achieved such prosperity means that it has come at a devastating cost to Nature. Estimates of our total impact on Nature suggest that we would require 1.6 Earths to maintain the world's current living standards (Dasgupta, 2021, p. 1).

Climate change and nature loss call for action. It is a long-term ambition that requires re-thinking certain models, challenging current practices and innovating. The climate and biodiversity crises are intimately linked. As stated in the IPBES-IPCC co-sponsored workshop's report on biodiversity and climate change, "(l)imiting global warming to ensure a habitable climate and protecting biodiversity are mutually supporting goals, and their achievement is essential for sustainably and equitably providing benefits to people" (Pörtner et al., 2021, p. 14).

Efforts to stop the sixth mass extinction underway can also help in stabilising global temperature increase. Mitigating climate change and adapting to climate change through nature-based solutions (NbS) can also help solve the biodiversity crisis. At the same time, NbS can help stop biodiversity erosion, mitigate climate change by sequestrating carbon in ecosystems (see, for example CGDD, 2019) and help adapt to climate change such as fight against the urban heat effect (for example, see Hobbie & Grimm, 2020). Pörtner et al. (2021) in their IPBES-IPCC report also insisted on "(t)reating climate, biodiversity and human society as coupled systems is key to successful outcomes from policy interventions" (p. 21).

1.2 Mainstreaming biodiversity in key economic sectors

To stop biodiversity decline and better manage Nature as an asset, area-based conservation actions, such as establishing new protected areas,[4] are necessary, but will not be enough and should be complemented by mainstreaming biodiversity into every decision-making process that contributes directly or indirectly to biodiversity loss. Such mainstreaming is an essential condition of the transformative change needed for humans to live in harmony with nature by 2050.

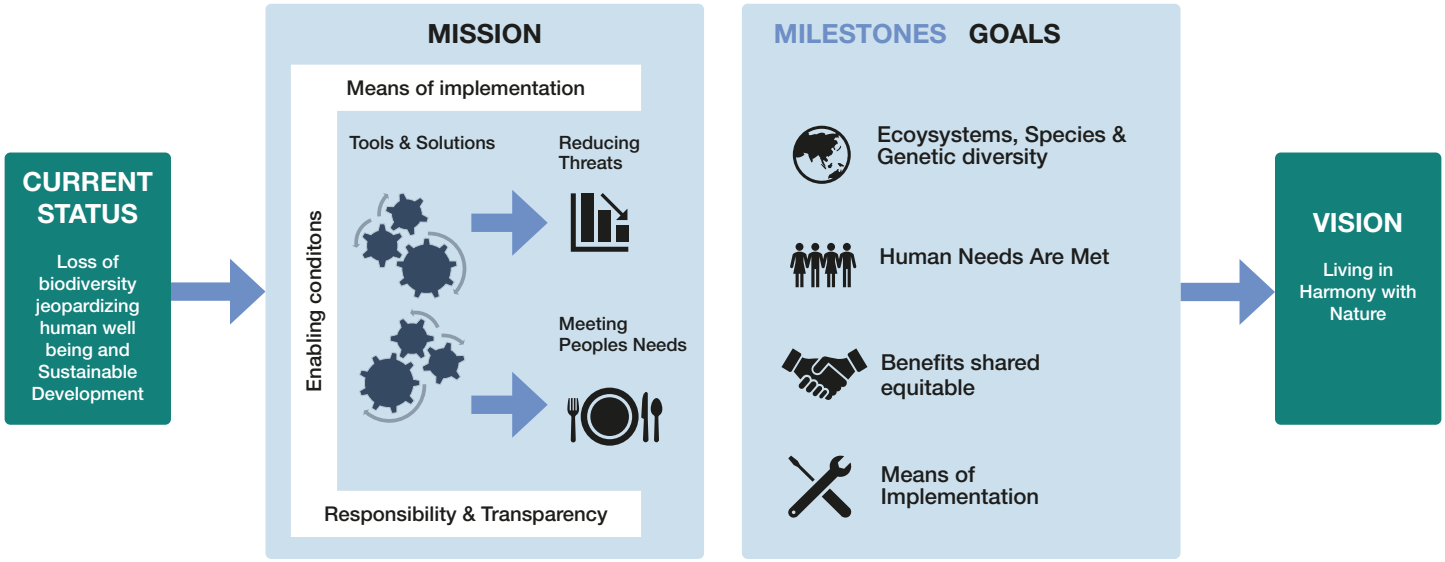
As indicated in its theory of change (Figure 1), the post-2020 Global Biodiversity Framework (GBF) "… assumes that transformative actions are taken to (a) put in place tools and solutions for implementation and mainstreaming, (b) reduce the threats to biodiversity and (c) ensure that biodiversity is used sustainably in order to meet people's needs and that these actions are supported by enabling conditions, and adequate means of implementation, including financial resources, capacity and technology." (CBD, 2021, p. 3).

In his note to COP14, CBD's Executive Secretary reports that:

> The challenge appears to be that national policy setting and decision-making processes do not take full account of biodiversity and ecosystem services, because of a lack of real understanding of their value and inadequate tools for integrating knowledge about ecosystem services into policy setting and decision making. As a result, different sectors (such as agriculture, water and forestry) may not fully understand and take account of the importance of biodiversity and ecosystem services in achieving their own objectives, and therefore risk undermining sustainability. Ecosystem assessments can deliver an evidence base that meets the needs of different sectors and encourages integration." (CBD, 2018, p. 1).

4 New protected areas [will] contribute to reaching Target 3 of the zero draft of post-2020 Global Biodiversity Framework, which is formulated as follows: "Ensure that at least 30 per cent globally of land areas and of sea areas, especially areas of particular importance for biodiversity and its contributions to people, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes (CBD, 2021, p. 6)."

Figure 1 **Theory of change of the post-2020 Global Biodiversity Framework.** Source: CBD (2021, Figure 1, p. 3)



Mainstreaming biodiversity into the decisions and action plans of economic sectors and across all sectors is a key lever for transformative change (IPBES, 2019). It means ensuring that biodiversity, ecosystems, their services and all associated values are fully and adequately considered in public-policy design and implementation as well as in the decisions of private stakeholders such as investment actors, such as investors, executive officers or farmers. It implies that impacts and dependencies on biodiversity are properly integrated throughout production and value chains. Successful implementation of this approach requires efforts and increased collaboration from all actors in society: State, private sector, civil society organisations (CSOs), indigenous peoples and local communities and citizens.

Article 6 of United Nations Convention on Biological Diversity (CBD) states that each Party shall "(…) (b) Integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies" (UN, 1992, p. 5).
As such, Parties have developed at least one National Biodiversity Strategy and Action Plan (NBSAP) aiming at a transparent plan to reconcile economic development and biodiversity protection. Whitehorn et al. (2019) have investigated the performance of countries in incorporating biodiversity mainstreaming into their post-2010 NBSAPs. The study finds that "developing countries, particularly those in Africa, have higher scores, indicating that they have a higher awareness of the importance of biodiversity mainstreaming" (p. 161). Nevertheless, their "findings suggest that biodiversity mainstreaming remains a challenge across much of the world" (p. 157). This is consistent with the Global Biodiversity Outlook 5 showing Aichi targets 1 and 2 (linked to mainstreaming) are poorly reached (SCBD, 2020).

Mainstreaming biodiversity into public and private actors'decisions will remain high on the political agenda as the "requirement to integrate consideration of the conservation and sustainable use of biological resources into national decision-making, and mainstream issues across all sectors of the national economy and policy-making framework, are the complex challenges at the heart of the Convention" (SCBD, n.a.).

1.3 The specific features of BIODEV2030

Initiated by the French Ministry for European and Foreign Affairs, funded by the French Development Agency (AFD) and coordinated by Expertise France, BIODEV2030[5] is jointly implemented by IUCN and WWF-France. Through a science-based and multi-stakeholder approach, and by empowering the CBD

5 The BIODEV2030 project (2019-2022) is funded by the French Development Agency, coordinated by Expertise France and jointly implemented by Expertise France, the International Union for Conservation of Nature (IUCN) and WWF-France.

National Focal Points, the overall objective of the BIODEV2030 project is to contribute to ambitious national and sectoral voluntary commitments in a range of key sectors to reduce pressures on biodiversity, seize ecosystem restoration opportunities and thus help stabilise biodiversity decline by 2030.

The project is being implemented in 16 pilot countries and aims to help reach the targets of the post-2020 GBF.

The GBF will probably include two groups of targets: i) Targets 1 to 8 relating to "Reducing threats to biodiversity"; and ii) Targets 14 to 21 about "Tools and solutions for implementation and mainstreaming". In particular, BIODEV2030 could contribute to achieving Targets 1 to 7 in the first group, as well as Targets 14, 15, 18, 19 and 21 in the second. The BIODEV2030 project can also be considered as a contribution to assist countries implementing the post-2020 GBF, by making the theory of change less theoretical and more practical and effective.

The project is implemented by IUCN in eight pilot countries – Benin, Burkina Faso, Ethiopia, Fiji, Guinea, Kenya, Mozambique and Senegal – and by WWF-France in eight other countries – Cameroon, Congo, Gabon, Guyana, Madagascar, Tunisia, Uganda and Viet Nam.

The focus on developing countries echoes Dasgupta (2021, p. 2), "Low income countries, whose economies are more reliant than high income countries on Nature's goods and services from within their own borders, stand to lose the most." In light of their diverse ecosystems, demographic and development challenges, the 16 pilot countries present a distinctive nature with which to identify and discuss both opportunities and difficulties for 'mainstreaming' biodiversity in economic sectors.

The governance of the BIODEV2030 project's activities encourages working at the interface of different communities of actors (scientists, private sectors' actors, government representatives and NGOs) (Box 1).

For the BIODEV2030 project to benefit the country at length, a full implementation of the voluntary commitments designed in the first phase would be needed. Likewise, it is important to build synergies with on-going projects in Africa on biodiversity assessment and mainstreaming, such as African Biodiversity Challenge led by South Africa National Biodiversity Institute (SANBI), the Biodiversity Assessment for Spatial Prioritization in Africa (BSPA) project (led by IUCN Species Survival Commission (SSC)), in collaboration with Birdlife South Africa and SANBI), and related Mapping Biodiversity Priorities (MBP) projects. Those synergies will help decision makers in prioritising actions and how to best allocate human and financial resources for biodiversity conservation and nature's contributions to people (NCP).

> Diagnosis 1 is a good study, they have pinpointed the main threats and pressures on biodiversity in the country. The three sectors and sub-sectors selected are agriculture (cotton) – livestock and mining (industrial and artisanal gold). This study confirmed our intuition. The actors in these sectors were not reluctant but on the contrary enthusiastic to have been identified. They are aware of their impacts but they are caught up in short-term logic: generating income for their families. The problem of poverty largely determines the choices of producers that impact biodiversity. Economic development and preservation of the environment are linked. It is a process that takes time. (…) This diagnosis has allowed to raise awareness, build capacity, produce and make available scientific data and assessments, and we will continue to identify and promote good practices among producers, negotiate with producers, implement action plans with stakeholders, specifying who does what. Thanks to diagnosis 1, we reached all the key players.
>
> It was necessary to have the representatives of producer organizations, the umbrella organizations. Now the challenge is to go down to the producers.
>
> Amadé OUEDRAOGO
> (CBD National Focal Point of Burkina Faso)

Box 1 | BIODEV2030: a project at the interface of communities of experts and communities of decision makers

The strategy of BIODEV2030 is to create, in each country, the conditions for an inclusive dialogue involving major actors from key economic sectors. The implementation relies on three main axes, called the 'three Ds', as follows:

1) **Diagnosis:** the process of co-creating voluntary commitments is based on an assessment (first step of the project), shared with stakeholders, on the extent and causes of biodiversity decline, particularly in relation to the country's economic sectors. This involves experts producing factual, science-based assessments in order to provide all stakeholders, whether biodiversity experts or not, with the information they need to discern what is at stake what (their impacts and dependencies on biodiversity), before any negotiations are undertaken or decisions made. Then, a second in-depth assessment of the selected sectors is undertaken to identify the stakeholders who will be involved in the dialogue process of developing commitments and sustainable practices.

2) **Dialogue:** in line with the whole of society approach which is key to BIODEV2030, a platform is designed to bring together various stakeholders around biodiversity preservation: private and public stakeholders, civil society organisations (CSOs), scientists, indigenous groups, local communities and citizens. The platform for dialogue allows the stakeholders to discuss, comment, express concerns and in the end take ownership of the assessments' findings, and then to engage in the negotiations to reach voluntary sectoral commitments. At a given point in time, it is also vital to reflect on the key actors who may not temporarily be represented but who should be, such as social scientists, the private sector, investment banks and primary industry multinationals who are not necessarily headquartered in the country.

3) **Dissemination:** through visibility, showcasing and learning efforts, the project will contribute to the international negotiations and subsequent implementation of the post-2020 Global Biodiversity Framework (GBF). Such an approach will inspire – or be taken up and adapted by – other stakeholders in other countries or sectors.

In summary, the BIODEV2030 project seeks to simultaneously associate scientists, representatives of private (chief executive officers of companies, heads of umbrella organisations, representatives of farmers, etc.) and other stakeholders (i.e. civil society), at each or public sectors (public policy-makers, specifically) and other stakeholders (i.e. scientists, civil society), at each key step of the process. As recalled by Cash et al. (2003), "a wide range of studies have identified the importance to effective science advising of "boundary work" carried out at the interface between communities of experts and communities of decision makers". Cash et al. show that "efforts to mobilize science (and technology) for sustainability are more likely to be effective when they manage boundaries between knowledge and action in ways that simultaneously enhance the salience, credibility, and legitimacy of the information they produce" (p. 8086).*

* Following Cash et al. (2003), "credibility involves the scientific adequacy of the technical evidence and arguments. Salience deals with the relevance of the assessment to the needs of decision makers. Legitimacy reflects the perception that the production of information and technology has been respectful of stakeholders' divergent values and beliefs, unbiased in its conduct, and fair in its treatment of opposing views and interests." (p. 8086).

1.4 Objectives of the study

To optimise mainstreaming actions in a given national economy, the following key questions were addressed: how can the main threats to biodiversity be quickly[6] and robustly identified? how can they be ranked?[7] what are the economic sectors causing these threats? what are the main opportunities for biodiversity protection and natural habitat restoration?

In each BIODEV2030 pilot country, the implementation of the project started with a scientific assessment of the status, trends and threats to biodiversity and ecosystems at national and local levels. The assessments were conducted by experts contracted by IUCN or WWF-France national or regional offices. The objective of the assessments was to identify the main drivers of biodiversity loss and the economic sectors that should be mobilised to address them, in order to accelerate the mainstreaming of biodiversity.

> Yes, it is key to have a science-based approach. It is important to be credible. During the data collection, the feedbacks we received following our questions sent by email were sometimes weak. It was necessary to complete, to combine different methods. Another limitation is that, at the time of the diagnosis, the academic literature on certain major national environmental issues simply does not exist, or is out of date or does not correspond to national context. To overcome this lack of academic articles published on key topics such as drivers of biodiversity erosion at national scale, it is necessary to combine scientific literature and national experts' knowledge (…).
>
> It is important to find a recipe that respects everyone's interests, does not marginalize the actors, helps them, builds their capacities, provides scientific data and diagnoses".
>
> Rantonirina Rakotoaridera
> (CBD National Focal Point of Madagascar)

The ultimate goal of this publication is thus to allow key actors in key institutions (governments, donors such as bilateral and multilateral development banks, non-governmental organisations (NGOs)) to benefit from the experience and lessons learned through the implementation in 16 countries of the BIODEV2030 first step, which is the 'assessment of main threats to biodiversity'.

The scientific value-added of this publication relies on the following key questions it expects to address:

- What combination of methods did the BIODEV2030 countries implement to identify and rank main threats to biodiversity and impacting sectors?
- BIODEV2030 project has also been a pilot for the STAR metric,[8] as it was considered as an opportunity to carry out the STAR metric under actual conditions in 16 countries. The STAR metric had never been used so extensively before, and this pilot project offered a window of opportunity to gain knowledge about its potential. Therefore, two key questions this project also allows to address are: how was STAR metric/approach applied to different countries? what challenges did the countries faced in using STAR and interpreting the results?
- Did the different methods converge/conflict in identifying main threats? Why? How did countries manage and overcome possible conflict between methods?
- What are the most relevant approaches and tools, and how were they combined to identify priority economic sectors for mainstreaming biodiversity and engage a national dialogue?
- How should existing tools and data be improved or completed to support more reliable and efficient science-based threat assessments?

6 A rapid assessment is a strength but it can also be a drawback. Indeed, the flipside of the coin is if data and knowledge gaps are too important at the time of conducting the study, prohibiting robust results. Then, if this method is applied in a country where data and knowledge gaps are significant, it might be necessary to take more time and wait for useful new expertise to be included and/or allow for regular updates of the results.

7 Note that in next step of BIODEV2030 project, the following questions are addressed: what are the direct and indirect drivers behind those threats? what are the main economic sectors determining those drivers? what are the specific production practices that should be changed? what are the key actors operating and originating those practices? what are the enabling conditions to transform those production practices?

8 For more information about STAR metric, see Mair et al. (2021a) (see also Boxes 5 and 6).

- How could the STAR metric be improved/ completed to better fit with such uses in (developing) countries?

The key findings and lessons learned of this study complement the report on mapping biodiversity priorities by SANBI and UNEP-WCMC (2016). Both recognise that a spatial approach, and thus maps and spatialised data, are necessary to obtain a relevant prioritisation of actions for biodiversity conservation. However, our specific focus is not only to prioritise areas but also to identify and rank the main threats to biodiversity and link them to key economic sectors and, whenever possible, sub-sectors.

Our specific and novel contribution to the field relates to the key learnings: i) from the unique experience of using the new STAR metric in 16 countries in many ways (scores and maps, both at the national and threat levels); ii) about how to best combine conventional data sources with new and innovative tools (STAR metric) and experts' elicitation processes; and iii) on how to strengthen the experts' elicitation exercise and make it as complementary as possible.

We are hopeful this publication will be considered by CBD and WCMC-UNEP as a capacity-building support tool for conducting national ecosystem assessments. It could be referenced in the next updated version of the IPBES Guide on the production of ecosystem assessments which is updated periodically by the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC). This would inform CBD National Focal Points about a simple[9] way to identify and rank main threats, and prioritise economic sectors to work with for biodiversity mainstreaming.

Finally, note that this publication relates to:

- IUCN resolutions and recommendations on biodiversity mainstreaming, such as:
  - WCC-2016-Res-059-EN IUCN Policy on Biodiversity Offsets;
  - WCC-2016-Res-067-EN Best practice for industrial-scale development projects;
  - WCC-2016-Rec-102-EN Protected areas and other areas important for biodiversity in relation to environmentally damaging industrial activities and infrastructure development;
  - WCC-2020-Res-116-EN Develop and implement a transformational and effective post-2020 global biodiversity framework;
  - WCC-2020-Res-043-EN Enhancing implementation of the Convention on Biological Diversity through National Biodiversity Strategies and Action Plans (NBSAPs);
  - WCC-2020-Res-121-EN Reducing the impacts of the mining industry on biodiversity; and
  - WCC-2020-Res-107-EN Reducing the impact of fisheries on marine biodiversity.
- IUCN publications reporting mainstreaming experiences at business level such as the *Guidelines on business and KBAs: managing risk to biodiversity*.

Structure of the report

The report is organised into six main chapters. The introduction (Chapter 1) is followed by a description of the 16 pilot countries' economic and ecological profiles (Chapter 2). The methodological approaches to identify and rank main threats to biodiversity in each countries are presented in Chapter 3. The key findings, including a synthesis of the main threats and selected sub-sectors, are described in Chapter 4. The chapter also includes a discussion of the methodology, as well as the strengths, limits and complementarities of the different methods that were combined during BIODEV2030's first step and possible ways to advance on the use of the STAR metric. In Chapter 5, key recommendations for practitioners (scientific and technical experts, NGOs, donors) are outlined, illustrated by good practices observed in BIODEV2030 reports. In conclusion, Chapter 6 provides an overview of a synthetic toolkit, describing a step-by-step process to identify and rank the main threats to biodiversity and associated economic sectors, in order to inspire and guide governments in other countries, donors (multi or bilateral) and development banks and international NGOs wishing to replicate a similar approach. Finally, the annexes contain a glossary and extensive information about the recommendations and suggested additional tools to assess main threats and select the target sectors.

9 Whereas a national ecosystem assessment can take three to four years (IPBES, 2018).

2 Economic and ecological profile of the 16 pilot countries

Clement Tardif/AFD

The sample of 16 countries covers a great diversity of developing countries with common features relevant for biodiversity (expectations of high economic growth, significant share of primary sectors in national GDP, high share of territory uncovered by protected areas underlining the importance of mainstreaming biodiversity into economic sectors).

2.1 Economic indicators

For the purposes of this report, instead of population dynamics,[10] the focus will be more (see Box 2) on GDP and GDP per capita (levels and trends) that are good proxies for production and consumption, both of which are current key indirect drivers of biodiversity loss. Key figures on the GDP structure (share of primary sectors' GDP in total GDP) are likewise provided, because it has an impact on land uses and land use changes, which are also direct drivers of biodiversity loss (IPBES, 2019).

The GDP growth can be a key indirect driver of biodiversity loss at national level, through increased (natural) resources consumption (Otero et al., 2020). Past and future trends are interesting to consider and compare. For example, based on 2021 data from the World Economic Outlook Database (IMF, 2021) for the 16 BIODEV2030 pilot countries observed during the period 1980-2020, representing 40 years, the findings show that:

- GDP (in constant prices) has been multiplied by a factor of between 2.1 (Fiji) and 12.9 (Viet Nam);
- nine out of the 16 pilot countries have experienced a multiplication by four of their GDP;
- in the 2000–2020 period, the GDP growth accelerated, compared with 1980–2000, in all but four countries (Congo, Fiji, Tunisia and Viet Nam).

10 According to the UN Population Division (UN DESA, 2019), despite a decelerating trend, population size is projected to double (or more) between 2020 and 2050 in seven out of the 16 pilot countries. Yet, the relationship between biodiversity and demographic change is complex. For example, Mehring et al. (2020) analysed many studies of the link between demography and biodiversity and show that "a considerable number of studies also point towards impacts that were context dependent, either positive or negative under certain circumstances" (p. 1309). Another reason is that this relationship is also highly controversial, as shown by Green et al. (2022) answering to Cafaro et al. (2022), overconsumption rather overpopulation is the root cause, at global level, of resources depletion, including biodiversity loss.

Box 2 | The GDP structure and growth matter for biodiversity

In the coming decades, in almost all of the 16 BIODEV2030 countries, we show that GDP is expected to grow (see Annex 2) both because of population growth and because the level of GDP/capita has a strong catch-up potential compared to more advanced economies.

In addition, the GDP structure and in particular the share of primary sectors 'GDP in total GDP, that is quite high many developing countries, matters for biodiversity. What is the reason for that?

Worldwide, land uses and land use changes are major drivers of biodiversity erosion (IPBES, 2019). For a given country, land uses and land use changes are largely driven by domestic and international demand for food products. Even if the international demand for food products tends to play a growing role in biodiversity erosion (up to around 30% of impacts according to Marques et al. (2019) and Irwin et al. (2022)), the domestic demand (that is directly influenced by population growth and economic development) is still playing a significant role. Subsistence farming, aquaculture and forestry (in particular, for wood energy) will consequently continue to contribute greatly to the domestic impacts of land use and land use changes on biodiversity and ecosystem services (such as carbon sequestration).

So, all other things being equal, the higher the GDP of the primary sectors, the higher the impacts on biodiversity. In the 16 BIODEV2030 pilot countries, the relative contribution of primary sectors to total GDP is decreasing but remains high (more than 20%) and the size of primary sectors' GDP will continue to grow, largely driven by population growth and the induced increasing food and feed demand. It is thus important to describe those trends (absolute and relative size of the primary sectors) to anticipate potential pressures on biodiversity at the national level.

GDP per capita is also a key indirect driver of biodiversity loss as it shapes the level of individual consumption and the types of consumed and demanded goods and services. For example, when GDP per capita increases, so does meat consumption (Sans & Combris, 2015) and it is well known that the meat production systems' impacts on biodiversity can be significant. Considering those possible correlations, it is worth noting that:

- between 1980 and 2020, GDP per capita has been multiplied by a factor of between 0.6 (a reduction occurred in Madagascar) and 7.2 (Viet Nam);
- it decreased only in Madagascar and Gabon; and
- it doubled or more in seven out of 15 countries.

In Annex II, we show the relative importance of the primary sectors (agriculture, forestry and fishing) in the 16 pilot countries' economies (share of GDP and share of total employment). Given their dependence on land activities, future GDP and per capita growth are very likely to contribute to increasing impacts on domestic biodiversity.

Future national development pathways will surely be contrasted among the 16 pilot countries, and will probably differ from the past and currently known patterns in the today's developed countries. However, should GDP growth remains coupled with biodiversity loss at national scale, it is an important indicator to consider, if only to raise awareness, prepare and

implement policies that will more effectively decouple economic growth from biodiversity and ecosystem erosion.

2.2 Ecological indicators

In the 16 BIODEV2030 pilot countries, total coverage of protected areas spans from almost 1% (Fiji) to more than 33% (Congo) of the national territory, while the proportion of threatened species (among those assessed) reaches between 3% (Burkina Faso) and 40% (Madagascar) (see Annex III).

The number and proportion of threatened species in a given country gives a static picture of the stakes associated with species. As a complementary source of information, the IUCN Red List Index (RLI) is more dynamic and synthetic as it aggregates into one single metric the data about the extinction risk evolution over time. Currently, the RLI is available for five taxonomic groups only (those in which all species have been assessed at least twice): birds, mammals, amphibians, cycads and warm-water reef-forming corals (IUCN, 2022a).

For those 16 BIODEV2030 pilot countries, the data for an RLI at the national level between 1993 and 2020 were obtained by weighting the fraction of each species' distribution occurring within a given country, specifically:

An RLI value of 1.0 equates to all species qualifying as Least Concern (i.e., not expected to become Extinct in the near future). An RLI value of 0 equates to all species having gone Extinct. A constant RLI value over time indicates that the overall extinction risk for the group is unchanged. If the rate of biodiversity loss were reducing, the RLI would show an upward trend (IUCN, 2022a).

The RLI trends at the national level are shown in Figure 12, Annex III.

Thus, based on the RLI level (initial-final) and trend (slope), three groups of countries can be identified:

- where the trend is clearly **decreasing**: Fiji, Kenya, Madagascar, Mozambique, Senegal, Uganda and Viet Nam,
- where the level (initial-final) and trend is **constant at a high level**: Burkina Faso, Congo, Gabon and Tunisia,
- where the level (initial-final) and trend is **constant at a low level**: Benin, Cameroon, Ethiopia, Guinea and Guyana.

A decreasing or constant at a low level RLI indicates that the country's contribution to preserving species from extinction at global scale should be reinforced.

In conclusion, we emphasise the fact that, considering the economic and ecological indicators of the 16 BIODEV2030 pilot countries, many other countries around the world could recognise themselves in those traits and be inspired by the experience of BIODEV2030's first step.

3 Identifying and ranking the main threats to biodiversity

Stéphane Brabant/Afrikafun

The scientific assessment, involving the identification and ranking of the main threats to biodiversity, as well as the main economic sectors driving them, mobilised the human and financial resources of each pilot country of the BIODEV2030 project. This first critical step of the project consisted of recruiting a team of scientific and technical experts who will undertake the assessment and whose terms of reference were approved at the national level, either by the CBD National Focal Point or by the steering committee of cooperating Ministries. In Benin, Burkina Faso, Ethiopia, Fiji, Guinea, Kenya, Mozambique and Senegal (IUCN-operated countries), the recruitment was limited to local experts, while in Cameroon, Congo, Gabon, Guyana, Madagascar, Uganda, Tunisia and Viet Nam (WWF-operated countries), both local and international experts were enlisted. The team of scientific and technical experts were retained according to their specific skills in ecological sciences and data and sustainability analysis, knowledge of the biodiversity and ecosystem challenges at different scales (from international to local), and more than 10 years of professional experience, at least for the team leader (where possible, in one of the key economic sectors suspected to impact biodiversity at national scale). The recruited experts were provided a suggested list of methodologies to apply, data sources and tools to conduct the scientific assessment, including: i) literature review and the use of global and national databases; ii) the STAR metric; and iii) interviews of national experts.

The combination of the three approaches resulted in the identification and ranking of the main threats to biodiversity, using the IUCN-CMP Threats Classification Scheme (Version 3.2) (IUCN, 2022b). On that basis, stakeholders discussed and decided on which sub-sectors to specifically select for next steps of the project. For example, when Level 2 threat – Annual and perennial non-timber crops – was indicated, specific crop(s) or agricultural practices with the most likely the highest impact on biodiversity were identified.

Table 1 Number of references by type cited in BIODEV2030 reports for IUCN-operated countries

REFERENCES	BENIN	BURKINA FASO	GUINEA	SENEGAL	ETHIOPIA	KENYA	MOZAMBIQUE	FIJI
Peer-reviewed scientific articles and/or books published	16 (3)	32 (16)	4 (3)	20 (8)	52 (11)	91 (37)	67 (26)	28 (12)
Technical reports from Ministries and other national organisations (agencies, bureaus, universities, NGOs, etc.)	3 (0)	9 (2)	8 (1)	9 (2)	9 (0)	22 (1)	81 (7)	11 (1)
Masteral or PhD Theses	2 (1)	10 (3)	2 (0)	11 (1)	2 (0)	0	10 (3)	1 (0)
Scientific papers presented at congresses	4 (0)	1 (0)	0	0	1 (0)	0	0	0
National Plans, Strategies, Reports to CBD, NBSAP, etc.	3 (0)	1 (0)	1 (0)	13 (2)	9 (1)	5 (0)	9 (1)	6 (1)
Reports from international institutions (FAO, IUCN, MEA, IPBES, UNEP, IWMI, UN-REDD, IMF, UNDP, TNC, USAID, USDA, Birdlife International, WCS, WWF International, ICRI, WRI, etc.)	7 (3)	6 (2)	2 (0)	6 (0)	7 (2)	23 (3)	39 (7)	4 (1)
Total	35 (7)	59 (23)	17 (13)	59 (13)	80 (14)	141 (41)	206 (44)	50 (15)

( ) Numbers in parentheses reflect the number of references that, according to their title, address issues related specifically to economic sectors' impacts on biodiversity and/or ecosystem services.

Source: Author based on BIODEV2030 country reports

Table 2 Number of references by type cited in BIODEV2030 reports of countries operated by WWF-France

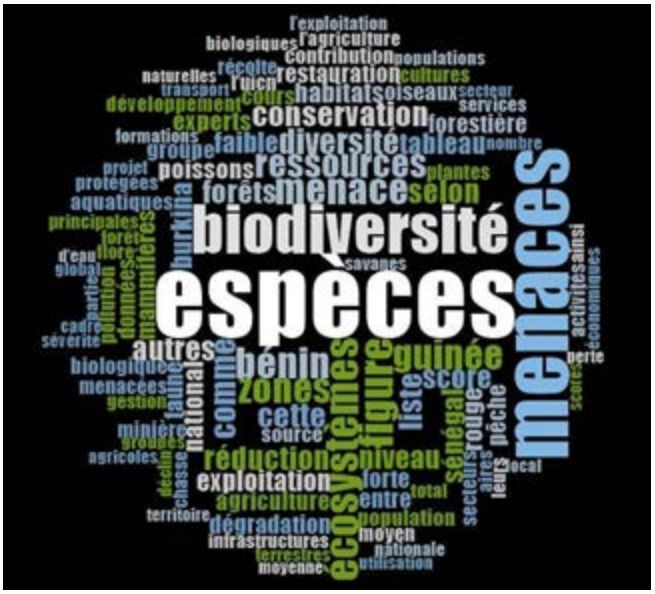
REFERENCES	CAMEROON	CONGO	GABON	GUYANA	MADAGASCAR	UGANDA	TUNISIA	VIET NAM
Peer-reviewed scientific articles and/or books published	38 (19)	19 (4)	n.a.	8 (6)	46 (17)	6 (2)	131 (46)	45 (6)
Technical reports from Ministries and other national organisations (agencies, bureaus, universities, NGOs, etc.)	18 (8)	0	n.a.	15 (8)	22 (1)	5 (1)	59 (9)	25 (3)
Masteral or PhD Theses	4 (2)	0	n.a.	0	2 (0)	0	11 (3)	1 (0)
Scientific papers presented at congresses	1 (0)	0	n.a.	0	0	0	5 (4)	1 (1)
National Plans, Strategies, Reports to CBD, NBSAP, etc.	5 (0)	0	n.a.	0	5 (1)	1 (1)	6 (0)	5 (0)
Reports from international institutions (FAO, IUCN, MEA, IPBES, UNEP, IWMI, UN-REDD, IMF, UNDP, TNC, USAID, USDA, Birdlife International, WCS, WWF international, ICRI, WRI, etc.)	32 (11)	0	n.a.	1 (1)	33 (5)	4 (0)	24 (5)	16 (3)
Total	35 (7)	59 (23)	17 (13)	59 (13)	80 (14)	141 (41)	206 (44)	50 (15)

n.a. Not available
( ) Numbers in parentheses reflect the number of references that, according to their title, address issues related specifically to economic sectors' impacts on biodiversity and/or ecosystem services.

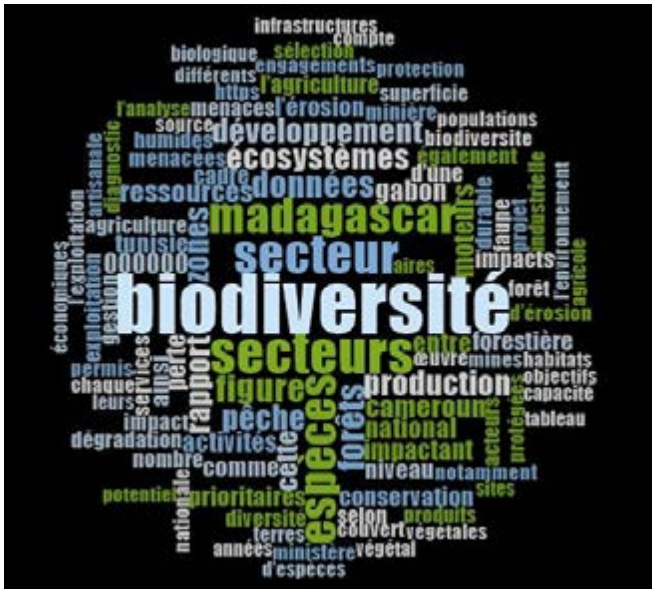
Source: Laura Poyer based on BIODEV2030 country reports.

Figure 2 Clouds of words for the French version of four reports by IUCN-operated countries **(a)** and four reports by countries operated by WWF-France **(b)**

(a)



(b)



Artwork by Mariana Saba (IUCN).

3.1 Literature review and other sources of data

The review of literature and other data sources was expected to allow the identification of the main threats. Specific instructions were given to guide the team of scientific and technical experts:

- review existing national official reports (such as reports to CBD and National Biodiversity Strategy and Action Plans (NBSAPs), government plans, strategies and roadmaps as well as Nationally Determined Contribution (NDC) under the Paris Agreement;
- use existing global databases (such as the IUCN Red List of Threatened Species™, the World Database on Protected Areas (WDPAs), the World Database of Key Biodiversity Areas (WDKBA), the Integrated Biodiversity Assessment Tool (IBAT), some FAO statistical data on deforestation, etc.);
- explore specific aspects by referring to academic peer-reviewed articles;
- compare resulting data with the STAR metric (scores and maps); and
- appraise the above information by conducting further interviews with other national experts.

Tables 1 and 2 present a typology of the data sources reviewed in the 15 BIODEV2030 reports, which can be summarised into three points:

1. Among all the sources cited, the proportion of scientific articles studying the sectors' impacts on biodiversity is much higher than for the technical reports from national organisations (Ministries, agencies, bureaus, offices, universities, NGOs, etc.). This may reflect a gap between the mobilised science that does establish and study those relationships and the national studies and reports that lag a bit behind and should continue integrating those links at national levels.

2. An apparent paradox: In their analysis of NBSAPs of 144 countries, Whitehorn et al. (2019) found that 'mainstreaming biodiversity' is more frequent in developing countries (and especially in developing African countries) compared to developed countries. In contrast, our study finds that the national plans, strategies and reports to CBD cited in the BIODEV2030 reports do not make a systematic and clear link between threats to biodiversity and proposed actions in economic sectors to halt biodiversity loss. There are two possible causes for this discrepancy: i) either the sample of BIODEV2030 countries is not representative of the African countries whose NBSAPs were included in Whitehorn's analysis or; ii) "mainstreaming of biodiversity" is more frequent in African countries but still remains low, which is what is reflected by our analysis.

3. Considering the flexibility given to IUCN and WWF-France to implement the project in the respective countries, it was interesting to compare some outcomes related to the scientific assessment in the eight countries operated by IUCN with the eight countries operated by WWF-France. Quite surprisingly, the proportion of sources cited in the BIODEV2030 reports with a link to economic sectors is the same in the countries operated by both IUCN and WWF-France. In the case of the latter, the frequencies are: 14% for Cameroon, 22% for Congo, 25% for Gabon, 28% for Guyana, 41% for Madagascar, 63% for Tunisia, 25% for Uganda and 14% for Vietnam – with a total average of 32%. The frequencies in IUCN reports are: 18% Benin, 20% for Burkina Faso, 21% for Ethiopia, 22% for Fiji, 29% for Guinea, 30% for Kenya, 39% for Mozambique and 76% for Senegal – with similar average of 32%. Concerning the word 'sector', the comparison of clouds of words generated for the French version of four IUCN countries (Benin, Burkina Faso, Guinea, Senegal) and four WWF-France countries (Cameroon, Gabon, Madagascar, Tunisia) appears to be slightly more frequently used in WWF-France reports (see Figure 2).[11]

Other databases, sources and tools (see Tables 3 and 4) were also consulted, such as The IUCN Red List of Threatened Species™ and IUCN Red List Index, WDKBA and WDPA.

To assess species' status and population trends, the IUCN Red List (see Box 3) was used in each country (IUCN, 2022a). A National Red List was used in five out of 15 countries, where it was available.

Along with the IUCN Red List, the IUCN-CMP Threats Classification Scheme (Version 3.2) (IUCN, 2022b) was used in almost all pilot countries. The scheme relies on Salafsky et al. (2008) and proposes on a complete set of direct threats to species or taxonomic groups. The system is hierarchical and has three different levels, from coarse to fine scale.

Each Level 1 entry[12] is sub-divided into several Level 2 entries.[13] Some (not all) of the Level 2 threats are sub-divided into Level 3 entries.[14] Although the classification for Levels 1 and 2 is designed to be comprehensive, consistent and mutually exclusive, Level 3 is at a much finer scale and is not comprehensive.Interestingly, the CMP classification of direct threats to biodiversity was extensively used by IUCN-operated countries in their assessment but to a much lesser extent by countries operated by WWF-France. This could be attributed to the tool being originally conceptualised by CMP-IUCN[15] and regularly updated by IUCN and who, as operator of the project, explicitly recommended its use to the team of scientific and technical experts.

Eleven out of 16 countries based their assessment on STAR scores and maps. Some countries had already completed their assessment when the article of Mair et al (2021) was published. The IUCN Global Ecosystem Typology (Keith et al., 2020) was used by five out of 15 countries, which is quite a good uptake for a newly established typology. Surprisingly, only three out of 15 countries used The Nature Conservancy's Threat Ranking System (2007). Regarding the WDPA and WDKBA, they were used, respectively, by six countries and 11 countries, out of 15, mainly as a tool to map priority areas for biodiversity in the country and cross this information with the spatial distribution of economic sectors' activities.

The complete list of data sources and tools, by country, can be found in Annex V.

11 For other clouds of words generated for the reports and sub-set of reports (by language, by operators), please see Annex IV.

12 For example, Threat Level 2 – Agriculture & aquaculture.

13 For example, Threat Level 2.1 – Annual & perennial non-woody crops; 2.2 – Wood & pulp plantations; 2.3 – Livestock farming and ranching and; 2.4 – Marine & freshwater aquaculture.

14 For example, Threat Level 2.1.1 – Shifting agriculture.

15 The CMP classification is updated regularly since it was first published (version 1.1).

Table 3 Tools, standards, handbooks and data sources used in BIODEV2030 reports by eight countries operated by IUCN

TOOLS, STANDARDS, HANDBOOKS AND DATA SOURCES	BENIN	BURKINA FASO	ETHIOPIA	FIJI	GUINEA	KENYA	MOZAMBIQUE	SENEGAL
IUCN Red List	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
National Red List	Yes	Yes	No	Yes	No	No	No	No
IUCN-CMP version 3.2 (IUCN, 2022b) of Salafsky et al. (2008)	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
STAR metric: Mair et al. (2021a)	Yes	Yes	Yes	Yes	Yes	No	Yes	No
IBAT	No	No	No	Yes	No	Yes	No	No
IUCN Global Ecosystem Typology (Keith et al., 2020)	No	No	Yes	No	No	Yes	Yes	No
The Nature Conservancy's Threat Ranking System (2007)	No	No	Yes	No	Yes	Yes	No	No
WDKBA	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
UNEP-WCMC and IUCN-WDPA	No	Yes	Yes*	No	No	Yes	Yes	No

* The Ethiopian National Ecosystem Assessment (NEA), conducted in collaboration with UNEP-WCMC by the Ethiopian Biodiversity Institute, was released and validated in April 2022 after the BIODEV2030 report for Ethiopia was finalised. Nevertheless, the main findings in both documents are in line, for example both are underlining the importance for biodiversity of forests and woodlands, aquatic and freshwater ecosystems and emphasising the impacts and pressures coming from land uses and land use changes. The landscape approach and the choice of sectors decided by stakeholders, as a result of the BIODEV2030 report presentation and discussion, are also consistent with the main findings of the Ethiopian NEA.

Source: Author based on BIODEV2030 country reports.

Table 4 Tools, standards, handbooks and data sources used in BIODEV2030 reports by eight countries operated by WWF-France

TOOLS, STANDARDS, HANDBOOKS AND DATA SOURCES	CAMEROON	CONGO	GABON	GUYANA	MADAGASCAR	UGANDA	TUNISIA	VIET NAM
IUCN Red List	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
National Red List	No	No	No	No	No	Yes	No	Yes
IUCN-CMP v. 3 (IUCN, 2022b) of Salafsky et al. (2008)	No	No	No	No	No	No	No	Yes
STAR metric: Mair et al. (2021a)	No	No	Yes	No	Yes	Yes	Yes	Yes
IBAT	Yes	Yes	No	Yes	No	No	No	No
IUCN Global Ecosystem Typology (Keith et al., 2020)	No	No	Yes	No	No	No	No	Yes
The Nature Conservancy's Threat Ranking System (2007)	No	No	No	No	No	No	No	No
WDKBA	Yes	No	Yes	No	No	Yes	No	Yes
UNEP-WCMC and IUCN-WDPA	Yes	No	No	No	No	No	No	Yes

Source: Laura Poyer based on BIODEV2030 country reports.

Box 3 | The IUCN Red List of Threatened Species™ and the National Red Lists

Contributed by: Neil Cox (IUCN)

The IUCN Red List of Threatened Species™ (hereafter IUCN Red List) is the foremost source of information concerning the global conservation status of species. Detailed species accounts, maps, and information on extinction risk status derived from the IUCN Red List Categories and Criteria System are currently available for 142,477 species from a mix of terrestrial, freshwater, and marine biomes (as of 6 June 2022). Global conservation information is now available for most of the world's vertebrate species, and there is an increasing inclusion of IUCN Red List content for invertebrate, plant and fungi species.

The information contained in the IUCN Red List has come from a wide range of sources, including IUCN Species Survival Commission (SSC) Specialist Groups, IUCN Red List Partner organisations (for example BirdLife International), or specialists working on IUCN-led assessment processes.

New or updated species extinction risk assessments for publication on the IUCN Red List are submitted to the IUCN Red List Unit throughout the year. Typically, the IUCN Red List is updated with hundreds to thousands of new or updated global species assessments twice or more annually.

There are both similarities and differences from the described IUCN Red List to the often quite diverse mix of available Regional, National or Sub-National Red Lists. Historically, many National Red Lists used criteria that were independent of the standardised IUCN Categories and Criteria system to document threatened species within their territories. This caused confusion at times, especially for nationally endemic species that could be assessed by IUCN under one system and differently by other bodies using an alternative approach.

In view of this important need to reconcile global and national listings, IUCN developed the Guidelines for Application of the IUCN Red List Criteria at Regional and National Levels). The guidelines help to match the IUCN Categories and Criteria system to the needs of regions, counties, or sub-national areas. This has numerous values, one of which being that species that are endemic to an assessed geography (region, country, or sub-national) can now be readily submitted to and published on the global Red List – expanding the availability of these standardised data to conservation practitioners, governments, civil society, and other stakeholders worldwide. It is important to note that when species are not endemic to an assessed sub-global geography or population they can be found to be threatened at that sub-global level (Critically Endangered, Endangered or Vulnerable), but this does not necessarily mean that the global population of that species taken in its entirety is globally threatened as the conservation status of only a portion of the global population has been reviewed.

The production of regional, national, and sub-national Red Lists following the IUCN system are also more readily useable by international conservation treaties, legislation, and policy. Indeed, countries reporting to the CBD on national conservation progress are required to produce National Biodiversity Strategies and Action Plans (NBSAP's) and aligning the national species assessment process with the IUCN standard allows clearer reporting and comparison of progress between countries. Options also exist to create indices to track changes in biodiversity status at global, regional and national scales, such as the IUCN Red List Index.

Since much of the needed conservation action takes place at a sub-global level, often driven by local conservation policy, legislation and planning, regional, national and sub-national Red Lists, have a great value added. Having sub-global Red Lists can focus on individual species populations that may have local significance and be locally imperilled but are not declining sufficiently to be listed as threatened on the IUCN Red List.

Although tracking the publication of new sub-global Red Lists can be difficult, IUCN and partners, co-ordinated by the National Red List Working Group (NRLWG), are continuously updating an important repository of data on available mostly National Red Lists with the intention that the coverage of this dataset will be a useful opportunity for sub-global data access and comparison between Red Lists for stakeholders. There are certainly opportunities for expanding the global coverage of sub-global Red Lists, perhaps most especially in under-represented biodiversity-rich continents such as Africa. Opportunities to help expansion of sub-global Red Lists are available through training in the use of the IUCN Red List Categories and Criteria System as free online resources and through direct coordination with IUCN.

In conclusion, while there are differences between sub-global and the global Red List, there are increasingly more similarities being developed. This helpfully increased coordination, in part possible through improved communication opportunities, builds the biodiversity information needed for the urgently needed efforts to prevent extinctions from local to global scales.

3.2 Using the STAR metric (scores and maps)

The STAR metric (see Box 4) relies on The IUCN Red List of Threatened Species and the classification of threats by IUCN-CMP™ version 3.2 (IUCN, 2022b), updated from the original version by Salafsky et al., 2008). A report on STAR data and results for each country had been produced by IUCN and shared with the team of scientific and technical experts before they started.

3.3 National experts' elicitation

The first two steps of the assessment to identify and rank main threats to biodiversity conducted by the team of scientific and technical experts were: 1) to review the existing literature and; 2) to use the STAR metric. The third step was to interview national experts. The objectives of these interviews were threefold:

- appraise the results of the literature review;
- challenge the STAR results regarding threat to species by:
  - considering ecosystems to protect in priority because they deliver many ecosystem services/nature's contributions to people instead of focusing solely on species);
  - complementing them, for example, with taxa not yet included in the STAR metric; and
  - add legitimacy to the results in the eyes of national stakeholders with the implicit assumption that results from national experts would be reflecting more accurately the national situation (rather than literature that sometimes is not relevant at national level and rather than the estimated STAR scores that are calculated using global data).

During the mobilisation of national experts, a diversity of techniques was observed: individual consultations or collective workshops were held; techniques to increase independence of experts 'statements, separated groups of specialists or a unique group of experts were used; fields of expertise were carefully considered in the design of the interviews; the STAR scores were provided or not before their assessment; the IUCN-CMP classification of threats was used or not; a debriefing was conducted to fine-tune the results of the first draft; and other such techniques.

Likewise, a variety of configurations surfaced when specific topics were addressed during the interview, such as combinations of species-threats or ecosystems-threats or taxonomic group threat(s), its scope, intensity, irreversibility and severity, whether having a direct or indirect impact on economic sectors, etc. For example, when the experts were asked to rate their statement about the intensity of a threat in a given species-threat combination at national level, both qualitative assessments (high, medium, low) and more quantitative attempts (up to five) were observed. To aggregate the statements of many experts, several methodological options were used, such as averaging, showing the diversity of their answers.

One common aspect of the elicitation process observed is the rather low proportion of economic sectors' experts. Most experts had an 'ecological' background (specialists of species, natural habitats, taxonomic groups, etc.), which is a perfectible point. Indeed, bringing economic sectors' experts right from the beginning of the process saves time and optimises accuracy in the identification of specific production practices that are causing biodiversity decline at the national level.[16]

Finally, we observed that the teams of scientific and technical experts evaluated only two out of the three components of biodiversity (see Annex VI): the species and the ecosystems dimensions of biodiversity. The genetic diversity was not evaluated, which could be mainly due to data and knowledge gaps, time constraints to conduct the assessment, or the absence of specialists in this particular field among them.

16 This will be discussed in length in Chapter 5.

Box 4 | The STAR metric

Contributed by: Antonin Vergez and Frank Hawkins (IUCN)

The Species Threat Abatement and Restoration (STAR) metric (Mair et al., 2021a) utilises The IUCN Red List of Threatened Species™. STAR combines data on species extinction risk, the threats they face and species Area of Habitat, to produce two complementary global data layers for threat abatement ($STAR_T$) and restoration ($STAR_R$). These can be used to identify areas where actions to abate threats or undertake habitat restoration have the potential to reduce species extinction risk and contribute to conservation goals.

What's a STAR value? STAR quantifies the relative contribution of different threats to the extinction risk of threatened (Vulnerable, Endangered and Critically Endangered) and Near Threatened species. Through appropriate management, threats to species can change over relatively short time periods that are relevant to managers and investors. Changes in the intensity of threats are expected to produce reductions in extinction risk for the relevant species.

The global STAR analysis in Mair et al. (2021a) shows that five countries (Indonesia, Colombia, Mexico, Madagascar and Brazil), contribute over 31% of total global STAR values but every nation can contribute towards halting biodiversity loss. Among actions to abate threats, more sustainable crop production and forestry dominate, since threats originated by these sectors contribute 41% of total STAR values for three taxonomic groups (terrestrial amphibians, birds and mammals). Key Biodiversity Areas (KBAs) cover 9% of the terrestrial surface but capture 47% of STAR values.

For a given location ***i*** and threat ***t***, the STAR Threat abatement (TA) score can be calculated among all species ***s*** as:

$$STAR_{threat\ abatement}\ (i) = \sum_{t}^{Nt} STAR_{threat\ abatement}\ (t,i)$$

and

$$STAR_{threat\ abatement}\ (t,\ i) = \sum_{s}^{Ns} P_{s,i}.W_s.C_{s,t}$$

where:

$P_{s,i}$ is the current area of habitat (AOH)[a] of each species ***s*** at location ***i*** (expressed as a percentage of the global species' current AOH); W_s is IUCN Red List category weight of species ***s*** (Near Threatened = 100; Vulnerable = 200; Endangered = 300; Critically Endangered = 400);[b] $C_{s,t}$ is the relative contribution of threat ***t*** to the extinction risk of species ***s***; ***Ns*** = total number of species at location ***i***; $C_{s,t}$ = (percentage of population decline because of threat ***t***) / (the sum of all percentages of population decline from each individual threat to species ***s***) and percentage of population decline because of threat ***t*** is a function of severity and scope.

For a given location ***i*** and threat ***t***, the STAR restoration (R) score, for the potential contribution of habitat restoration (and threat abatement therein), can be calculated among all species ***s*** as:

$$STAR_{restoration}\ (i) = \sum_{t}^{Nt} STAR_{restoration}\ (t,i)$$

and

$$STAR_{restoration}\ (t,i) = \sum_{s}^{Ns} H_{s,i}.W_s.C_{s,t}.M_{s,i}$$

where:

$H_{s,i}$ is the extent of restorable AOH for species ***s*** at location ***i*** (expressed as percentage of the global species' current AOH); $M_{s,i}$ is a multiplier to discount restoration scores, equal to 0.29 (derived from a published global meta-analysis (see Jones et al., 2018)).

To calculate $C_{s,t}$, scope and severity of each threat are combined as in Table 2 of supplementary materials of Mair et al. (2021a). Scope options are:

- Affects the whole population (>90%)
- Affects the majority of the population (50–90%)
- Affects the minority of the population (<50%)

Severity options are:

- Causing or likely to cause very rapid declines
- Causing or likely to cause rapid declines
- Causing or likely to cause relatively slow but significant declines
- Causing or likely to cause negligible declines
- No declines
- Causing or likely to cause fluctuations

The expected percentage population decline over 10 years or three generations from combinations of scope and severity scores per threat (see table below).

		SEVERITY					
		Very rapid declines	Rapid declines	Slow, significant declines	Negligible declines	No decline	Causing/ could cause fluctuations
SCOPE	Whole (>90%)	63	24	10	1	0	10
	Majority (50–90%)	52	18	9	0	0	9
	Minority (<50%)	24	7	5	0	0	5

Some of the limitations of calculating $C_{s,t}$ in this way will be presented and discussed in Chapter 4.

[a] See Brooks et al. (2019) for measurement issues.

[b] In terms of using an exponential or an 'equal steps' (100 for NT, 200 for VU, 300 for EN and 400 for CR) approach for weighting species, Mair et al. (2021a) undertook a test as part of the sensitivity analyses (included in the supplementary information to the paper). While there is no right or wrong answer, the a9uthors concluded that 'equal steps' was preferable for two main reasons: i) it allowed STAR to align with the approach to species weighting taken by the well-established Red List Index; and ii) an exponential weighting would result in the metric being entirely dominated by CR species, making it more of a CR metric than a threatened species metric (Mair, 2021).


Cyril le Tourneur d'Ison/AFD

4 Key findings

4.1 Main threats to biodiversity identified and sub-sectors selected

The results of the assessment of main threats to biodiversity (step 1 of the BIODEV2030 project) were systematically presented by the team of scientific and technical experts to stakeholders at one or more workshop(s) at national level. During the discussion, the team of scientific and technical experts had the opportunity to enhance the **credibility** of the results, while the stakeholders could react to the salience or **relevance** of the results for decision-making and express their **interests** and **concerns**, as well as anticipate the potential consequences of actions once a sector was selected.

With this process that lasted a relatively short period of time,[17] **robust results were obtained and approved by stakeholders. This is vital to maintaining the momentum and building efficient actions with a strong foundation.** At the close of this first step, some policy briefs and sectoral notes were produced and are available on the BIODEV2030 website.

The main threats identified by the teams of scientific and technical experts, along with the sectors and sub-sectors selected by the stakeholders, are:

- agricultural sector (different food and cash crops) – 16 countries;
- mining sector – 10 countries;
- fisheries sector – five countries;
- forestry sector (logging and wood harvesting) – five countries; and
- livestock sector – four countries.

Tables 5 and 6 provide a more detailed description.

In addition, in eight out of the 16 countries, stakeholders have decided to further work at landscape level instead of remaining at national and sectoral levels.

17 Less than one year in total, which includes the period of call for tenders and approval of the final report to be by IUCN or WWF-France and national stakeholders.

Table 5 Main threats identified (and ranked, where applicable) and the selected (sub-)sectors in BIODEV2030 pilot countries operated by IUCN

COUNTRY	MAIN THREATS TO BIODIVERSITY IDENTIFIED (AND RANKED, WHERE APPLICABLE)	SECTOR/SUB-SECTORS SELECTED BY STAKEHOLDERS	LANDSCAPE APPROACH
BENIN	Use of biological resources (forestry sector: timber and non-timber forest products)/agriculture (cotton-growing mainly in the north and food crops in the south) and marine and freshwater aquaculture/residential and commercial development (urbanisation sector).	Agriculture (cotton and food crops); timber and forestry	No
BURKINA FASO	1) Annual and perennial non-timber crops; 2) hunting and collecting land animals; 3) farming; 4) collecting land plants; 5) fishing, and harvesting of aquatic resources, 6) agricultural and forestry effluents; 7) mining and quarries; and 8) industrial and military effluents	Mining (gold); agriculture (cotton); livestock rearing	No
ETHIOPIA	1) Livestock farming and ranching; 2) Annual and perennial non-timber crops; 3) Logging & wood harvesting; 4) Housing and urban areas; 5) Habitat shifting and alteration	Coffee; cereals; livestock farming; logging; and wood harvesting	Bale Eco-Region and South-west forests
FIJI	Annual and perennial non-timber crops; logging and wood harvesting/ Invasive non-native species/diseases. These primary threats form components of the same overarching threat – namely the loss, reduction of quality, and fragmentation of the native forest habitats in which the majority of Fiji's endemic biodiversity is restricted.	Agriculture and coastal fisheries	Vanua Levu
GUINEA	1) Agriculture (extensive agriculture on slash and burn, and intensive agriculture/monoculture with the use of chemical inputs); 2) logging, clearing and other wood extraction; and 3) mining and quarrying.	Agriculture (rice farming, fruits and vegetables), forestry sector (logging timber and firewood and charcoal sector (carbonisation)), mining lindustrial and artisanal (gold sector and bauxite industry)	One region per sub-sector
KENYA	For terrestrial biodiversity: Annual and perennial non-timber crops, and hunting and collecting terrestrial animals. For marine biodiversity: Climate-related habitat, shifting and alteration, oil and gas drilling, fishing and harvesting aquatic resources. The economic sectors driving these threats were identified as: agriculture, forestry, energy, and fisheries. Considering the intricate links between agricultural (crop) expansion, effluents, logging and wood harvesting, the potential to reduce species decline is multiplied significantly by focusing on synergies between the agriculture and forestry sectors.	Agriculture (cereals, flowers), livestock rearing and forestry (logging and wood harvesting) sectors in dryland ecosystems	Focus on dry zones
MOZAMBIQUE	Annual and perennial non-timber crops; logging and wood harvesting; fire and fire suppression/habitat shifting and alteration; hunting and trapping terrestrial animals	Agriculture (commercial crops), extractive Industry (focus on impacts of infrastructures) and fishery sectors (small-scale and industrial)	No
SENEGAL	Agriculture (natural habitats conversion, pollution by chemical inputs, slash and burn); fisheries (overfishing); and forestry (energy and other wood uses)	Agriculture (horticulture, cereals, livestock farming), mining, fisheries	Thiès region

Note: when ranking threats was possible, they appear preceded by a number.

Source: Author based on BIODEV2030 country reports.

Table 6 Main threats identified (and ranked, where applicable) and (sub-)sectors selected in BIODEV2030 pilot countries operated by WWF-France

COUNTRY	MAIN THREATS TO BIODIVERSITY IDENTIFIED (AND RANKED, WHERE APPLICABLE)	SECTOR/SUB-SECTORS SELECTED BY STAKEHOLDERS	LANDSCAPE APPROACH
CAMEROON	1) Rural production; 2) agro-industrial plantations; 3) forestry; 4) urban development	Agriculture (crops, subsistence farming), infrastructures	No
CONGO	Expansion of shifting agriculture (small scale); agro-industry; unsustainable overexploitation of natural forests for fuelwood and urban markets; logging and timber; road and urban infrastructure	Agriculture, mining	No
GABON	1) Mining; 2) agriculture; 3) forestry; 4) hydroelectricity; 5) oil; 6) port infrastructure	Agriculture, mining	No
GUYANA	Coastal ecosystems: concentration of population on coastal areas; agricultural and fishing activities on coastal areas; oil resources exploitation in the sea (offshore oil wells) Terrestrial ecosystems (forests and savannahs): formal and illegal mining and logging; infrastructure projects; tourisme; lands conversion to mega farm	Agriculture; mining	No
MADAGASCAR	Subsistence and exportation agriculture and breeding/firewood and charcoal/wild flora and fauna species traffic/artisanal and industrial mining/ hydrocarbons/hydroelectricity production	Agriculture/fishery (corn and shrimp industries), mining (artisanal gold mining)	No
TUNISIA	1) Over-exploitation of natural resources and ecosystems: agriculture; fishing; forestry; extractive industries; 2) urbanisation and development of linear infrastructure: roads; railroads; power lines; 3) Processing sectors (agri-food/ textile) and services (tourism)	Agro-industry, extractive industries (careers)	Yes
UGANDA	Various fires (criminal and terrorist actions); abundance of quarries and development of extractive industries; hunting and collection of species; overgrazing and animal overcrowding; water erosion and sediment transport; siltation and sedimentation at dams; overexploitation of groundwater and irrational practice of intensive agriculture; salinisation of soil and deterioration of its physico-chemical properties; urbanisation; pollution; climate change	Agriculture (crops, subsistence farming), energy sector (biomass, mining, careers)	Yes
VIET NAM	Biological use (hunting and collecting wildlife, timber logging and harvesting aquatic resources)/forested land conversion (agriculture and aquaculture)	Aquaculture (shrimp and fish breeding), forestry (forest plantations and wood harvesting)	Yes

Note: when ranking threats was possible, they appear preceded by a number.

Source: Laura Poyer based on BIODEV2030 country reports.

Within domestic boundaries, specific landscapes or territories have been chosen by stakeholders for two main reasons: i) STAR maps showing high scores in the area; ii) an economic sector, known at national level as impacting biodiversity, is particularly present in the area.

In some countries, the selection of sectors by stakeholders did not correspond exactly to the threats ranking by the scientific and technical experts. This is because of various reasons on which we address in Chapter 4. For example, in the case of Burkina Faso, the main threat identified was 'hunting and collecting terrestrial animals'. However, the 'hunting' sector was not selected in subsequent discussions by stakeholders. It appeared to be consensual among them that the hunting sector was not sufficiently well-organised to be mobilised in the framework of the BIODEV2030 project. More generally, working with informal sectors has been found to be difficult by certain stakeholders' groups in some countries. Although these sectors have been identified as major contributors to the erosion of biodiversity, working with the actors involved represents a challenge due to, for example, their large number, wide spatial distribution, lack of structure in the sector, absence of governance and good representativeness, legitimacy of existing bodies, and low resources of umbrella structures when they exist.

The sectors described in Tables 5 and 6 are consistent with the major drivers of biodiversity loss and ecosystem degradation worldwide (IPBES, 2019; Dasgupta, 2021) – agriculture, cattle farming and forestry (timber and wood for energy).

4.2 Countries where methodologies converged and diverged

The team of scientific and technical experts mobilised different methods as a way to reinforce, validate, confirm the findings coming from every single and independently applied approach. In this sub-section, we analyse in which countries the literature review and mobilisation of other data sources, the use of the STAR metric and the experts' elicitation methods aligned or conflicted in identifying and ranking main threats to biodiversity.

To address those questions, each BIODEV2030 report was reviewed and compared based on the three approaches: existing data and literature, STAR calculations and maps, and specific expertise (expert qualitative judgement). The main threats identified in each of the followed approach were subsequently compiled, and when the approach allowed for ranking main threats such information was collected (see Tables 8 and 9). The results sometimes lacked clarity: the comparison of the classification of threats between the three methods was not always clearly expressed in the reports, and the link between an observed threat and an economic sector which would be responsible for it was not always well detailed.

In **Guinea**, for example, the three methodologies converged resulting in the identification of three main threats to biodiversity (in decreasing order of importance): i) agriculture, agricultural and monoculture inputs; ii) logging, clearing and other timber harvesting; and iii) mining and quarrying.

In **Burkina Faso**, the literature review was done through (i) the internet and (ii) library searches. The following keywords in both English and French, associated with 'Burkina Faso', were used for internet search:

> biodiversity, biological diversity, diversity, threat, plant, animal, constraint, fauna, mammals, birds, amphibians, reptiles, flora, plants, reservoirs, threats.

Based on these keywords, the frequency of threats cited in both internet and library searches was:

1) poaching-hunting – 30%;
2) overgrazing – 29%;
3) destruction of forest habitats (including deforestation, excessive cutting of wood, delimbing/clearing, carbonisation, firewood, straw mowing) – 29%;
4) bush fires – 25%; and
5) agricultural practices – 23%.

The literature review and use of other data sources in Burkina Faso was followed by a reclassification of threats of main threats using the IUCN-CMP 3.2 Level 2 typology of threats gave the following results (without any ranking at this stage): housing and urban areas/logging and wood harvesting/mining and quarrying/annual and perennial non-timber crops/ hunting and collecting terrestrial animals/fishing and harvesting aquatic resources/gathering terrestrial plants.

According to the STAR total scores, the main threats were (using IUCN-CMP 3.2 Level 2 typology):

1) Hunting and collecting terrestrial animals;
2) Livestock farming and ranching;
3) Annual and perennial non-timber crops;
4) Agricultural and forestry effluents; and
5) Work and other activities.[18]

18 Threat 6: "Human intrusions and disturbance", specifically Threat 6.3 "threats from human activities that alter, destroy and disturb habitats and species associated with non-consumptive uses of biological resources". (See IUCN-CMP version 3.2 of the threats classification (IUCN, 2022b) on the basis of Salafsky et al., 2008).

Finally, using IUCN-CMP 3.2 Level 1 typology, the main threats according to national experts interviewed were:

1) Agriculture and aquaculture;
2) Climate change and weather conditions;
3) Energy production and mining;
4) Residential and commercial development; and
5) Use of biological resources.

Aggregating the information gathered, the team of scientific and technical experts in Burkina Faso concluded that the main threats in the country are: i) annual and perennial non-timber crops; ii) hunting and collecting land animals; iii) farming; iv) collecting land plants; v) fishing and harvesting of aquatic resources; vi) agricultural and forestry effluents; vii) mining and quarries; and vii) industrial and military effluents. Then, during a workshop aiming at presenting and discussing the results coming from the study of the scientific and technical experts and also at selecting sectors to work on, the stakeholders selected the following sectors (and sub-sectors): mining (gold), agriculture (cotton), livestock rearing.

The same assessment and analysis were undertaken for Fiji to show the different threats identified and ranked for terrestrial and marine ecosystems following each methodology. The findings are presented in Table 7.

Likewise, the main threats in countries operated by IUCN and WWF-France are presented in Tables 8 and 9, respectively.

Table 10 provides a synthesis of the information in Tables 8 and 9 on whether the three main methodologies converged, diverged or whether the trend was unclear in each country.

Table 7 Main threats identified by each methodology in the BIODEV2030 report on Fiji

METHODOLOGY	TERRESTRIAL ECOSYSTEMS	MARINE ECOSYSTEMS
Literature review	Invasive species, agriculture and habitat loss	Overfishing and coastal habitat modification
STAR metric	Invasive species, habitat modification, logging and agriculture	n.a.
Experts' elicitation	Invasive species, agriculture (reduction of quality and fragmentation of the native forest habitat)	Biological resource use, climate change, commercial coastal development and pollution

Source: Author based on the BIODEV2030 report on Fiji.

Table 8 Main threats identified (and ranked, where applicable) per approach in four IUCN-operated countries. Details about the specific methodology are in blue.

COUNTRY	MAIN THREATS IDENTIFIED PER APPROACH			SYNTHESIS OF THE THREE APPROACHES IN THE REPORT	SECTOR/SUB-SECTORS SELECTED BY STAKEHOLDERS
	APPROACH 1 LITTERATURE REVIEW	APPROACH 2 STAR SCORES	APPROACH 3 EXPERTS' ELICITATION		
BENIN	Use of IUCN-CMP 3.2 Level 2 and subjective appreciation of the severity of threats at national level, and separated for ecosystems, animals	Use of IUCN-CMP 3.2 Level 2 threats	Frequency of experts stating that CMP 3.2 level 1 threat is "very important"	Aggregation by the team of scientific and technical experts	Agriculture (cotton, rice & soya), timber & forestry
	Annual & perennial non-timber crops/logging & wood harvesting/gathering terrestrial plants/fires and fire suppression/ mining & quarrying/livestock farming & ranching/agricultural and forestry effluents/garbage and solid waste/fishing & harvesting of aquatic resources/ housing & urban areas/Wildlife-fisherman conflicts/prioritisation of high-yielding (exotic) varieties/hunting & collecting terrestrial animals/household sewage and urban waste water/invasive non-native/alien species	1) Annual & perennial non-timber crops; 2) hunting & collecting terrestrial animals; 3) livestock farming & ranching; 4) logging & wood harvesting; 5) work & other activities	(1) Use of biological resources; 2) agriculture and aquaculture; 3) residential and commercial development; 4) natural system modifications; 5) climate change and extreme meteorological conditions; 6) pollutions; 7) energy production and mining	Use of biological resources (forestry sector: timber and non-timber forest products)/agriculture (cotton-growing mainly in the north and food crops in the south) and marine and freshwater aquaculture/ residential and commercial development (urbanisation sector).	
BURKINA FASO	Reclassification of threats in the IUCN-CMP 3.2 typology (level 2) - threats with very high severity according to the literature	Use of IUCN-CMP 3.2 Level 2 threats	Frequency of citation by experts (CMP 3.2 level 1 threats)	Aggregation by the team of scientific and technical experts	Mining (gold), agriculture (cotton), livestock rearing
	Housing & urban areas/Logging and wood harvesting/mining & quarrying/annual & perennial non-timber crops/hunting & collecting terrestrial animals/ fishing and harvesting aquatic resources/gathering terrestrial plants	1) Hunting & collecting terrestrial animals; 2) livestock farming & ranching; 3) annual & perennial non-timber crops; 4) agricultural & forestry effluents; 5) work & other activities	(1) Agriculture & aquaculture; 2) climate change & weather conditions; energy production & mining; 4) residential & commercial development; 5) use of biological resources	1) Annual & perennial non-timber crops; 2) hunting & collecting land animals; 3) farming; 4) collecting land plants; 5) fishing, & harvesting of aquatic resources; 6) agricultural & forestry effluents; 7) mining and quarries; & 8) industrial & military effluents	
ETHIOPIA	Consultants listed but not ranked threats	Use of IUCN-CMP 3.2 Level 2 threats	The question addressed to the expert assessors was to identify three top ranked threats to biodiversity of Ethiopia.	Aggregation by the team of scientific and technical experts	Coffee, cereals, livestock farming, logging and wood harvesting
	Terrestrial ecosystems and species: Residential/ urbanisation/crop cultivation/ livestock grazing/transportation corridors/poaching terrestrial animals/logging and wood harvesting/fire/invasive alien species/climate change. Freshwater ecosystems and species: settlement and cultivation/ razing/fishing and harvesting aquatic resources/ draining for agriculture use/ Invasive alien species/pollution/ climate change	1) Annual & perennial non-timber crops; 2) livestock farming & ranching; 3) housing & urban areas; 4) agricultural & forestry effluents; 5) habitat shifting & alteration	1) Annual & perennial non-timber crops; 2) livestock farming & ranching; 3) logging & wood harvesting; 4) housing & urban areas	1) Livestock farming & ranching; 2) annual & perennial non-timber crops; 3) logging & wood harvesting; 4) housing & urban areas; 5) habitat shifting & alteration	

Table 8 (continued)

COUNTRY	MAIN THREATS IDENTIFIED PER APPROACH			SYNTHESIS OF THE THREE APPROACHES IN THE REPORT	SECTOR/SUB-SECTORS SELECTED BY STAKEHOLDERS
	APPROACH 1 LITTERATURE REVIEW	APPROACH 2 STAR SCORES	APPROACH 3 EXPERTS' ELICITATION		
FIJI	Consultants listed but not ranked threats	Use of IUCN-CMP 3.2 Level 2 threats. The following ranking reflects the STAR_TA scores calculated classically for terrestrian amphibians, birds and mammals (a total of 32 species), then extended for some other terrestrian species in Fiji: reptiles (13 species), molluscs (72 species) and plants (85 species). Compared to terrestrian species, marine species are much less endemic, so their STAR scores contribute very little to the total STAR score. Note nevertheless that for marine species, two main threats are biological resource use, fishing and harvesting aquatic resources.	The taxonomic groups presented below are amphibians, birds, mammals, reptiles and plants for the natural terrestrial ecosystem; freshwater fish for the freshwater ecosystem and marine vertebrates and invertebrates for the marine ecosystem. Two hundred and fifty-two statements on Level 2 threats to the taxonomic groups mentioned above were extracted from the 24 respondents.	Aggregation by the team of scientific and technical experts	Agriculture & coastal fisheries
	TERRESTRIAL ECOSYSTEMs: The three biggest threats reported in the literature for terrestrial species and endemic species are: invasive species, agricultural practices & habitat loss, all three of which are anthropogenic pressures. MARINE ECOSYSTEMS: The main anthropogenic threats to Fiji's reefs & nearshore areas are overfishing, coastal habitat modification & removal of beach rock & coral for building and infrastructure.	1) Invasive non-alien/alien species/diseases; 2) annual & perennial non-timber crops; 3) logging & wood harvesting; 4) fire & fire suppression; 5) housing & urban areas	AMPHIBIANS, BIRDS AND MAMMALS: 1) Invasive non-native/alien species/ diseases; 2) annual & perennial non-timber crops; and 3) logging & wood harvesting. REPTILES, FRESHWATER FISHES AND PLANTS: annual & perennial non-timber crops and invasive non-native species/diseases. MARINE INVERTEBRATES AND VERTEBRATES: pollution (agricultural & forestry effluents) & biological resource use (fishing & harvesting aquatic resources).	Annual & perennial non-timber crops/logging & wood harvesting/invasive non-native species/ diseases. These primary threats form components of the same overarching threat – namely the loss, reduction of quality, and fragmentation of the native forest habitats in which the majority of Fiji's endemic biodiversity is restricted.	

Table 8 (continued)

COUNTRY	MAIN THREATS IDENTIFIED PER APPROACH			SYNTHESIS OF THE THREE APPROACHES IN THE REPORT	SECTOR/SUB-SECTORS SELECTED BY STAKEHOLDERS
	APPROACH 1 LITTERATURE REVIEW	APPROACH 2 STAR SCORES	APPROACH 3 EXPERTS' ELICITATION		
GUINEA	Consultants listed but not ranked threats	Use of IUCN-CMP 3.2 Level 2 threats	n.a.	Aggregation by the team of scientific and technical experts	Agriculture (rice farming, fruits & vegetables), forestry sector (logging timber & firewood and charcoal sector (carbonisation)), mining industrial & artisanal (gold sector & bauxite industry)
	Overexploitation of resources or unsustainability of operating systems (agriculture, livestock, salt, fisheries, wood collection)/ urbanisation infrastructure and equipment/mining and quarrying/pollution/climate change	1) Annual & perennial non-timber crops; 2) logging & wood harvesting; 3) mining & quarrying; 4) hunting & collecting terrestrial animals; 5) housing & urban areas	1) Extensive agriculture on clearing & burning, intensive agriculture/ monoculture with use of chemical inputs; 2) climate change; 3) wildlife hunting & poaching; 4) livestock, pastoral overload & transhumance; 5) wood for energy	1) Agriculture (extensive agriculture on slash and burn & intensive agriculture/monoculture with the use of chemical inputs); 2) logging, clearing & other wood extraction & (iii) mining & quarrying.	
KENYA	Many references cited in the report but no synthesis about what the literature says on main threats to biodiversity in Kenya. The report used only STAR scores and maps and then experts elicitation to identify and rank main threats.	Use of IUCN-CMP 3.2 Level 2 threats	Frequency (%) of IUCN-CMP Threat Classification System level-two threats reported by assessors using the Simplified Threat Assessment Tool (STAT)	Aggregation by the team of scientific and technical experts	Agriculture (cereals, flowers), livestock rearing and forestry (logging & wood harvesting) sectors in dryland ecosystems
	None	1) Annual & perennial non-timber crops; 2) logging & wood harvesting; 3) livestock farming & ranching; 4) habitat shifting & alteration; 5) wood & pulp plantations	1) Hunting and collecting terrestrial animals; 2) housing & urban areas; 3) annual & perennial non-timber crops; 4) roads & rail-roads; 5) logging & wood harvesting	TERRESTRIAL BIODIVERSITY: Annual & perennial non-timber crops and hunting & collecting terrestrial animals. MARINE BIODIVERSITY: Climate-related habitat shifting & alteration, oil & gas drilling, fishing & harvesting aquatic resources. The economic sectors driving these threats were identified as agriculture, forestry, energy & fisheries.	
MOZAMBIQUE	Consultants listed but not ranked threats	Use of IUCN-CMP 3.2 Level 2 threats	Frequency (%) of IUCN-CMP Threat Classification System level-two threats reported by assessors using the Simplified Threat Assessment Tool (STAT)	Aggregation by the team of scientific and technical experts	Agriculture (commercial crops), extractive Industry (focus on impacts of infrastructures) & fishery sectors (small-scale and industrial)
	Conversion, loss, degradation & fragmentation of natural ecosystems, overexploitation of species, introduction of invasive species & pollution	1) Annual & perennial non-timber crops; 2) logging & wood harvesting; 3) fire & fire suppression; 4) habitat shifting & alteration; 5) hunting & collecting terrestrial animals	1) Annual & perennial non-timber crops; 2) logging & wood harvesting; 3) mining, oil and gas; 4) fishing and harvesting; 5) fire & fire suppression	Annual & perennial non-timber crops/logging & wood harvesting/fire & fire suppression/habitat shifting & alteration/hunting & trapping terrestrial animals	

Table 8 (continued)

COUNTRY	MAIN THREATS IDENTIFIED PER APPROACH			SYNTHESIS OF THE THREE APPROACHES IN THE REPORT	SECTOR/SUB-SECTORS SELECTED BY STAKEHOLDERS
	APPROACH 1 LITTERATURE REVIEW	APPROACH 2 STAR SCORES	APPROACH 3 EXPERTS' ELICITATION		
SENEGAL	Consultants listed but not ranked threats	Use of IUCN-CMP 3.2 Level 2 threats	71 experts attributed scores to Level 1 threats for ecosystems and taxa (the ranking below is for ecosystems)	Aggregation by the team of scientific and technical experts	Agriculture (horticulture, cereals, livestock farming), mining, fisheries
	Overexploitation of biological resources (overfishing, poaching, overgrazing, mining & abusive cutting of trees)/ destruction & fragmentation of ecosystems (urbanisation, hydraulic developments in particular), mining (& mercury & cyanide pollution), coastal erosion & sea sand extraction/changes in ecological conditions (salinisation and land acidification accentuated by recent droughts, invasive species & pollution (mines, agricultural inputs & plastics)	1) Annual & perennial non-timber crops; 2) hunting & collecting terrestrial animals; 3) logging & wood harvesting; 4) livestock farming & ranching; 5) war, civil unrest & military exercises	1) Use of biological resources; 2) agriculture & aquaculture; pollution; 3) natural system modifications; 4) climate change & ecological conditions	Agriculture (natural habitats conversion, pollution by chemical inputs, slash & burn), fisheries (overfishing) & forestry sectors (energy & other wood uses)	

n.a. Not available

Source: Author based on BIODEV2030 country reports.

Table 9 Main threats identified per methodology in the eight countries operated by WWF-France (ranked where data is available). Details about the specific methodology are in **blue**.

COUNTRY	MAIN THREATS IDENTIFIED PER APPROACH			SYNTHESIS OF THE THREE APPROACHES IN THE REPORT	SECTOR/SUB-SECTORS SELECTED BY STAKEHOLDERS
	APPROACH 1 LITTERATURE REVIEW	APPROACH 2 STAR SCORES	APPROACH 3 EXPERTS' ELICITATION		
CAMEROON	In depth analysis of data and information from the literature via the five components of the DPSRI framework	IUCN-CMP 3.2 Level 2 threats not used by the consultants	Consultation of expert groups and weighting of biodiversity loss criteria in relation to socio-economic, political or strategic priorities	Perception of the consultants (based on the analysis of sectoral impacts on ecosystems and land uses)	Agriculture (crops, subsistence farming), infrastructure
	Indirect and direct drivers: rural production (small-scale subsistence farming, livestock, exploitation of forest resources by local population/logging & mining (artisanal mines, quarries & hydrocarbons)/ infrastructure/urbanisation/ agro-industries/urban development/fishing/ poaching/bush fires	n.a.	1) Rural production; 2) agro-industrial production; 3) urban development; 4) logging; 5) infrastructure construction; 6) mining	1) Rural production; 2) agro-industrial plantations; 3) forestry; 4) urban development	
CONGO	Use of a previous study realised in 2014 Congo-Brazzaville to identify and quantify drivers of deforestation. Listed but not ranked.	STAR metric was not used	No experts elicitation	n.a.	Agriculture, mining
	Expansion of shifting agriculture (small scale)/agro-industry/ unsustainable overexploitation of natural forests for fuelwood & urban markets/logging and timber/road && urban infrastructure	n.a.	n.a.	n.a.	

Table 9 (continued)

COUNTRY	MAIN THREATS IDENTIFIED PER APPROACH			SYNTHESIS OF THE THREE APPROACHES IN THE REPORT	SECTOR/SUB-SECTORS SELECTED BY STAKEHOLDERS
	APPROACH 1 LITTERATURE REVIEW	APPROACH 2 STAR SCORES	APPROACH 3 EXPERTS' ELICITATION		
GABON	Based on IUCN functional typology/Consultants listed but not ranked threats N.B.: use of ecosystem approach (focus on five ecosystems), sectoral rather than threats ranking according to the quantity of ecosystems impacted by each economic sector	Use of IUCN-CMP 3.2 Level 2 threats, calculation of STAR threat abatement scores	Sectors priorisation based on biodiversity metrics, time-framed classification	Threats and sectors identified for each ecosystems: multi-criteria weighting of biodiversity metrics; ranking according to the intensity of the impacts and their abatement potential in relation to the sectoral growth dynamics	Agriculture, mining
	DRYLAND AND SWAMP FORESTS: logging/mining. MANGROVES: urban development/agricultural practices/infrastructures & pollution from oil extraction activities. SAVANNAHS: large-scale land conversion & associated future agricultural uses. RIVERS AND WETLANDS: energy and transport infrastructure/climate change/logging. MARINE ECOSYSTEM: illegal fishing/oil & gas activities	1) Annual & perennial non-timber crops; 2) logging & wood harvesting; 3) hunting & collecting terrestrial animals; 4) industrial & military effluents; 5) roads & railroads	Current threats: oil/forestry/industrial agriculture. Future threats: industrial mining/industrial agriculture/coastal fishing/informal urban expansion activities	1) Mining; 2) agriculture; 3) forestry; 4) hydroelectricity; 5) oil; 6) port infrastructure	
GUYANA	Participatory and stakeholder centered approach Ranking criteria (impact, reversibility and willingness) but no synthesis about what littérature says on main threats to biodiversity in the Guyanas	STAR metric has not been used but use of IBAT metric instead regarding threats to species at risk with the best mitigation potentiel	Experts contributed to the measure of the intensity of impacts through bilateral meetings and workshops. However, their assessment is not clearly specified in the report but is rather incorporated in the larger participative approach in order to identify the main threats.	Conclusion of the report based on stakeholder consultations and the national socio-economic context analysis N.B.: prospective approach and economic development perspectives	Agriculture, mining
	None	1) Fishing & harvesting aquatic resources; 2) logging & wood harvesting; 3) housing & urban areas; 4) agro-industry farming; 5) mining & quarrying	None	COASTAL ECOSYSTEMS: concentration of population on coastal areas/ agricultural and fishing activities on coastal areas/ oil resources exploitation in the sea (offshore oil wells). TERRESTRIAL ECOSYSTEMS (forests and savannahs): formal and illegal mining and logging/ infrastructure projects/ tourism/lands conversion to megafarm	

Table 9 (continued)

COUNTRY	MAIN THREATS IDENTIFIED PER APPROACH			SYNTHESIS OF THE THREE APPROACHES IN THE REPORT	SECTOR/SUB-SECTORS SELECTED BY STAKEHOLDERS
	APPROACH 1 LITTERATURE REVIEW	APPROACH 2 STAR SCORES	APPROACH 3 EXPERTS' ELICITATION		
MADAGASCAR	Consultants listed but not ranked threats (ecosystem approach) N.B.: none of the publications reviewed quantified threats	Use of IUCN-CMP 3.2 Level 2 threats (TA)	Sectors are ranked based on literature and stakeholders' assessments	Aggregation by the team of scientific and technical experts	Agriculture/fishery (corn & shrimp industries), mining (artisanal gold mining)
	TERRESTRIAL ECOSYSTEMS: demographic growth/ timber harvesting/ agricultural expansion & intensification/artisanal mining/hydroelectric production/hunting & harvesting. FRESHWATER AND WETLANDS: agricultural development/ timber harvesting/ artisanal fishing/mining/ hydroelectric production/ climate change. MARINE ECOSYSTEMS: industrial & artisanal fishing/industrial agriculture (aquaculture, artisanal agriculture, forestry)/mining/tourism/ international trade/ hydrocarbon extraction.	1) Annual & perennial non-timber crops; 2) livestock breeding; 3) hunting & collecting terrestrial animals; 4) logging & wood harvesting; 5) invasive species	Classification based on the instensity of threats 1) Industrial & artisanal fishing; 2) hydroelectricity production; 3) firewood & charcoal; 4) wild flora & fauna species traffic; 5) subsistence farming & livestock; 6) mining; 7) hydrocarbon Classification based on the importance of each type of impacted ecosystem 1) Industrial and artisanal fishing; 2) mining; 3) hydrocarbon; 4) hydroelectricity production; 5) subsistence farming & livestock; 6) wild flora & fauna species traffic; 7) firewood & charcoal	Subsistence & exportation agriculture & breeding/ firewood & charcoal/ wild flora & fauna species traffic/artisanal & industrial mining/hydrocarbons/ hydroelectricity production	
TUNISIA	No synthesis about what literature says on main threats to biodiversity in Tunisia scientific approach based on the analysis of land-use evolution maps, IUCN STAR data and available literature (species and biodiversity loss, socio-economic characterisation of economic sectors)	Use of IUCN-CMP 3.2 Level 2 threats	About 20 surveys were conducted with biodiversity experts: identification of the most impacting sectors. Based on several indicators rated from 0 (no impact to low) to 5 (very high impact) Reverse typology: classification of sectors according to the identified impacts.	Aggregation by the team of scientific and technical experts	Agro-industry Extractive industries (careers)
	None	1) Work & other activities; 2) agricultural & forestry effluents; 3) annual & perennial non-timber crops; 4) other ecosystem modifications; 5) hunting & collecting terrestrial animals	HABITAT FRAGMENTATION AND CONSUMPTION OF NATURAL AREAS: 1) industry; 2) Infrastructure; 3) agriculture. POLLUTION (MARINE AND TERRESTRIAL): (1) industry, 2) Infrastructure, (3) agriculture. Climate change: 1) industry; 2) agriculture; 3) infrastructure	1) OVER-EXPLOITATION OF NATURAL RESOURCES AND ECOSYSTEMS: agriculture, fishing, forestry, extractive industries; 2) URBANISATION AND DEVELOPMENT OF LINEAR INFRASTRUCTURE: roads, railroads, power lines; 3) PROCESSING SECTORS (agri-food/textile) AND SERVICES (tourism)	

Table 9 (continued)

COUNTRY	MAIN THREATS IDENTIFIED PER APPROACH			SYNTHESIS OF THE THREE APPROACHES IN THE REPORT	SECTOR/SUB-SECTORS SELECTED BY STAKEHOLDERS
	APPROACH 1 LITTERATURE REVIEW	APPROACH 2 STAR SCORES	APPROACH 3 EXPERTS' ELICITATION		
UGANDA	Consultants listed but not ranked threats: threats are not quantified in the 30 references used state of knowledge on threats impacting the main taxonomical groups	Use of IUCN-CMP 3.2 Level 2 threats – Threats classification based on the $STAR_T$	Use of expert knowledge to validate maps and discussed threat selections (based on STAR formula) but no ranking Analysis of the level of threat, their correlations and the reality on the ground	Aggregation by the team of scientific and technical experts	Agriculture (crops, subsistence farming), energy sector (biomass, mining, careers)
	MAMMALS (REGIONAL APPROACH): increasing rural population/land use change for agriculture && charcoal/invasive species/commercial and subsistance farming/ uncontrolled cattle grazing & poaching/ human settlement. BIRDS: conversion & modification of habitat due to agricultural expansion/ use of agro-chemicals/ excessive use of fire & trapping. REPTILES AND AMPHIBIANS: wetland enroachment for agriculture & building/pollution from agrochemicals/ industrial effluent & sewage FISH: siltation from the agricultural fields & euthropication/ pollution from urban centres/introduced species/ water hyacinth/human over-exploitation	1) Annual and perennial non-timber crops; 2) logging & wood harvesting; 3) livestock farming & ranching; 4) fire & fire suppression; 5) recreational activities	Annual & non-timber perennial crops/Livestock farming and ranching/ logging and wood harvesting	Various fires (criminal & terrorist actions)/ Abundance of quarries & development of extractive industries/ Hunting & collection of species/Overgrazing & animal overcrowding/ Water erosion & sediment transport/Siltation & sedimentation at dams/ Overexploitation of groundwater & irrational practice of intensive agriculture/Salinisation of soil & deterioration of its physico-chemical properties/Urbanisation/ Pollution/Climate change	
VIET NAM	Understanding of the consultant on the type of threats from what the literature says (listed but not ranked)	Use of IUCN-CMP 3.2 Level 2 threats (several taxonomic groups were not included in the calculation of STAR scores – fish, mollusks, reptiles, insects and flowering plants)	Workshops and consultations organized with experts from the core working groups but no ranking has been described in the report	Aggregation by the team of scientific and technical experts	Aquaculture (shrimp & fish breeding) Forestry (forest plantations & wood harvesting)
	SPECIES LEVEL: ecosystem degradation/ land conversion/biological resource uses/agriculture and aquaculture/ residential & commercial development. ECOSYSTEM LEVEL: biological resource use (hunting, illegal trade of wildlife)/agriculture & aquaculture/infrastructure develoment/natural system modification	1) Annual & perennial non-timber crops; 2) Logging & wood harvesting; 3) Hunting & collecting terrestrial animals; 4) Roads & railroads;) Mining & quarrying	None	Biological use (hunting & collecting wildlife, timber logging & harvesting aquatic resources)/forested land conversion (agriculture & aquaculture)	

Source: Laura Poyer based on BIODEV2030 country reports.

4.3 Leveraging strengths, limitations and synergies

The study revealed that combining the three different methodologies – literature review, STAR metric and experts' elicitation – was a real asset for carrying out this type of assessment. This was recognised by the teams of scientific and technical experts In countries operated by IUCN and WWF-France. The following discussion shows that there is a valid rationale for such synergies, as each method has its own strengths and limitations (see also Table 11).

Synergy 1

STAR is a spatially explicit metric that utilises the IUCN Red List data. STAR scores are calculated based on the data of mammal, birds and amphibian species classified as Near Threatened (NT), Vulnerable (VU), Critically Endangered (CR) and Endangered (EN). The scores quantify the potential for threat abatement (T) and habitat restoration (R) to contribute to the global reduction of species' risk of extinction.

The STAR metric has the following properties: it is quantitative, scalable, additive and spatially explicit. Nevertheless, the STAR metric focuses on conservation of Near Threatened or Threatened species. It is absolutely justified and necessary, but it does not embrace the whole complexity of biodiversity. The generic term 'biodiversity' itself includes ecosystems and genetic diversity. Thus, from the perspective of mainstreaming biodiversity, it is worth noting that:

- Other species, such as those categorised with a Least Concerned (LC) status and all the other species that have not been assessed yet in the IUCN Red List, are not considered in the STAR approach.
- Human beings, including those who are engaged in economic activities, can simultaneously: i) impact biodiversity through different kind of pressures; ii) be dependent on biodiversity for their core activity; and iii) benefit from biodiversity through ecosystem services (or Nature's contributions to people).[19]

Table 10 Overview of countries where main methodologies converge, diverge or are unclear in identifying and ranking main threats to biodiversity

COUNTRY	CONVERGED	DIVERGED	UNCLEAR TRENDS
COUNTRIES OPERATED BY IUCN			
Burkina Faso	L, S	E	
Benin			L, S, E
Ethiopia	L, S		
Fiji	L, S, E		
Guinea	L, S, E		
Kenya*			S, E
Mozambique	S, E	L	
Senegal			L, S, E
COUNTRIES OPERATED BY WWF-FRANCE			
Cameroon**	L, E		
Congo	L, S		
Gabon	S, E		L
Guyana*	S, E		
Madagascar***	L, S	E	
Tunisia*	S, E		
Uganda	L, S, E		
Viet Nam****	L, S		

L: Literature review[a] **S**: STAR metric uses **E**: Experts' elicitation

* No literature review results appear in the BIODEV2030 report for this country.

** STAR metric was not used in the BIODEV2030 report for Cameroon.

*** In the BIODEV2030 report on Madagascar, stakeholders (and not experts)[b] were interviewed.

**** No experts' elicitation appear in the BIODEV2030 report for Viet Nam.

[a] In a broad sense, i.e. including the use of multiple databases, sources and tools such as The IUCN Red List of Threatened Species™.
[b] Please see Annex 1 – Glossary.

Source: Author and Laura Poyer based on BIODEV2030 country reports.

19 See IPBES' conceptual framework.

Table 11 Strengths and limitations of the three methodologies

STRENGTHS	LIMITATIONS
LITERATURE REVIEW	
• Focus on ecosystems, genetic diversity and species are possible. • Diversity of sources, data, approaches and questions treated.	• Multiple studies with no systematic nor integrated framework analysis; comparing studies may not always be possible. • Not necessarily spatially explicit. • Identification of threats is possible but not their ranking. • Significant drivers of biodiversity erosion at national level can sometimes not be described yet in scientific peer-reviewed articles. This can be the case for a booming economic sector, with a high speed of development, whereas scientific approach takes more time from data collection to academic publication.
STAR METRIC	
• Quantitative, scalable, additive. • Spatially explicit. • Possibility to link STAR scores with specific commodities by overlapping STAR maps and areas of production of these commodities. • Possibility to rank main threats. • Relies on robust data and expertise (the IUCN Red List) accumulated for decades. • Linked to a clear biodiversity global target: reducing the global extinction risks of species. • Adapted for the calculation of global, national and local targets and for assessing progress towards achieving those targets. • Applicable in the following contexts: post-2020 global biodiversity framework, SDGs, SEEA, NBSAPs, Bonn Challenge, financial institutions comparing investments, companies evaluating biodiversity risks in their value chains.	• STAR currently 'only' considers Near Threatened (NT) and Threatened (VU, EN, CR) species among 'only' three taxa – mammals, amphibians and birds (N = 5359 species).* • Focuses on species and not ecosystems. • Based on an assessment of threats at the global level for a given species. • Does not contain information on spatial variation in threat intensity. • Assumes a certain form of 'altruism'** because spatial variation in the conservation status of species' populations is not accounted for in the STAR metric and only the species threatened at the global level have the highest scores. • Sometimes, difficulties encountered with the interpretation of the STAR metric's results (e.g. Ethiopia and some signs of scepticism by authors of Benin's report). * See also section 2.2.2 (BIODEV2030 report for Fiji) (for non-STAR taxonomic group, especially for marine species that are so important in that country) ** 'A certain form of 'altruism': A country that is home to individuals of a globally threatened species but in where this same species is not threatened, unlike other species (which could be endangered in that country). Following STAR, more resources (human, financial, etc.) are allocated to the conservation of such a species because it is globally threatened, while the government of that country may want to focus on more threatened species within its own borders (or on which its tourism industry depends heavily, for example).
EXPERTS' ELICITATION	
• Possibility to rank main threats. • Strengthen ownership of results. • Mobilise ad hoc experts on specific questions not addressed in the literature. • Possibility to ask prospective questions to experts on, for example, future threats. • Possibility to challenge or 'ground-proof' results coming from the STAR metric (and the IUCN Red List).	• Possible bias related to the expert's specialty or to certain fields of expertise not being represented • Difficult inter-expert comparisons and aggregations. • No integrated spatial framework.

Source: Author based on BIODEV2030 country reports.

- Least Concerned or non-assessed species can be at the root of ecological functions can be at the root of ecological functions providing ecosystem services that benefit human communities and economic sectors. It is important to raise awareness of stakeholders in economic sectors about the fact that ordinary biodiversity, through their ecological functions, can bring much value to humans through the ecosystem services they benefit from.

By focusing on threatened species conservation, the STAR approach does not allow the discussion of the spatial distribution of threats (and the potential of restoration actions) to non-threatened species nor to certain key ecosystem services.

In addition, conserving species bears direct costs and stakeholders can perceive that there are no associated direct benefits. There are obviously examples that could prove otherwise, for instance when the conserved species are at the root of the tourism industry (for instance like in Kenya or South Africa). By contrast, reducing threats or pressures on ordinary biodiversity and ecological functions determining some key ecosystem services also induces costs, but can yield direct benefits for individual, societies and private companies. The literature review, the use of other data sources and the experts' elicitation process can help complementing the STAR metric that focuses on threatened and near threatened species.

Synergy 2

The review of literature allows to better set the institutional context and take stock of the existing knowledge and relevant studies at the national level. It is a necessary first step with some drawbacks.

The literature review and expert's elicitation have their own limits as they are not necessarily quantitative nor spatial, and the multitude of sources (publications and individual experts) imply that it can be difficult to integrate such methodologies into a common framework analysis.

The STAR metric not only allows to rank main threats at national scale by breaking down STAR scores by threats (see Box 9) but it also offers a robust and standardized framework to assess and identify, in an integrated manner, key areas where actions of threat abatement or habitat restoration will deliver the maximum positive contribution in terms of decreasing species global risks of extinction.

Synergy 3

The example of the BIODEV2030 report for Senegal is interesting to show that national experts can bring additional precision for a given threat category (threat related to agriculture, for example):

> Globally, the use of biological resources and agriculture constitute the greatest threats on biodiversity in Senegal (…). Activities like fishing, harvesting illegal logging, illegal hunting and the collection of bushmeat remain the main drivers of this first threat. In addition, the poverty of the populations, the weakness of local communities' commitments, devastating fishing practice, ignorance of the benefits associated with the conservation of natural resources and habitat degradation. For example, in aquatic ecosystems, poaching of certain species, such as the manatee, sea turtles and dolphins, combined with degradation of key habitats, such as mangroves and marine herbarium, have considerably affected the fauna. Agriculture has been cited by experts as the economic sector which most affects the biological diversity in the country. Clearances, particularly those linked to cash crops like peanuts and cotton destroy ecosystems. Because of these crops, natural regeneration of woody species is systematically destroyed, favouring a degradation of the woody cover of agroforestry parks. The use of chemicals (fertilisers and pesticides) in these agricultural environments contaminate groundwater and surface water, especially in valleys where certain taxonomic groups, such as fishes, are affected negatively. In this sector, agricultural varietal selection impoverishes genetic diversity weakening the survival of species and ecosystems. Slash-and-burn culture and shifting cultivation are common practices that favour the multiplication of clearings and the recurrence of fires. Harvesting and mechanization of agriculture are factors contributing to forest and savanna degradation in the country. (Translation by the author) (ISE & IUCN, 2021, p. 49)

With respect to the STAR metric used in almost each of the BIODEV2030's first step reports, the findings include the following:

Box 5 | Current developments on the STAR metric

Contributed by: Frank Hawkins (IUCN)

Use of STAR at national scale

It is indeed useful to remember that BIODEV2030 has used the estimated STAR value derived from published information in The IUCN Red List of Threatened Species™.

The shortcoming of the estimated STAR values will persist, as pointed out by the experts involved in the BIODEV2030 project (see the two unexpected features in Chapter 4.4), at least in the interpretation of the estimated STAR scores at the level of the country.

The solution for this problem is to move to a calibrated STAR value for the country according to the methodology laid out in the STAR Guidance Note (forthcoming).[a)]

Given the large areas covered by many of the pilot countries, a possible approach to calculating a calibrated STAR value for the whole country would be:

- Produce estimated STAR reports for each province of the country;
- Produce calibrated STAR values for each province in the country using the methodology in the Guidance Note.[a)] This would enable the user to eliminate threats to species that do not occur in each province, and get to a greater level of precision on the distribution of threats by province; and
- The calibrated STAR scores for each province could then be added up across threats to produce the calibrated STAR score for the country.

Use of STAR at local/project scale

STAR has been designed to be used in assessing options and measuring the impacts of actions to reduce species extinction risk. The process of deploying STAR for these purposes consists of three steps:

1. Screening of opportunities: calculation of the estimated STAR value for sites or countries, or Area of Interest (AOI), which is currently done by running a report in IBAT.[b)] This allows users to compare options for contributions for species extinction risk reduction in different sites, or across a larger site (for instance a country).

2. Establishing baselines and setting targets: calculation of the calibrated STAR value[c)] for an AOI, incorporating expert input to confirm the presence of threatened species and the threats that apply to them, the specific description of the threat that will be the objective of conservation measures and the trend of the threat that is intended to change. It is the baseline against which impacts can be measured and is used to set targets for the management.

3. Delivering management to achieve targets: calculation of the realised STAR value for an AOI, which assesses the extent to which management of the specific threats has delivered the targets set in the previous step.

An IUCN guidance material for the calculation of the calibrated and realised STAR values for an AOI has been developed[b)] and will enable users to set a baseline against which the impacts of management to reduce species extinction risk can be measured.

The key step in the calculation of the calibrated STAR score is the confirmation of the presence of threatened species and the specific character of the threats that apply to them in the AOI. The STAR portal in IBAT will contain calibrated STAR calculation routines to facilitate this process, possibly in 2023.

Once the threats present in the AOI have been confirmed, it will be followed by the definition of a proxy for confirmed threats that will be the subject of target-setting and then measurement to determine if targets are met. When management has been applied, the realised STAR will show how successful the management has been in delivering extinction risk reduction.

As far as the issue related to how a particular threat is reflected in an AOI, the proxy definition process will accomplish it, which is an appropriate way to demonstrate how management can reduce a threat. Given the continuous gradient of different land-use approaches that might be placed under, for example smallholder farming, it is a better approach compared to an endless sub-classification of threats. Smallholder farming impacts the threatened species present in the AOI through the clearance of stream-side vegetation in farmland, and consequently has an impact on the threatened amphibians living in this habitat. The proxy metric selected in this case might then be the rate of clearance of stream-side vegetation', which over time has been around 5% per annum. In this case, the management proposed to deal with this threat will target the reduction of the threat to 0.5% per annum within five years. Achievement of this target will enable the calculation of a realised STAR value following the method described in the Guidance Note.[a)]

[a)] See STAR Guidance Note (IUCN, forthcoming).

[b)] Integrated Biodiversity Assessment Tool, available here: Integrated Biodiversity Assessment Tool (IBAT).

[c)] IBAT will also host a functionality for calibrated STAR in due course.

- STAR metric can help all actors – companies, the finance industry, governments and civil society – to better plan projects that would bring benefits for threatened species, assess biodiversity risk and align contributions to achieve global targets.
- STAR can support governmental and non-state actors in quantifying their contributions to meeting science-based species targets within the post-2020 global biodiversity framework.
- STAR will progressively incorporate new taxa: marine and freshwater species, plants and reptiles. On the longer term, genetic diversity and ecosystems (through IUCN Red List of Ecosystems) could be integrated.
- STAR metric is a powerful tool for analysts, but might not be a good entry point for farmers or local politicians. Farmers may not be motivated by the possibility of having contributed to the reduction of a given number of units of STAR score. The same might be the case for a politician, as the national total STAR score of BIODEV2030 countries represent less than 1% of the global STAR score. It is therefore necessary to engage with farmers, corporations and sectors' representatives in identifying what they know and understand about the impacts on biodiversity of their current production practices and the possible alternative biodiversity-positive practices that could be adopted. At the same time, the required enabling conditions and facilitating measures must be identified such as taxes, subsidies, regulatory, information, certification and standard compliance.

Experts' elicitation can be useful in complementing STAR by providing an analysis of ecosystem services that could be preserved and sustained to maintain 'nature's benefits to people', as well as indicate areas where the identified main threats are most intense in the country.

Regarding the synergies between STAR and experts' elicitation, two additional points can be highlighted:

- The STAR metric and consequently the STAR-based analysis in the BIODEV2030 reports, reflect mammals, birds and amphibians species assessed as Near Threatened and Threatened (Vulnerable, Endangered and Critically Endangered). Species of Least Concern as well as ecosystem services and other biodiversity values are not included in the STAR analysis. In addition, threats are not coded for the majority of species of Least Concern on the IUCN Red List.
- The national experts interviews can then bring a complementary perspective, which includes: other taxonomic groups (not only mammals, birds and amphibians), species not belonging to the NT, VU, CR and EN extinction risk categories for example least concern species, analysis of evolution of ecosystem services and also dynamic assessment on past, present and future threats.

In summary, we found that the combination of methodologies to carry out the assessment allowed for a better integration of "spatial and non spatial but also quantitative and qualitative information".[20]

4.4 Advancing the use of STAR metric

The use of the 'threat factor' in the mathematical expression of STAR (T or R), referred to as $C_{s,t}$ in Mair et al. (2021a), was initially questioned by the teams of scientific and technical experts in several pilot countries. The review of their reports finds two unexpected features:

1. **$C_{s,t}$ does not depend on the location, region or country as it is set globally for a given combination of species *s*–threat *t*.**

The relative contribution of each threat to each species extinction risk does not vary spatially in STAR. This is because $C_{s,t}$ (the relative contribution of threat ***t*** to the extinction risk of species ***s***) is determined at the global level. Consequently, STAR does not quantify spatial variation in the intensity of threats. The only space-dependent factor is the $P_{s,i}$ reflecting the current AOH of species s at location i (expressed as a percentage of the global species' current AOH). In essence, only the spatial distribution of the AOH of the species gives the spatial dimension to the STAR metric.

Experts also pointed out that STAR does not allow for the consideration of the relative intensity of

20 There is one remaining question that remains to be addressed: how might convergence or divergence of the three methods differ if the robustness of the evidence base were compared? Although robustness of each single method has not been assessed explicitly, the team of scientific and technical experts may have implicitly considered it when they synthesised all the information and proposed the identification and ranking of main threats.

threats in their country or in one region (compared to other regions/countries). Determining $C_{s,t}$ at global scale for a species **s** is considered as a limitation, although work is on-going to overcome it (see Box 5). However, it can be argued that STAR scores broken down per threats are an excellent starting point for the ranking exercise (Box 9).

2. **The ranking of threats did not necessarily correspond to the perception or knowledge of experts for a given threat in their country (for all species or a subset of species).** This could originate from the fact that the specific national intensity of a given Level 3 threat is not reflected in the STAR scores.

The threats classification (IUCN-CMP version 3.2 (IUCN (2022b) first published by Salafsky et al. (2008)) allows to distinguish different types of production system in its Level 3 systems. For example, the IUCN-CMP 3.2 Level 2 threat, *Annual and perennial non-timber crops*, is broken down in the next Level 3 as follows:

- Shifting agriculture;
- Small-holder farming;
- Agro-industry farming; and
- Scale Unknown/Unrecorded.

As such, Level 3 does not allow distinguishing between different intensities of a given threat at local level. It does not make it possible to describe the specific way in which Level 3 threats are impacting species and the severity of the impacts. Furthermore, within the same Level 3 threat, for example 'small-holder farming', there could be many sub-types of farming system depending on the quantities of chemicals per hectare that are used. This means that there is a need to gather data describing the impact mechanism and quantifying the severity. Such data could be gathered during the calibrated STAR phase (see Box 5).

Possible ways to advance the use of the STAR metric

Two possible ways of advancing the use of the STAR metric have been identified:

- by gathering information on how threats vary spatially, and
- by gathering information on the severity of threats and determining how threat severity should be quantified (to be able to distinguish, for example, between different agricultural systems using different levels of chemical inputs).

In both ways, the results can be delivered through the calculation of calibrated STAR, which uses expert information and local data to determine the spatial distribution of threats and the severity of those threats (Box 5).

Data on the spatial variation in threats might help to reinforce the STAR metric buy-in by national experts, as calibrated STAR combines national/local experts' knowledge of threats and all the positive aspects of the STAR metric (spatially explicit, scalable, quantitative, transparent).

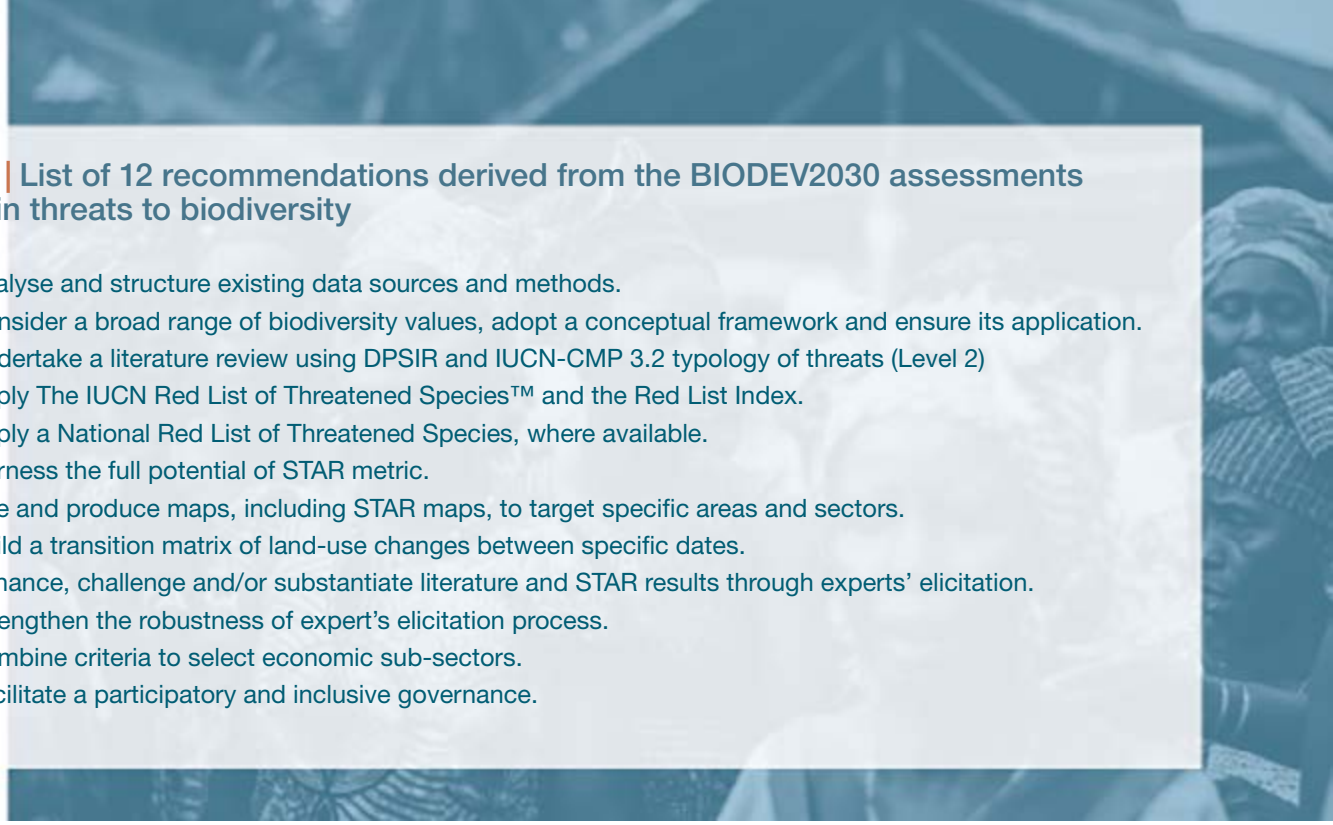
5 Recommendations derived from the BIODEV2030 assessments

Issembe Sonier/AFD

This chapter aims to take stock of the know-how acquired from the BIODEV2030 project on how to efficiently identify and rank the main threats to biodiversity, and help design relevant mainstreaming actions. The 12 recommendations derived from the BIODEV2030 assessments are presented in Box 6. They are expected to benefit other countries, as well as the development community, donors, academe and private sector organisations, who might wish to follow a similar approach.

The recommendations are illustrated with good methodological practices observed in the 16 pilot countries. For example, it is key to have a clear vision of every step of the assessment of the main threats to biodiversity and how to combine the different methodologies, tools and data sources. As biodiversity, ecosystem and their services, and pressures from human activities are spatially distributed, using existing or producing maps is an efficient way to illustrate results and prepare a well-informed discussion with stakeholders. Building a transition matrix at national scale showing land uses and land use changes over time is also helpful to seize the dynamics of landscapes' evolution. Some of the efficient observed ways to progress in BIODEV2030 countries was to use existing data to the largest extent possible in The IUCN Red List of Threatened Species™ and the National Red List, where available, as well as using the STAR metric in three different ways and exploring innovating techniques to complement and adapt it to the national context.

When complemented with national experts' elicitation, the depth and credibility of the analysis were reinforced. Furthermore, there are two good practices linked to inclusiveness that can be emphasised: i) taking into consideration a broad range of values associated with nature, such as use and non-use values (existence or bequest values); and ii) involving a representative set of stakeholders in the discussion of the main results of the assessment.



Box 6 | List of 12 recommendations derived from the BIODEV2030 assessments of main threats to biodiversity

1. Analyse and structure existing data sources and methods.
2. Consider a broad range of biodiversity values, adopt a conceptual framework and ensure its application.
3. Undertake a literature review using DPSIR and IUCN-CMP 3.2 typology of threats (Level 2)
4. Apply The IUCN Red List of Threatened Species™ and the Red List Index.
5. Apply a National Red List of Threatened Species, where available.
6. Harness the full potential of STAR metric.
7. Use and produce maps, including STAR maps, to target specific areas and sectors.
8. Build a transition matrix of land-use changes between specific dates.
9. Enhance, challenge and/or substantiate literature and STAR results through experts' elicitation.
10. Strengthen the robustness of expert's elicitation process.
11. Combine criteria to select economic sub-sectors.
12. Facilitate a participatory and inclusive governance.

5.1 Analyse and structure existing data sources and methods

At the outset, it is key to gather all the relevant literature and data sources (academic and scientific literature, as well as technical reports from national or international institutions, and government plans and strategies) addressing biodiversity (species and ecosystems and their services) concerns, such as extent, condition, status, population trend, threats, values, etc. More importantly, a clear vision and understanding of the different steps of the assessment and methodologies to be combined is essential. It is worth clarifying which ecosystems, taxa or even species to consider, specific approaches (typically literature review, use of the STAR metric and experts' interviews) and data to mobilise, as well as the conceptual framework to use and concepts to define, in particular values associated with biodiversity.

A clear vision of each stage, as well as distinct strengths, limitations and synergies of the different methodologies, will help organise and allocate resources. The identification and ranking of the main threats and their links to economic sectors can thus be done more efficiently and quickly, yielding more robust and plausible results.

5.2 Consider a broad range of biodiversity values, adopt a conceptual framework and ensure its application

As demonstrated by IPBES (2022) in its *Summary for Policy-Makers* of the assessment of the diverse values and valuation of nature,

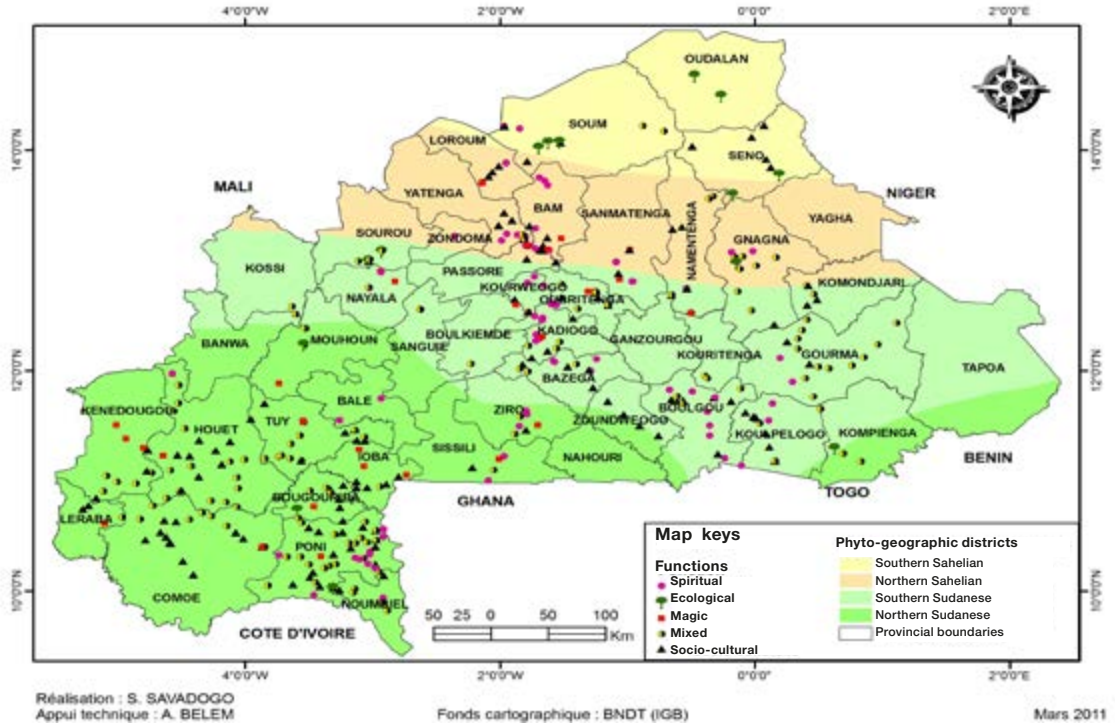
> "(t)he causes of the global biodiversity crisis and the opportunities to address them are tightly linked to the ways nature is valued in political and economic decisions at all levels" and "(d)espite the diversity of nature's values, most policymaking approaches have prioritized a narrow set of values at the expense of both nature and society, as well as future generations, and have often ignored values associated to indigenous peoples and local communities' worldviews" so "(t)he diversity of nature's values in policymaking can be advanced by considering a typology of nature's values that encompasses the richness of people's relationships with nature." (p. 4)

In this light, a conceptual framework must be adopted to allow for the consideration of a broad and inclusive range of biodiversity values (see, for example, the conceptual frameworks of IPBES,[21] the UK National Ecosystem Assessment,[22] or the

21 https://ipbes.net/conceptual-framework

22 http://uknea.unep-wcmc.org/LinkClick.aspx?fileticket=KSXkgw7AKSY%3D&tabid=82

Figure 3 **Burkina Faso – Spatial distribution of sacred groves and their associated functions**
Source: BIODEV2030 report on Burkina Faso (2021, Figure 11, p. 35).



French Efese [23] programme).[24] Along with biodiversity values, there are justified reasons or rationales to conserve Nature and everything that matters for people at national and global levels (IPBES, 2022), among them: the intrinsic value of nature (non-anthropocentric values); all kinds of Nature's benefits to people (anthropocentric values), such as biophysical (biosphere's ability to enable human endeavour (energy, materials, land)), instrumental (nature's ability to supply benefits) and relational (nature's gifts, goods and services (actual services enjoyed, including regulating, provisioning and cultural services)); and those values linked with the good quality of life (health, education, knowledge, identity, autonomy, diversity and options, living well in harmony with nature and Mother Earth).

To illustrate an interesting, although not a unique case, the **Benin BIODEV2030 report** highlighted the social importance of sacred forests. As described in section 2.1.2 on Forests and Savanah ecosystems:

> A multitude of sacred forests of varying size depending on the degree of traditional conservation is present in the landscape. According to Benin's fifth report on biodiversity […], there are around 3,000 relics of sacred forests with a total area of around 18,360 hectares (0.16% of the territory) mainly concentrated in the South of the country and which are great reservoirs of biodiversity and endangered species of flora and fauna. They are home to several threatened plant species such as: *Afzelia africana, Albizia ferruginea, Dennetia tripelata, Gardenia imperialis, Khaya grandifoliola, Khaya senegalensis, Milicia excelsa, Mimusops andongensis, Monodora myristica, Zanthoxylum zanthoxyloides*. According to surveys carried out by Sokpon & Agbo (2010), these forests play various functions, including ecological (8.1% of respondents), religious (61.14%) and socio-cultural (29.45%) functions. The Project for the Integration of Sacred Forests into the Network of Protected Areas of Benin (PIFSAP) recognized the importance of integrating them into the system of protected areas in Benin. (Translated by the author) (IUCN, 2022a, pp. 18–19)

23 Evaluation française des écosystèmes et des services écosystémiques (Efese): https://www.ecologie.gouv.fr/sites/default/files/Thema%20-%20%20-%20Le%20cadre%20conceptuel.pdf

24 In practice, applying those conceptual frameworks require remaining open(-minded), as a first step or as an attitude, to be adopted by the team of scientific and technical experts, regarding how local stakeholders answer simple questions, such as: "Why do you care about nature? What specific aspects of nature are of interests for you, your family, your village, your economic activity? Why does it count?".

In section 2.3.1 on Protected Areas of the report, other features are underlined about Sacred Forests:

> … sacred forests are considered private protected areas which play a significant role in the conservation of biodiversity. They are relatively small in size and are found all over the country. The inventory of these forests currently shows 3,000 sacred forests, of which 70% have an area of less than one hectare, 18% cover an area between one ha and 5 ha and 12% are larger than 5 ha. However, some vast sacred forests exist such as for example those of Igbo Doleo (1,600 ha), Adjougni (1,200 ha), Ekpasso (800 ha), Igbo Lakou (600 ha), Felia (600 ha) in the Department of Zou and Adakplame (450 ha) and Gnanhouizoun (300 ha) in the Department of Ouémé (…). (Translated by the author) (IUCN, 2022a, p. 46)

The **BIODEV2030 report on Burkina Faso** points out that sacred groves and water points have been highlighted and mapped (Figure 3):

- "Sacred groves are protected areas managed according to traditional or customary rules by local communities. Under this name are also counted the groves sacred, sacred forests, wooded shrines as well as sacred hills. Prospecting carried out across the country has identified 1,206 sacred groves (…).
- Sacred water points include sacred ponds, wells and rivers. They cover areas 1.52 ha on average, i.e. around 150 ha for the ninety-nine (99) sites identified." (Translated by the author) (BIODEV2030 report on Burkina Faso, 2021, p. 35)

The associated functions of the sacred groves are: cultural, magic, ecological or mixed.

What is specifically at the root of the sacredness of a forest or a water point enables the understanding of the significance of 'value' for humans. For example, it can be useful to establish a link between ecological functions and the root of sacredness. This might appear irrelevant to the subject of a report whose focus is to identify and rank threats to biodiversity – but it is not. Indeed, it facilitates a better understanding of 'value', whether it be utilitarian values (ecosystem services providing humans a benefit) or non-utilitarian such as heritage value. To properly design conservation actions, it is therefore essential to consider a broad range of values associated with biodiversity, it is recommended to use a conceptual framework[25] as a basis.

Finally, a given stakeholder can have many types of relationships with nature and can value nature in many different ways and aspects. For example, nature can matter to a private company because of the ecosystem goods that it harvests and markets (such as a sawmill). At the same time, the same company's operations can be dependent on regulating services provided by the good functioning of ecosystems (for example certain natural habitats regulating pests that would otherwise affect the wood quality). Another example: an individual can be an employee of a sawmill, so in favour of high production and mono-specific forest plantation. At the same time, this same individual prefers trees diversity for recreational purposes and feels that natural forests should be protected and kept unexploited so that future generations (his/her own grandchildren) can enjoy the beauty of such places.

In other words, there is no unique relationship between one stakeholder and one type of nature's value. It is a useful exercise to draw a list of the different ways and reasons why each type of stakeholders value nature.

25 For example, the IPBES conceptual framework, the UK National Ecosystem Assessments (NEA), or the French .

5.3 Undertake a literature review using DPSIR and IUCN-CMP 3.2 (Level 2)

While reviewing the literature to assess the state of nature in a given country, for example, the status and population trends of species, the increasing or decreasing trends of ecosystem services provided, or the importance of non-use values associated with some features of biodiversity, it is recommended that all data gathered be organised using the **Driving Pressures-State-Impacts-Responses** (DPSIR) framework and apply it to biodiversity loss (Maxim et al., 2009; Spangenberg et al., 2009).

In this study, threats and pressures are almost synonymous (see Annex I – Glossary) in the assessment of the main threats to biodiversity. The expression 'threat' refers to the international classification of that threat, whereas 'pressure' relates to IPBES reports and tries to establish a bridge between economic sectors and their specific productive practices that give rise to biodiversity loss.

According to the DPSIR framework, 'drivers' can be both direct and indirect, although as a first step in the identification and ranking of main threats to biodiversity,[26] it is rather recommended to instead focus on direct drivers. However, it is useful to bear in mind that indirect drivers (Box 7) may also shape direct drivers.

A common confusion observed when using the DPSIR framework in the BIODEV2030 reports is that the 'impact' box is understood as impacts on nature, whereas it should rather describe impacts that the deteriorating state of nature have on human welfare and well-being.

To conclude our recommendation on the review of literature, two closing suggestions can be highlighted:

– As shown in Chapter 3, the study finds that the proportion of references cited in BIODEV2030 reports linking economic sectors was quite low, on average 32%, for all countries operated by both IUCN and WWF-France. This could be due to the gap between existing literature (academic, grey, technical and institutional reports) and local knowledge. Establishing an explicit link (based on the title, for example) at the outset between harmful production practices in economic sectors pressures on biodiversity would be useful in future similar assessments in other countries. Thus, increasing the proportion of such literature and decreasing those of 'pure' ecological references would help accelerate and strengthen the correlation between sectors and threats and the Red List Index.

– At the end the literature review, reclassify the main identified and described threats using the IUCN-CMP 3.2 typology of threats (Level 2) to facilitate the comparison of results with the IUCN Red List and the STAR metric results.

5.4 Use The IUCN Red List of Threatened Species™ and Red List Index

Clarify what are the threatened species with relevant indicators (range, population trends, endemism, etc.) using the IUCN Red List (see Box 3).

It is recommended to distinguish between global and national trends when assessing a species' status. This can be an essential distinction and help identify and highlight examples of conservation successes (species recovering and acquiring the Least Concern status) and better conservation and/or production practices. Be clear at all times when describing status and population trend of a species: is it about species present in a country whose status at the global level is threatened, or rather whose status at the national level is threatened? Where available, it is also recommended to use a National Red List of Threatened Species, as a complement to The IUCN Red List of Threatened Species™. Their synergy lies in the fact that the IUCN Red List indicates the extinction risk of species at the global level, whereas the National Red List provide information on the national scarcity of a given species. This can help guide decisions about how much resources should be allocated at the national level to conserve species that have different extinction risk at global and national levels (see Recommendation 5.5).

26 In further steps dedicated to designing commitments and actions, it will be useful, if not necessary, to understand deeper roots of those direct drivers: agronomical reasons, fiscal incentives, cultural habits, regulatory induced behaviours, etc.

Box 7 | Indirect drivers of biodiversity and social norms matter

Neglecting or minimising the underlying causes – indirect drivers and social norms – of threats and direct drivers of biodiversity loss can lead to inefficient design and implementation of actions to mitigate them.

Some threats are determined by sectors and activities which in turn are determined by institutional rules (trade policies), demographic trends, cultural and societal preferences, etc. Ideally, one should address simultaneously direct and indirect drivers of biodiversity loss.

As formal institutions are not always able to enforce collectively desirable outcomes,[a] Nyborg et al. (2016) argue that informal institutions, such as social norms,[b] can be important. Some examples include changing diets, buying an electric car, banning smoking in public places, etc. According to the authors, policies should focus more on shaping social norms so that human individual behaviour is more aligned with global biodiversity and climate goals. To do so, there is a need to identify or create tipping points, i.e. moments when a vicious circle equilibrium can be transformed into a virtuous circle. Social sanctioning (by norm followers on norm violators), can help create such a tipping point, even more easily when behaviours are observable by others (neighbours, for example). But Nyborg et al. argue that "firms' and individuals' greenhouse gas emissions originate from a plethora of actions; many of which are barely observable and yield considerable material benefits. In such cases, there may be no tipping points. In some cases, policy can make tipping points arise even where none were initially present" (p. 42).

Policies can seek to enhance inter-relatedness of choices made by individuals and firms by increasing their visibility to reinforce virtuous social feedbacks. And if social feedback is dominated by other incentives, policies can focus on more traditional instruments, such as taxes, subsidies, regulations, etc.

As behaviour is determined by beliefs, and beliefs by expectations, another "potentially powerful role of policy is to provide reasons for people to change their expectations. This is different from attempting to persuade people to change normative values." (p. 43).

So, "Judging whether patterns of socially or environmentally detrimental behaviours may be broken by changed social norms is not easy. When looking for tipping points, the following questions are useful: Is the behaviour observable? Does it involve coordination benefits? Are tastes likely to be shaped by behaviours (e.g., preferring foods one is used to)? Is the alternative behaviour low cost? If the answers are negative, policies may be used to change some of them. If answers are positive, the next step is to look for ways to break self-fulfilling expectations, by providing reasons for people to believe that others will take up less damaging behaviours." (p. 43).

While indirect drivers of biodiversity loss are important to consider, their significance can be addressed in detail at a second stage when analysing the reasons, for example, the social norms or actors' expectations that shape harmful production practices and how to influence them with targeted public policies.

[a] This would, for example, be critical in terrestrial animal harvesting.
[b] Defined as "predominant behavioural pattern within a group, supported by a shared understanding of acceptable actions and sustained through social interactions within that group" (Nyborg et al., 2016, p. 42).

Table 12 Ethiopia – Status of bird species with different population trend based on IUCN Red List

POPULATION TREND	ETHIOPIA – IUCN RED LIST THREAT STATUS CATEGORY						
	CR	EN	VU	NT	LC	DD	Total
(a) All species							
Decreasing	7	10	14	21	162		214
Increasing					79		79
Stable		2	2	3	463	1	471
Unknown			1		54	2	57
Total	**7**	**12**	**17**	**24**	**758**	**3**	**821**
(b) Endemic species							
Decreasing		2	5	3	2		12
Stable					3		3
Unknown			1		1		2
Total		**2**	**6**	**3**	**6**		**17**

CR = Critically Endangered; **EN** = Endangered; **VU** = Vulnerable; **NT** = Near Threatened; **LC** = Least Concern; **DD** = Data Deficient

Source: BIODEV 2030 report on Ethiopia (2022, Table 6, p. 48).

The IUCN Red List was used in all the BIODEV2030 reports, which helped to better identify the status of species extinction risks. In the BIODEV2030 report for Ethiopia, for example, this kind of table was produced for mammals, reptiles, birds and amphibians (Table 12).

An example of the different type of information on a given set of species' population existing at global and national levels is presented, in the case of Primate species in Kenya, in Table 13.

Nevertheless, observing the proportion of threatened species (among all the assessed species) in a country over time may not be robust enough to understand whether the situation is getting better, or worse, for a country's species. This is because new species are being assessed and updates to existing assessments are made on a regular basis.

To understand whether the situation is getting better or worse for certain species at national level, as indicated in the IUCN Red List Index website:

> … the Red List Index (RLI) has been developed, which shows trends in the status of groups of species based only on genuine improvements or deteriorations in status of sufficient magnitude to qualify species for listing in more threatened or less threatened Red List Categories. […] Currently, (at global level) the RLI is available for five taxonomic groups only (those in which all species have been assessed at least twice): birds, mammals, amphibians, cycads and warm-water reef-forming corals. […] (IUCN, 2022a [website])

The RLI can be calculated for a specific taxonomic group and at global scale, but it can also

> … be disaggregated to produce national and regional Red List Indices by weighting by the fraction of each species' distribution occurring within a particular country or region, building on the methodology published by Rodrigues et al. (2014). These show how well species (in the groups covered) are conserved in the country or region relative to its potential contribution to global conservation of these species groups (IUCN, 2022a).

The RLI can provide an aggregate information on current trends of extinction risks for specific taxonomic groups.

5.5 Use a National Red List of Threatened Species, where available

The BIODEV2030 report on Benin states the importance of considering that many species not threatened at the global scale can be threatened at the country scale, and therefore deserve special attention for their sustainable conservation. **Thus, it is key to clearly distinguish species population trends at global and national levels using the IUCN Red List and a National Red List, where available.** An example of data scarcity at the national level for reptiles is revealed in the report:

> … reliable estimation of a level of reptile population trend in Benin remains problematic because relevant reptile biological data over several years is scarce. Information is often collected over short field seasons, at different spatial scales and in different ecosystems, yielding point estimates of population parameters and species abundances that vary widely between studies. (Translated by the author) (BIODEV2030 report on Benin, 2021, p. 34)

Table 13 Kenya – Full list of Primate species, conservation status and population trends

	SPECIES	IUCN RED LIST STATUS	GLOBAL POPULATION TREND	LOCAL POPULATION SIZE
1	Angola Colobus (*Colobus angolensis*)	LC	Unknown	Unknown
2	Guereza Colobus (*Colobus guereza*)	LC	Decreasing	Unknown
3	Mt. Kilimanjaro Guereza Colobus (*Colobus caudatus*)	EN	Decreasing	200–300
4	Tana River Red Colobus (*Piliocolobus rufomitratus*)	EN	Decreasing	1 100–1 300
5	Tana River Mangabey (*Cercocebus galeritus*)*	CR	Decreasing	1 000–1 200
6	Yellow Baboon (*Papio cynocephalus*)	LC	Stable	Unknown
7	Olive Baboon (*Papio anubis*)	LC	Increasing	Unknown
8	Patas Monkey (*Erythrocebus patas*)	LC	Decreasing	Unknown
9	Tantalus Monkey (*Chlorocebus tantalus*)	LC	Stable	Unknown
10	Vervet Monkey (*Chlorocebus pygerythrus*)	LC	Decreasing	Unknown
11	De Barazza's Monkey (*Cercopithecus neglectus*)	LC	Unknown	Unknown
12	Gentle/Sykes Monkey (*Cercopithecus mitis*)	LC	Decreasing	Unknown
13	Red-tailed Monkey (*Cercopithecus ascanius*)	LC	Decreasing	Unknown
14	Potto (*Perodicticus potto*)	LC	Stable	Unknown
15	Large-eared Greater Galago (*Otolemur crassicaudatus*)	LC	Stable	Unknown
16	Small-eared Greater Galago (*Otolemur garnettii*)	LC	Decreasing	Unknown
17	Northern Lesser Galago (*Galago senegalensis*)	LC	Decreasing	Unknown
18	Somali Lesser Galago (*Galago gallarum*)	LC	Stable	Unknown
19	Kenya Coast Dwarf Galago (*Paragalago cocos*)	LC	Decreasing	Unknown

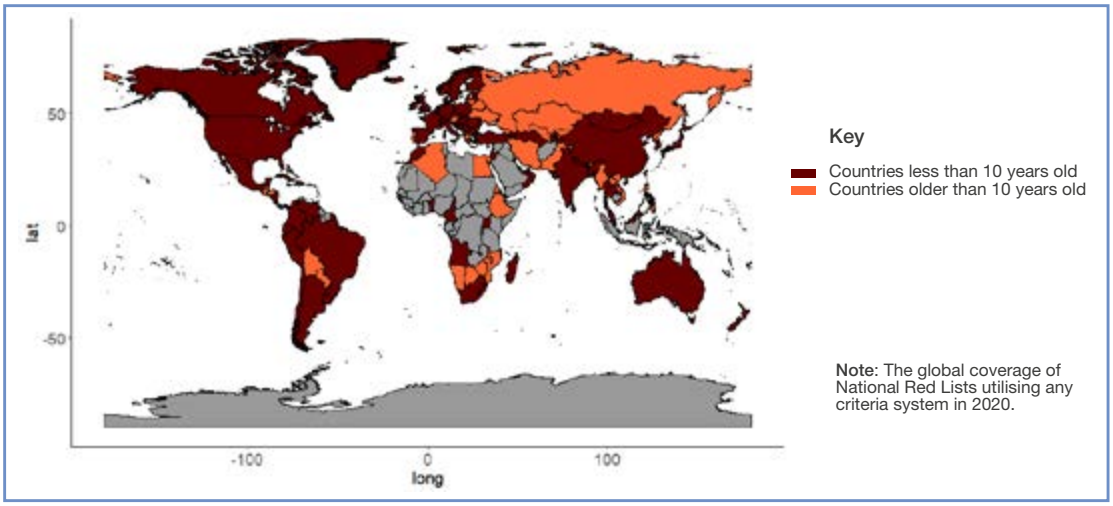
Source: BIODEV2030 report on Kenya (2020).

Table 14 Knowledge gaps in species' population trends: distinguishing four possible configurations

POPULATION TREND		GLOBAL SCALE	
		Trend is known	Trend is unknown
NATIONAL SCALE	Trend is known	Configuration 1	Configuration 2
	Trend is unknown	Configuration 3	Configuration 4

Source: Author.

Figure 4 **Map showing countries with a National Red List** Source: ZSL and IUCN National Red List Working Group, National Red List Database (2020))



Going a step further, Table 14 shows that four configurations exist depending on whether we know or not, for a given species in a country, the trend of its population.

It might be useful to estimate how many species are in each of the four configurations. This will allow to better advocate for the allocation of resources to conservation actions at the national level.

When trends are unknown, both at global and national scales represented in Configuration 4, it can be harder to justify the allocation of resources for conservation actions. When trends are known (Configuration 1), it may be easier to advocate for such actions and the information on respective trends will help design conservation actions at the national scale as well as improve the species' global status.

In the case of Configuration 1, there are four sub-configurations crossing two possible population trend options (decreasing, increasing) at each level (national, global):

- if both global and national trends are known to be negative, i.e. decreasing, the global and national societies' interests are aligned and conservation actions conducted at national level will benefit both the global and the national societies;
- if global trend is decreasing while national trend is increasing, allocating additional national resources to further the conservation of the species at national level may require transfers from global to national level;
- conversely, if global trend is increasing, whereas national trend is decreasing, a national society could feel directly incentivised for its own benefit to pursue species conservation;
- lastly, if national and global trends are known to be positive, i.e. increasing, resources may be better allocated to other threatened species with decreasing population trends.

In the case of Configuration 3, despite an unknown national population trend, it might be relevant to boost species conservation at national level, especially if the global trend is decreasing.

In the case of Configuration 2, since global trend is unknown while national trend is known, the society may decide to allocate resources to conservation actions for those species within national parameters, i.e. whether the trend is increasing or not, and, if decreasing, doing a cost-benefit analysis associated with a range of possible conservation actions.

Benin and Madagascar are among the few African countries having a National Red List (Figure 4 above). In 2011, Benin produced a National Red List of Threatened Species and it has been used in the BIODEV2030 report for Benin, in parallel with the IUCN Red List.

The main reason was that some national experts expressed concerns about the STAR results and IUCN Red List status categories for some species. The threat severity assessment is done globally in the IUCN Red List, and STAR fully relies on the data from

the IUCN Red List. It means that, for a given species, the heterogeneity of a given threat across countries is not captured in the IUCN extinction risk status assessment and thus in the STAR metric. Simply put, a national assessment of the impacts (scope and severity) of threats on species present in the country may have higher chances to be acknowledged and understood by national stakeholders.

It also helps to prioritise conservation efforts and resources allocation at national and sub-national scales. As reflected in Table 15, the Benin BIODEV2030 report:

> ... compares the number of mammal species belonging to each category of conservation status according to the IUCN Red List and that of Benin. A total of 58 species are classified in the category of near threatened (NT) and threatened species (VU, EN, CR) on the Benin Red List […] against only 22 species according to the IUCN Red List […]. One ungulate species (Bongo, *Tragelaphus eurycerus*) is estimated to be extirpated from ecosystems in Benin and as such has received extinction (EX) status in the Benin Red List […], while it is almost threatened on the IUCN Red List. As a result, many species considered not threatened at the global scale may be at the country level and therefore deserve special attention for their sustainable conservation. (Translated by the author) (BIODEV2030 report on Benin, pp. 29–30.)

Table 15 Number of Mammals species and their conservation status, based on IUCN Red List and Benin National Red List

CONSERVATION STATUS	NATIONAL BENIN RED LIST	IUCN GLOBAL RED LIST
DD	85	5
LC	14	130
NT	13	9
VU	30	8
EN	12	4
CR	3	1

CR = Critically Endangered; **EN** = Endangered; **VU** = Vulnerable; **NT** = Near Threatened; **LC** = Least Concern; **DD** = Data Deficient

Source: BIODEV2030 report on Benin (2021, p. 34).

Table 16 STAR (threats abatement and restoration) scores in each BIODEV2030 country

STAR SCORES USED IN THE BIODEV2030 COUNTRIES'REPORTS			
COUNTRY	STAR THREAT ABATEMENT	STAR RESTORATION	PROPORTION OF STAR RESTORATION WITH RESPECT TO STAR THREAT ABATEMENT (%)
Burkina Faso	83	168	203
Benin	101	22	22
Cameroon	not used	not used	not used
Congo	128 610	4 050	3
Ethiopia	12 393	194 151	1 567
Fiji	4 011	1 388	35
Gabon	176 494	2 155	1
Guinea	332	75	23
Guyana	not used	not used	not used
Kenya	9 436	7 354	78
Madagascar	74 179	6 111	8
Mozambique	2 730	423	15
Senegal	211	26	12
Tunisia	87 395	35 435	41
Uganda	1 874	821	44
Viet Nam	14 192	1 936	14

Source: Author, based on contributions from Philippe Puydarrieux and IBAT.

At national level, it can also be significant to establish the fact that a species has completely disappeared and all the more if it is an emblematic species. In that respect, experts' elicitation can also be completed by informal sources expressing a 'traditional knowledge'. Guinea's BIODEV2030 report, for example, has been noted that on the basis of oral sources, "… we do not exclude the existence, in the near past, on Guinean territory of giraffes (*Girafa cameloperdalis*), rhinoceros (*Diceros hicornis*), even zebras, even though we are certain that they are not here anymore on Guinean territory today". (Translated by the author) (BIODEV2030 report on Guinea, 2021, pp. 49.)

Box 8 | Using STAR metric: the case of Ethiopia

STAR data and results for Ethiopia were surprising because of six species with STAR restoration ($STAR_R$) scores higher than 3,000, which are three mammals, two amphibians and one bird, all species that had very large ranges but are now very restricted and highly threatened:

- ***Arvicanthis blicki*** ($STAR_R$ score = more than 95,000)
- ***Ptychadena nana*** ($STAR_R$ score = more than 46,000)
- ***Crocidura Llucina*** ($STAR_R$ score = more than 31,000)
- ***Tachyoryctes macrocephalus*** ($STAR_R$ score = more than 6,000)
- ***Leptopelis yaldeni*** ($STAR_R$ score = more than 5,000)
- ***Crithagra ankoberensis*** ($STAR_R$ score = more than 3,000)

We did a very simple sensitivity analysis to compare the total STAR scores for Ethiopia 'with' versus 'without' the six species with $STAR_R$ scores higher than 3,000.

Without those six species, we found for Ethiopia:

- Total $STAR_T$ score = 10,599 (instead of 11,804)
- Total $STAR_R$ score = 4,397 (instead of 193,832)

Without those six species, the country's STAR profile was much less surprising.

Source: Mair et al. (2021b).

Box 9 | STAR scores per threat at national level

STAR scores per threat at national level can be calculated, are meaningful and allow the ranking of threats, but some limitations should be kept in mind. Although the $C_{s,t}$ factor is assessed at the global level for a given combination species-threat, it is not apparent whether calculating a STAR score for each threat by breaking down, at national level, the STAR threat abatement and the STAR restoration scores makes sense. Actually, this is a limitation of STAR, i.e. that scores are calculated based on global data, and therefore when breaking down to the national or site level, it is necessary to bear this in mind and carry out ground-truthing (i.e. calculation of calibrated STAR).

Nevertheless, even with this limitation in mind, it is still reasonable to use estimated STAR scores per threat at national level as a starting point. This is because the STAR calculation uses area of habitat (AOH) data to ensure that for any particular site/country, the weight of each individual species depends on the proportion of AOH in a country.

For endemic species, their entire STAR score is captured within a country, in which case the documented threats for that species undoubtedly occur within that country. However, in the case of non-endemic species, then the greater the proportion of the species AOH within a country, the greater the likelihood that the documented threats for that species also occur within that country (based solely on probability, assuming an equal probability of a threat occurring in any part of the species distribution). Thus, for any particular species-threat combination, the country with, for example 90% of the species AOH, will also have 90% of the score for that threat-species combination. Inversely (i.e. the country with 10% of AOH will have only 10% of the score for the threat-species combination), it means that there is less weight placed on the threats where the associated species have little AOH within the country.

A further limitation is that assessment of the scope and severity of threats to species (i.e. the components used to calculate $C_{s,t}$) can be challenging, and may be imperfectly documented. This is because often there is limited data available to the experts who undertake the IUCN Red List assessments on the impact and distribution of threats to species. Nevertheless, the IUCN Red List assessments provide the best available global data on species extinction risks and threats faced.

Despite these limitations, developers of the STAR metric have found that in general, the formulation of STAR produces reasonable national STAR scores for individual threats.

Table 17 Mozambique – Top 10 (Level 2) threats based on STAR scores

TOP 10 (LEVEL 2) THREATS	MOZAMBIQUE	
	STAR RESTORATION SCORE	STAR THREAT ABATEMENT SCORE
Annual & perennial non-timber crops	2 647	57 371
Logging & wood harvesting	1 914	46 100
Fire & fire suppression	1 738	45 250
Habitat shifting & alteration	640	28 947
Hunting & collecting terrestrial animals	960	16 857
Housing & urban areas	860	13 285
Wood & pulp plantations	571	12 147
Roads & railroads	241	7 016
Invasive non-native/alien species/diseases	151	5 954
Mining & quarrying	538	5 249

Sources: Based on BIODEV2030 report on Mozambique, with contributions from Philippe Puydarrieux and IBAT.

Table 18 Senegal – Top 10 (Level 2) threats based on STAR scores

TOP 10 (LEVEL 2) THREATS	SENEGAL	
	STAR RESTORATION SCORE	STAR THREAT ABATEMENT SCORE
Annual & perennial non-timber crops	1 150	9 247
Hunting & collecting terrestrial animals	921	7 581
Logging & wood harvesting	419	3 843
Livestock farming & ranching	396	3 625
War, civil unrest & military exercises	247	2 088
Agricultural & forestry effluents	227	1 331
Housing & urban areas	57	660
Dams & water management/ use	45	335
Droughts	28	311
Problematic native species/ diseases	51	196

Sources: Based on BIODEV2030 report on Senegal, with contributions from Philippe Puydarrieux and IBAT.

5.6 Harness the full potential of STAR metric

Based on the BIODEV2030 reports, our study finds that the STAR metric has been mainly used in the following ways:

- in calculating STAR threat abatement ($STAR_T$) and STAR restoration ($STAR_R$) scores at country level;
- breaking down STAR scores by threat to facilitate ranking;
- mapping STAR scores to identify areas with opportunities to abate threats and restore habitats; and
- extending STAR metric to other species not included in the methodology (see Box 11 and the BIODEV2030 report on Fiji).

1) **Calculating $STAR_T$ and $STAR_R$ scores at country level**. Authors of BIODEV2030 reports considered the $STAR_T$ and $STAR_R$ scores that were produced by IUCN and provided to them. Those results are shown in Table 16.

It is interesting to note that the $STAR_T$ score is higher than $STAR_R$ score in each country except in Burkina Faso and Ethiopia (see Box 8). In 12 of the 16 countries,[27] reducing threats would be a more effective lever to maximise the country's contribution to reaching post-2020 GBF goals of preserving threatened species.

In Burkina Faso, $STAR_R$ score represents almost the double of the $STAR_T$ score. This highlights the opportunities associated to restoration actions either for public actors or private actors, such as businesses in the field of ecological engineering or companies that would like to offset their residual impact in the framework of the mitigation hierarchy. Restoring habitats will contribute to the global goal of diminishing

27 Of the 16 countries, Cameroon and Guyana did not use STAR, while in Burkina Faso and Ethiopia, STAR restoration scores are higher than STAR threat abatement ones,

Table 19 Ranking of Level 2 threats based on the STAR score in seven countries (with Senegal as reference point)

TOP 10 (LEVEL 2) THREATS	SENEGAL	BURKINA FASO	GUINEA	BENIN	KENYA	MOZAMBIQUE	ETHIOPIA
	RANK						
Annual & perennial non-timber crops	1	3	1	1	1	1	1
Hunting & collecting terrestrial animals	2	1	4	2	6	5	7
Logging & wood harvesting	3	6	2	4	2	2	5
Livestock farming & ranching	4	2	10	3	3		2
War, civil unrest & military exercises	5						
Agricultural & forestry effluents	6	4		6			4
Housing & urban areas	7	7	5	7	8	6	3
Dams & water management/use	8	10		8	9		
Droughts	9	8		10			9
Problematic native species/ diseases	10				7		8
For countries other than Senegal: Other level 2 threat and their rank in the country's top 10 threats	→	5) Work & other activities	3) Mining & quarrying	5) Work & other activities	4) Habitat shifting & alteration	3) Fire & fire suppression	4) Habitat shifting & alteration
		9) War, civil unrest & military exercises	6) Work & other activities	9) Fire & fire suppression	5) Wood & pulp plantations	4) Habitat shifting & alteration	6) Fire & fire suppression
			7) Fire & fire suppression		10) Fire & fire suppression	7) Wood & pulp plantations	
			8) Wood & pulp plantations			8) Roads & railroads	
			9) Habitat shifting & alteration			9) Invasive non-native/ alien species/ diseases	
						10) Mining & quarrying	

Sources: Author based on BIODEV2030 reports on Benin, Burkina Faso, Ethiopia, Guinea, Kenya, Mozambique and Senegal, with contributions from Philippe Puydarrieux and IBAT.

extinction risk for threatened species and should be reflected in a decreased STAR score following such actions.

2) **Breaking down STAR scores by threat to facilitate ranking of threats.** The STAR scores can also be broken down and calculated for each individual threat (Level 2) according to IUCN-CMP classification version 3.2 (IUCN, 2022b) (first published by Salafsky et al., 2008) (see Box 9). Interestingly, the STAR restoration scores can also be subdivided by threat, where it is assumed that habitat restoration should be accompanied by threat abatement therein.

Breaking down STAR scores by threats allows to rank them at national scale. So, this specific use of the STAR metric allows to go beyond the sole identification of main threats as it provides a new way to rank threats among the sub-set of main ones.

For instance, according to the STAR threats abatement scores calculated per threat, the leading threat out of the top 10 threats in Mozambique and Senegal is annual and perennial non-timber crops. Table 17 shows the complete list of threats for Mozambique and Table 18 for Senegal (for a similar list for Benin, Burkina Faso, Ethiopia, Guinea and Kenya, see Annex VII).

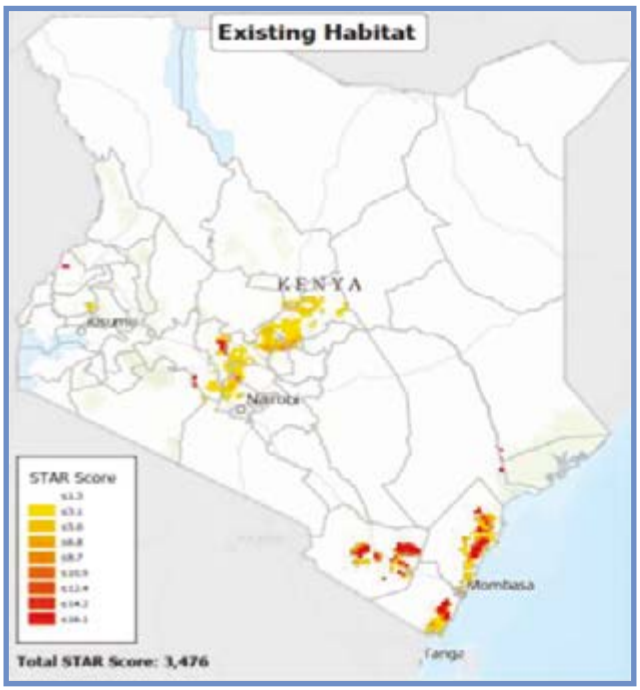
A more integrated vision for a sub-set of seven countries is proposed in Table 19, using only STAR threats abatement scores and taking the ranking of threats in Senegal as a reference and a basis of comparison. The upper part of Table 19 corresponds to the rank of the threat in the country. For the six other countries, when one of their top 10 threats is not among Senegal's top 10, that particular threat is indicated in the lower part of the table with its corresponding rank.

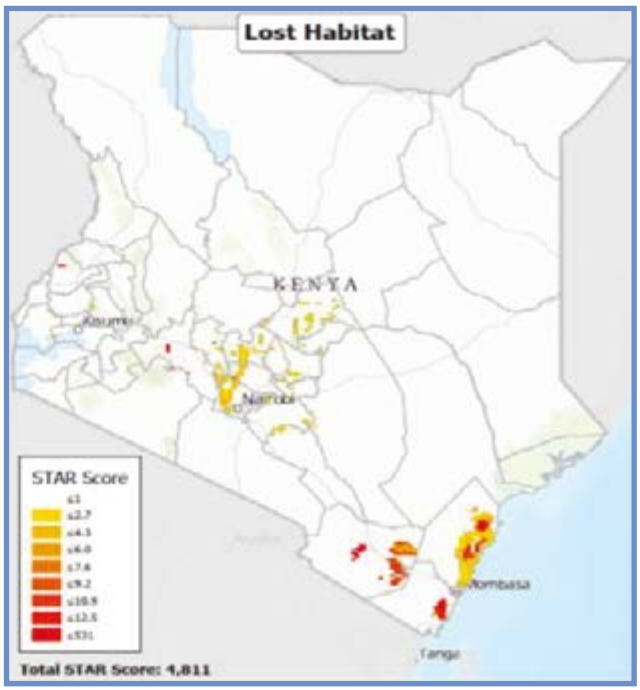
Table 19 reveals that, among around 45 threats evaluated individually:

- **Annual and perennial non-timber crops** is the main threat in six out of the seven countries, and is one of the top two main threats in all the countries;
- **Livestock farming and ranching, logging and wood harvesting and hunting and collecting terrestrial animals** are often in the top five.
- The **mining and quarrying** threat is surprisingly not frequent (included in the top 10 threats in only two countries). This is a bit unexpected because experts have quite frequently pointed out the mining sector as impacting biodiversity at national level. Our interpretation is that **mining and quarrying** is highly localised and relatively rare across space. Thus, it is more likely to have a low STAR score because it will be documented (at global level, see Box 10) for a relatively few species and as having a narrow scope.
- The **fire and fire suppression** threat is unusually frequent (belongs to the top 10 threats in five countries), whereas this threat was not identified in the literature review nor the experts' interviews. It must be noted that it is unclear whether **fires and fire suppression** have a systematic anthropogenic origin.

Figure 5 **Kenya – STAR threat abatement scores (a) and STAR restoration scores (b).** Grid cell score categories range from Very Low to Very High. Low scores do not imply the absence of threatened species. Grid cells are at a 10-km resolution. Source: BIODEV2030 report on Kenya (2020, Figure 2, p. 16).

(a)





(b)

Box 10 | The Integrated Biodiversity Assessment Tool (IBAT)

Contributed by: Ben Jobson (IBAT Alliance)

IBAT is a web-based mapping and reporting tool, licencing commercial access to global biodiversity datasets consisting of The IUCN Red List of Threatened Species™, the World Database on Protected Areas (WDPA) and the World Database of Key Biodiversity Areas (WDKBA). In the majority of cases, due to the terms of use for these datasets, governments can access IBAT freely. The biodiversity datasets represented in IBAT are hosted and maintained by the IBAT Alliance consisting of BirdLife International, Conservational International, the International Union for Conservation of Nature (IUCN) and the United Nations Environment Programme-World Conservation Monitoring Centre (UNEP-WCMC).

IBAT provides a range of biodiversity reporting functionalities that offer fast and intuitive methods of querying global biodiversity datasets to gain site-specific insights on biodiversity risk and opportunities. IBAT Reports include a Proximity Analysis, IFC and World Bank PS6/ESS6 Report on Critical Habitat, Freshwater Report, Multi-site Analysis and Species Threat Abatement and Restoration (STAR) Metric Report (examples can be found here).

IBAT was primarily designed to inform early-stage biodiversity risk assessment of project siting (for example extractives/infrastructure development) and project finance. Through bespoke risk screening reports for defined spatially-explicit areas, IBAT can provide non-technical users and non-biodiversity experts with rapid insights derived from global biodiversity databases.

IBAT provides nationally-relevant data that are disaggregated from global datasets, to support conservation planning and reporting. Through IBAT's Country Profiles, users can view insights on the biodiversity in different countries, as well as how countries are performing in relation to a range of indicators relevant to SDGs 14 and 15.

Since 2021, IBAT has been the home of the Species Threat Abatement and Restoration (STAR) Metric, which can be accessed as a global data layer or through bespoke STAR Reports for defined Areas of Interest. IBAT was the tool through which countries were assessed in relation to STAR for the BIODEV2030 Project.

For information on how to get started with IBAT, please contact ibat@ibat-alliance.org or set up an account.

Box 11 | Extending the STAR approach to species not included in the metric: the case of Fiji

Facing the scarcity of data on AOH for many species of Fiji, the authors tried to adapt the STAR metric approach using a proxy for the $P_{s,i}$ (the current area of habitat (AOH) of each species ***s*** at location ***i*** (expressed as a percentage of the global species' current AOH)) factor in the $STAR_T$ mathematical expression.

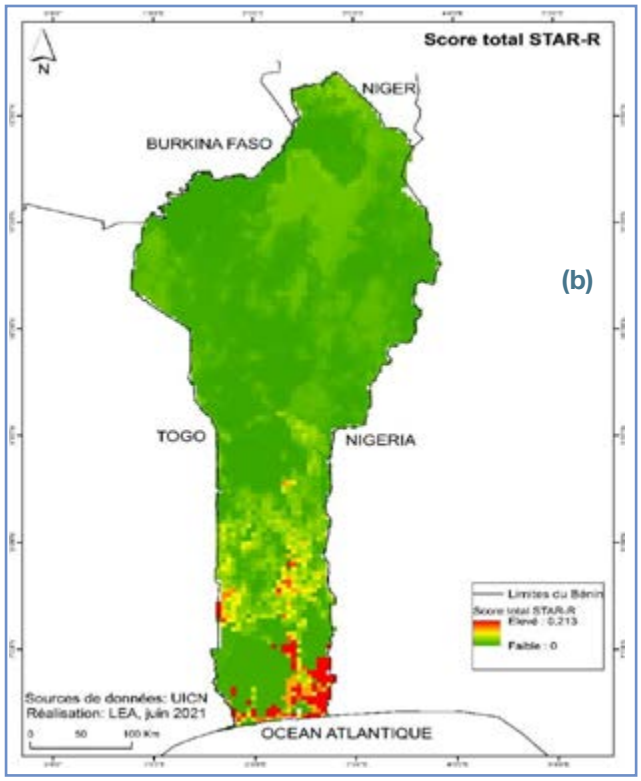
As stated in the BIODEV2030 report on Fiji:

> "One immediate concern about the initial STAR analysis was that it was undertaken using a small proportion of the species in country, from a small subset of taxa. Extrapolating up from this to represent the principal threats to Fijis biodiversity as a whole seemed dangerous, without undertaking some checks.
>
> We were aware that, for Fiji, there is reasonably extensive coverage of other terrestrial fauna, namely Reptiles (31 Fijian species are included on the IUCN Red List, of which 18 are Globally Threatened or Near Threatened) and gastropods (200 Fijian species are on the Red List of which 72 are Globally Threatened or Near Threatened). In addition, we felt that the flora of Fiji should be represented. A total of 208 species of Magnoliopsida, 9 Pinopsida, 70 Liliopsida and 1 Cycadopsida occur in Fiji and are on The IUCN Red List of Threatened Species™ v. 2021-1. These include 65, 4, 18 and 1 species, respectively, classed as either Globally Threatened or Near Threatened (see Appendix 1 for additional species). Not all species within these taxa have been assessed through the IUCN Red List – but each are well represented. These additional species were assessed using the slightly modified methodology described briefly below.
>
> The STAR analysis uses Area of Habitat (AOH) and expresses the importance of each species to Fiji's biodiversity based on the percentage of the total (global) AOH that occurs in Fiji. For many of the reptile, mollusc and plant species, there are no readily available AOH data available.
>
> Consequently, we used the number of countries that a species occurs in as a surrogate of AOH to weight the impact of each species on Fiji's biodiversity. This weight is equal to 1/(No. of countries) expressed as a percentage.
>
> Using this approach, endemic species score 100, species in two countries score 50 and species in 10 countries score 10 and so on. That percentage is then multiplied by the IUCN Red List score (NT = 1, VU = 2, EN = 3, CR = 4) as previously described." (pp. 18–19).

This is called the 'modified Country' approach. It has been applied to species with no data of AOH because they belong to taxonomic groups that are currently not included in the STAR metric.

Figure 6 **Benin – Maps showing the spatial distribution of STAR scores.** STAR threat-abatement scores maps (a); STAR restoration scores maps (b). Source: BIODEV2030 report on Benin (2021, Figure 31, p. 55)

(a)



(b)

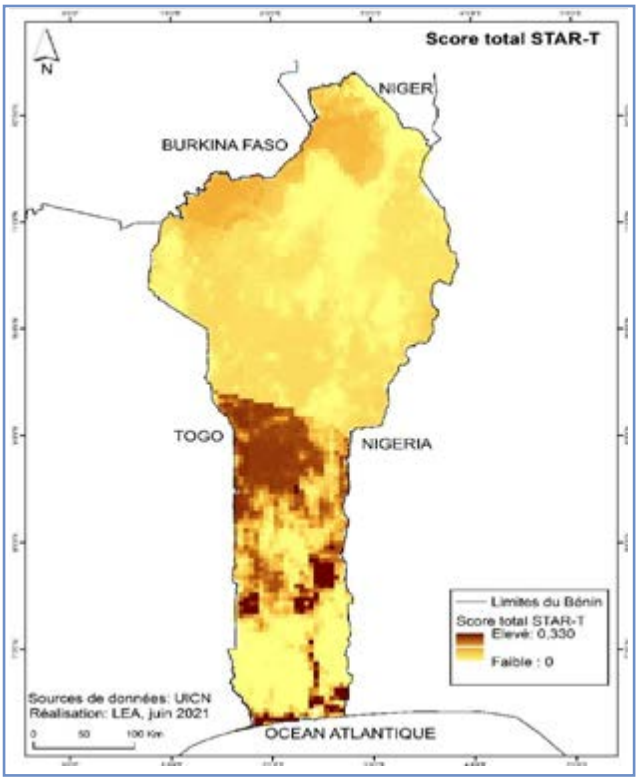
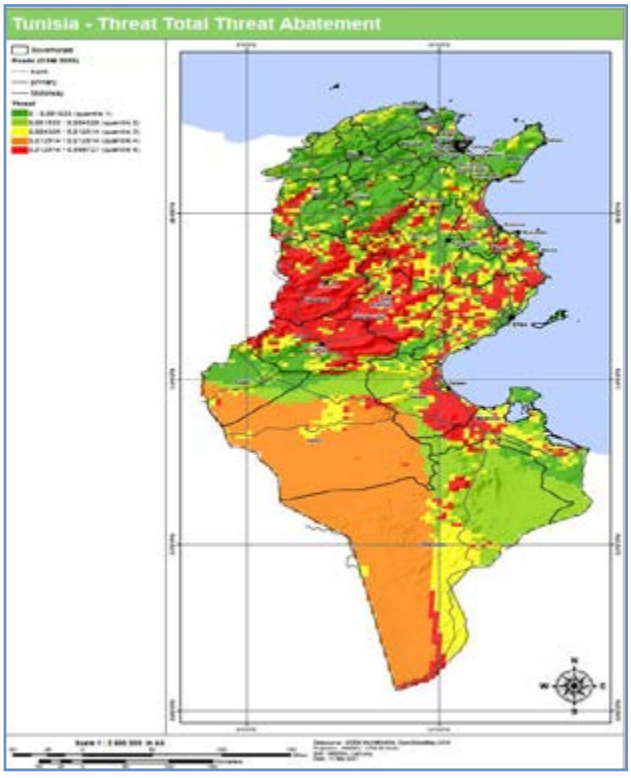


Figure 7 **Tunisia – Maps showing the spatial distribution of STAR scores.** STAR threat-abatement scores maps (a); STAR restoration scores maps (b). Source: BIODEV2030 report on Tunisa (2021, Figure 6, p. 20).

(a)



(b)

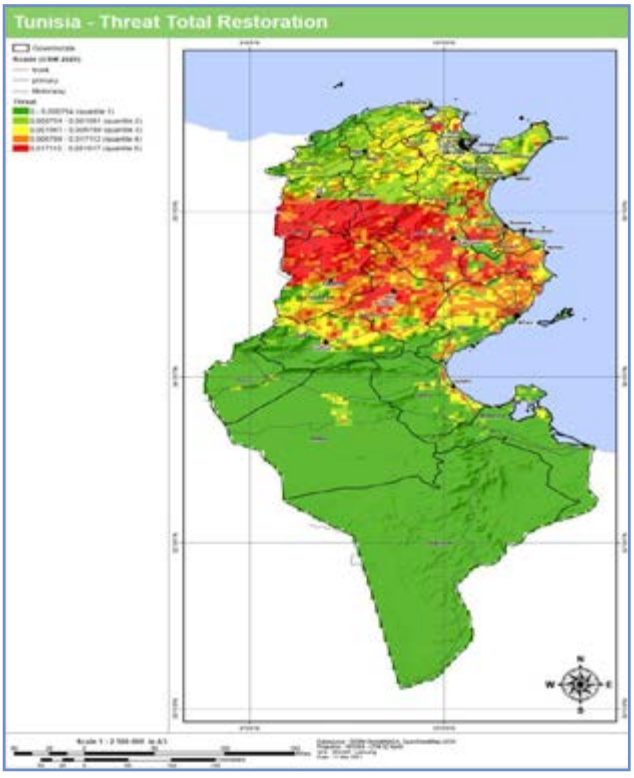
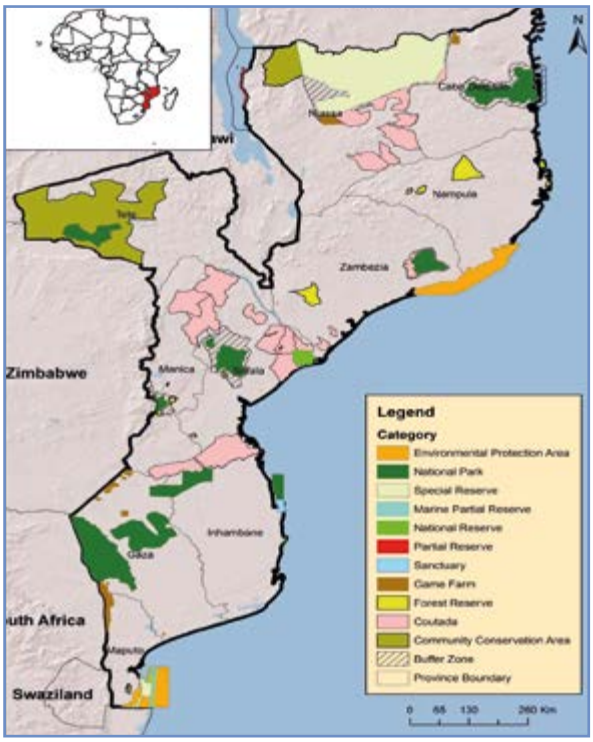


Figure 8 **Mozambique – Protected areas (a) and KBAs (b) of significant economic importance**
Source: BIODEV2030 report on Mozambique (2021, Figure 6, p. 59 and Figure 7, p. 63)

(a)



(b)

3) **Mapping STAR scores to identify opportunities to abate threats and restore habitats.** The STAR scores have also been spatially represented in maps (see Recommendation 5.7).

All those different types of application of the STAR metric are available using IBAT (see Box 10).

4) **Extending STAR metric to other species not included in the methodology**

Box 11 shows an innovative approach that was used by the authors of the BIODEV2030 report on Fiji.

5.7 Use and produce maps, including STAR maps, to target specific areas and sectors

The BIODEV2030 reports presents mapped STAR scores in Kenya (Figure 5), and in Benin (Figure 6) and Tunisia (Figure 7). STAR maps allow experts to identify and stakeholders to discuss the best places to reduce threats and restore habitats.

In Figure 6, the STAR scores corresponding to threat abatement actions and restoration actions are spatially distributed. The maps for Tunisia (Figure 7) show:

- a common geographical sector in terms of pressure reduction and restoration potential in the centre-west of Tunisia (zone bordered by Le Kef (also El Kef), Zaghouan, Kairouan, Sidi Bouzid and Kasserine);
- an area marked by a strong threat reduction potential south of Gabes-Medenine; and
- part of the Sub-Saharan zone (south-west) where the reduction of threats can contribute to a reduction in the erosion of biodiversity.

The production of maps to complete STAR maps, will help understand, locate and target protected areas, KBAs and key economic activities. Such maps can also be duly compared (or overlapped) to identify specific areas of primary interest for conservation and mainstreaming actions. Subsequently, it will then be possible to target specific territories combining high STAR scores, the presence of either a KBA or a protected area and the presence of key economic activities which are all significant for economic development and key drivers of biodiversity erosion.

Figure 8 (above) presents an example of two such maps included in the Mozambique BIODEV2030 report which compared with main areas of economic activities.

Table 20 Guinea – Change in land use from 2005 to 2015

LAND USE/ECOSYSTEM	LAND USE/ ECOSYSTEM (HA)	AREA IN 2005 (HA)	VARIATION OF AREA BETWEEN 2005 AND 2015 (HA)	VARIATION OF AREA BETWEEN 2005 AND 2015 (%)
Urban areas	158 664	177 514	18 850	11.9
Mines and construction sites/ Quarries	9 751	12 598	2 848	29.2
Rainfed, lowland and rear mangrove crops	1 936 842	2 076 094	139 251	7.2
Permanent crops, palm groves and agroforestry systems	1 687 076	1 691 410	4 333	0.3
Dense tree formation	2 199 283	2 172 744	-26 540	-1.2
Mangrove	144 639	141 953	-2 686	-1.9
Wooded savannahs	8 468 421	8 442 479	-25 942	-0.3
Savannahs and shrub formations	9 485 909	9 377 295	-108 613	-1.1
Open space with little or no vegetation	254 085	163 090	-5	-35.8
Indoor wetlands	121 153	118 716	-2 436	-2.0
Maritime wetlands	99 677	99 406	-271	-0.3
Water surface	110 261	111 462	1 201	1.1

Source: AFD et al. (2019).

5.8 Build a transition matrix of land-use changes between specific periods

With regard to terrestrial ecosystems (land), constructing a transition matrix between two dates can be beneficial. To do so, there is a need to get access to GIS data reflecting a relevant land-cover/land-use/ ecosystem typology.

Descriptions of land use and land-use changes were made for the BIODEV2030 reports on Guinea and Viet Nam. In the report on **Guinea**, tables were produced at national level as well as at regional levels for each of the four Guinean regions (Maritime Guinea, Middle Guinea, Upper Guinea and Forest Guinea).

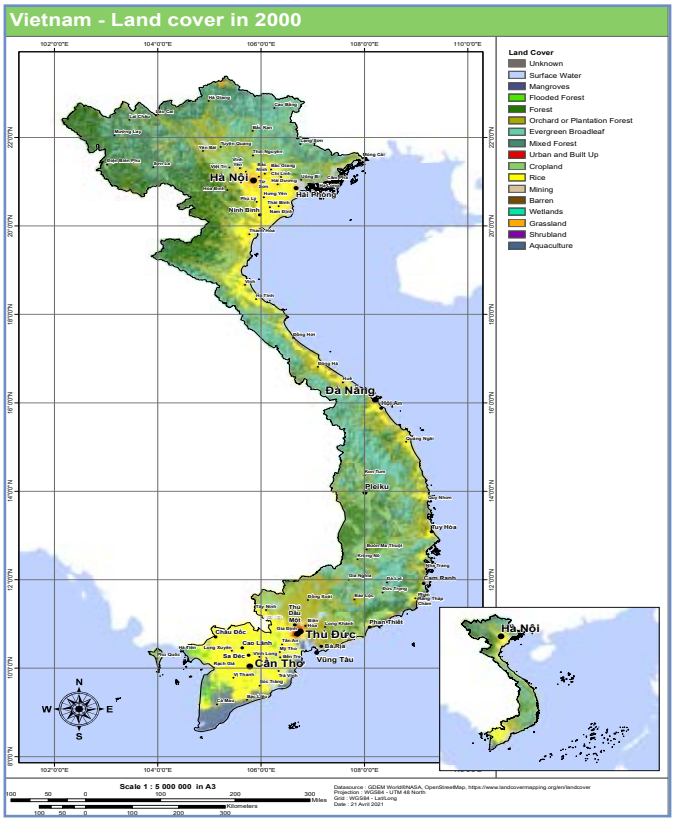
In Uganda, the authors of the BIODEV2030 report, suggested GIS is a valuable tool for analysing biodiversity trends from a habitat approach. Since then, the data are easily accessible and accurate, which enables to carry out relevant analysis at the habitat level.

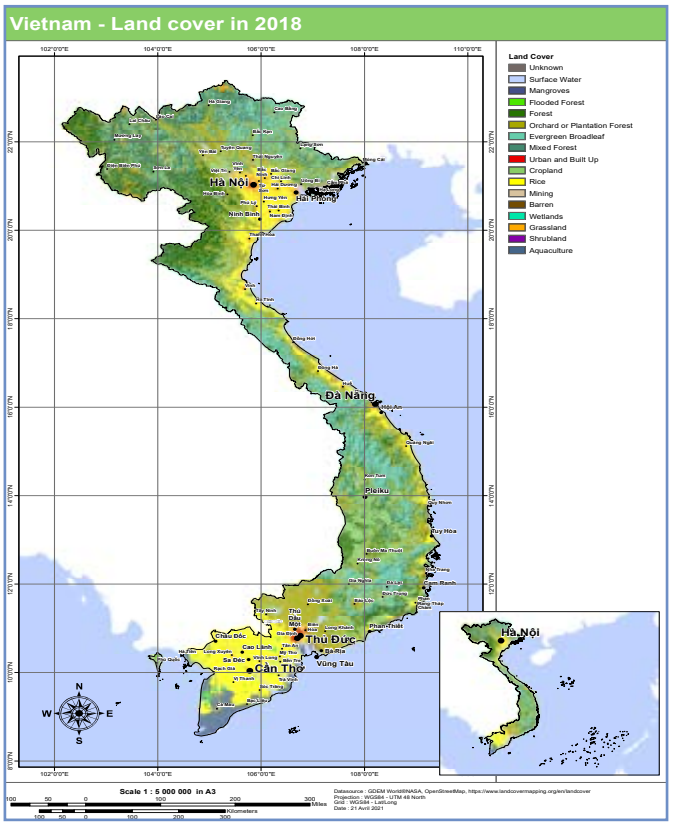
The use of a multitude of typologies to describe the spaces was also observed. In Benin, for example, the study mentions climatic zones (Guinean-Congolese Zone, Sudano-Guinean Zone, Sudanese Zone), land occupation classes, Phyto districts, hunting zones, agroecological zones, watersheds and 'study sites' without any link to the description of species population trends or threats. It is therefore recommended to restrict the number of scales considered (for example at the national scale, or administrative level such as region or county, and perhaps even KBAs) and refer to these spatial units in the analyses of species population trends and threats.

Table 20 shows the variation of extension of different land-uses/ecosystem types, which can be a useful tool to understand ecosystems variations over a period of time. For example, between 2005 and 2015, the **rainfed, lowland and rear mangrove crops** area has increased by almost 140,000 hectares, or +7.2%. However, it is not indicated what were those new hectares of crops before they were converted: were they '**dense tree formation? mangrove savannah** and **shrub formation**? It is also shown that savannah and shrub formations have lost 108,613 hectares in within the same period spanning 10 years. Again, which category has benefited' from this loss? Given the highly significant increase, it is more probable that **rainfed, lowland** and **rear mangrove crops** did benefit from this loss. However, have all the lost savannah and shrub formations been converted into **rainfed, lowland** and **rear mangrove crops** or was it more diverse and complex?

Although the table shows changes in land uses from 2005 to 2015 in Guinea, the missing information is a detailed description of land-use flows that could

Figure 9 **Viet Nam – Maps showing land cover and land cover changes in 2000–2018.** Source: BIODEV2030 report on Viet Nam (2021, Figures 4, 5 and 6, p. 64; Figure 7, p. 63).





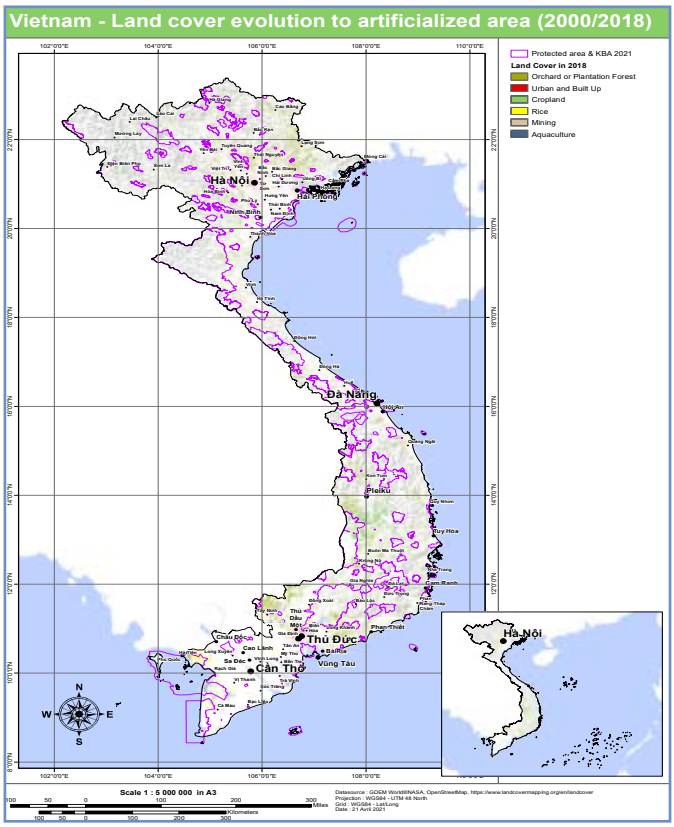


Figure 10 Viet Nam – New uses of forests, flooded forests, mangroves and mixed forests converted in 2000–2018. Source: BIODEV2030 report on Viet Nam (2021, Figures 7, 8, 9 and 10, pp. 65–66).

address the following questions. For example, did the urban areas increase? at the expense of which other land use type(s)? Savannahs and shrub formations have decreased by more than 100,000 hectares; what did they become (in terms of land use type)? This information can be assembled in what is called a transition matrix, which is a useful tool to grasp the landscape dynamic at local, regional or national level.

Concerning the BIODEV2030 report on **Viet Nam**, three maps were produced to show the land cover in 2000, 2018 and the land cover changes between 2000 and 2018 (Figure 9).

The maps in Figure 9 were constructed using remote sensing techniques and the Regional Land Cover Monitoring System developed by the SERVIR-Mekong project (Saah et al., 2020). The imagery resolution is 600 metres per side which makes it feasible to highlight major changes in land use at the scale of a country. On that basis, it became possible to understand the factors impacting the reduction of the forest cover. As a developing country, Viet Nam relies a lot on natural resources for economic development. Land is one of the most important natural resources used for the development of almost every economic sector. There is a clear relationship between land use and the loss of biodiversity. **Therefore, measuring the loss of biodiversity through the change of land use can be recognised more easily by policy makers**. The authors of Viet Nam BIODEV2030 report have analysed land cover and land cover changes for a period of 18 years. This is a longer period than

the national economic development strategy, which is usually updated every five years, so it can help to understand and inform policy makers more precisely on the fundamental and long-term drivers of biodiversity loss.

Given that forested areas have been the most impacted habitats, a particular attention was given to these habitats by the authors. Figure 10 shows specifically the transformation of different types of forests in Viet Nam between 2000 and 2018.

Despite showing an extraction (for forests and mangroves) of what could be a systematic transition matrix in Viet Nam between the given period, Figure 9 is not quite a 'transition matrix', which should also show the new uses of former forests, This would help understand the possible sectoral drivers of forest conversion during that given period.

Land use changes are a good proxy to assess part of the pressures on biodiversity. If there is a need to be more specific, an analysis of the relationship between disturbance of forest landscapes and biodiversity must include deforested areas as well as the evolution of associated habitats, such as configuration, composition and residual surface extension). The BIODEV2030 report on Congo considered such factors in their analyses and review of literature on this matter (Barlow et al. 2016; Decaens, 2018); Gardner et al., 2009); Melo et al., 2017); Montoya et al., 2008); Villard & Metzger, 2014).

5.9 Enhance, challenge or substantiate literature, maps and STAR results through experts' elicitation

The assessment of the impacts or severity of a given threat is done at global scale in the IUCN Red List and STAR metric. In this regard, in some countries, national experts expressed concerns about this specific aspect which means that, for a given species, the heterogeneity of a given threat across countries is not captured in the IUCN extinction risk status assessment and thus in the STAR metric.

It has been underlined in several BIODEV2030 reports (e.g. Benin, Senegal and Uganda) that assessments of threats and impacts should also be conducted at national level. A national assessment of the impacts (scope and severity) of threats on species that are present in the country may have higher chances of being acknowledged and understood by national stakeholders.

One of the means to do such a complementary assessment is to interview national experts of species, threats or taxa, or even of economic sectors. This was undertaken for several BIODEV2030 reports and proved to be very useful in complementing or even challenging the results of the literature review and STAR metric.

This specific recommendation discusses the good practices in assessing the **severity** of threats at national level, observed in the BIODEV2030 reports of Benin and Senegal.

As a starting point for a given threat that is assessed at national level through experts' elicitation, it is important to distinguish between the different concepts of: i) **scope** (percentage of national population of the species or of the taxon that is affected by the threat); ii) **intensity** (level of expression of the threat in the country); iii) **irreversibility** (whether the threat can be removed where it already impacted biodiversity); and iv) severity (combination of scope, intensity and irreversibility) of the threat. It is essential to note that scope and severity are specific to a combination of species (or taxon)–threat, whereas the threat's intensity and irreversibility are assessed at national level once and for all are the same for any species (or taxon).

For example, in the case of Senegal BIODEV2030, the experts' elicitation process to assess the severity of threats at national level focused on four taxonomic groups because they are well represented in Senegal, and at the same time the most threatened by human activities at national level: fishes, birds, mammals and plants. Some 71 experts from various institutions were interviewed. The team of scientific and technical experts had pre-selected a maximum of 12 threats for each taxonomic group from of IUCN-CMP classification version 3.2 (IUCN, 2022b).

The process was driven by the IUCN Guidelines for Using the IUCN Red List Categories and Criteria, version 15.1 (IUCN Standards and Petitions Committee, 2022).

A good practice is expected to first select a set of threats that are relevant at national level (see, for

Table 21 Possible combinations of scope and intensity to qualitatively assess the contribution of a threat to the decline of the population at national level

		SCOPE (PERCENTAGE OF THE POPULATION OF THE SPECIES OR OF THE TAXONOMIC GROUP AFFECTED BY THE THREAT AT NATIONAL LEVEL)		
		MORE THAN 60%	BETWEEN 20% AND 60%	LESS THAN 20%
INTENSITY OF THE THREAT	HIGH	High	High	Medium
	MEDIUM	High	Medium	Medium
	LOW	Medium	Medium	Low

Source: Author.

Table 22 Possible combinations of contributions of a threat to the decline of a species population and its irreversibility at national level

		CONTRIBUTION TO THE DECLINE OF THE POPULATION (SPECIES OR TAXON)		
		HIGH*	MEDIUM*	LOW*
IRREVERSIBILITY OF OF THE THREAT	HIGH	High	High	Medium
	MEDIUM	High	Medium	Medium
	LOW	Medium	Medium	Low

* These values emanate from Table 21.

Source: Author.

example, Senegal BIODEV2030 report). Then ask each expert to independently assess:

- the **intensity** of each threat in the country (qualitative categories should be proposed such as High, Medium and Low);
- for each combination (**species** (or *taxon*), **threat**), assess the **scope** which is the percentage of national population of the species (or taxon) affected by the threat and that which can be categorised as High (more than 60%), Medium (between 20% and 60%) and Low (less than 20%); and
- the **irreversibility** of each threat in the country (qualitative categories should be proposed, such as High, Medium and Low)

The next phase should consist of averaging and combining experts' assessments of **intensity** and **scope**, bearing in mind that it is possible to determine the **contribution** of threat ***t*** to the decline of population of the **species** (or a taxon) at national level, which can be categorised (see Table 21), for example, as follows:

- High: the threat is a very important factor in the decline of the population.
- Moderate: the threat contributes moderately to the decline of the population.
- Low: the threat contributes little to the decline of the population.

Experts can also be asked to assess the **irreversibility** of each threat type. The following levels of **irreversibility** could be proposed:

- High – reversible but practically impossible;
- Moderate – reversible with a strong commitment and strong mobilisation of resources; and
- Low – easily reversible at relatively low cost.

Likewise, it is possible to combine **contribution** to national population decline and **irreversibility** to assess the **severity** of a threat for each combination species (or taxon) threat.

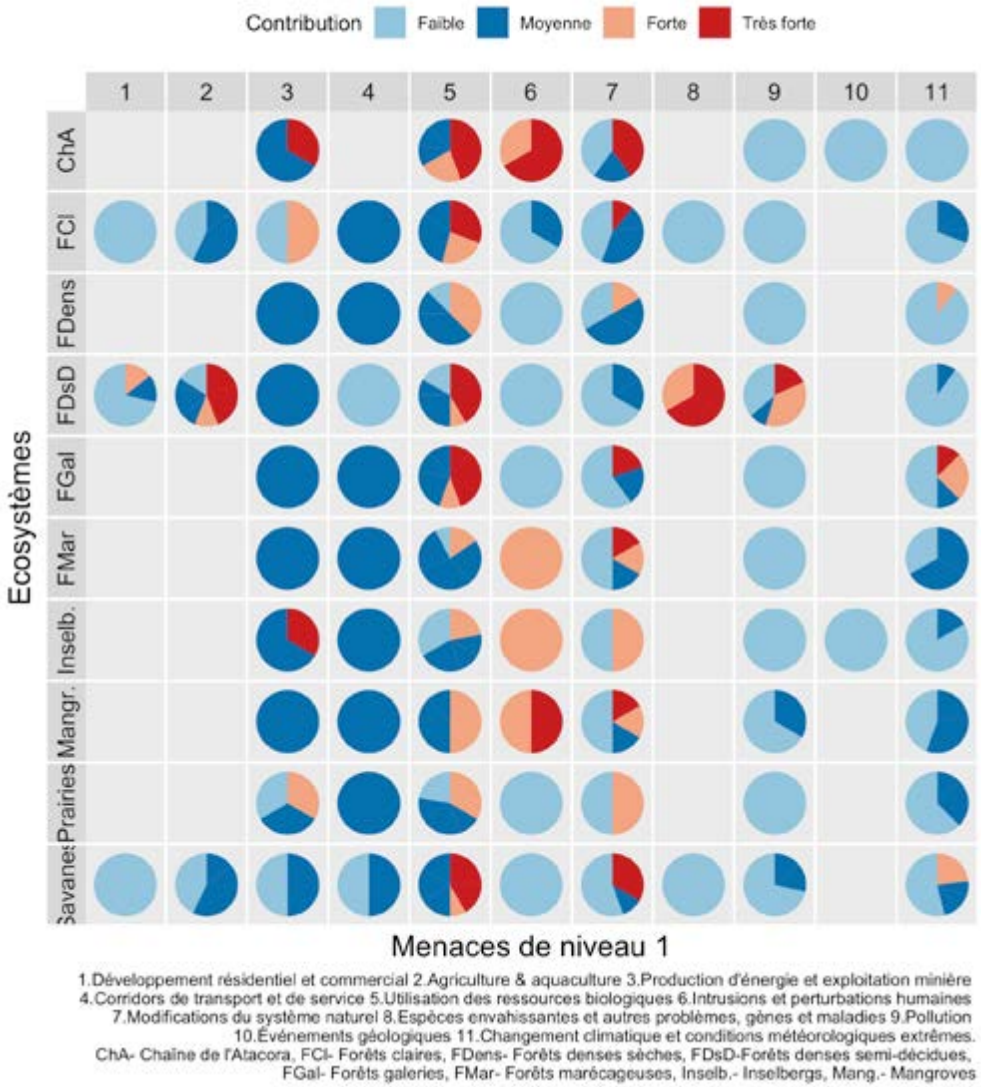
Table 22 summarises the ways **severity** of threats, which is species (or taxon)–dependent, can be retrieved to qualitatively assess its severity at national level. Analysis of the data obtained through experts 'interviews made it possible to assess and rank main threats on taxonomic groups.

Thus, the process that can be carried out as follows:

Scope x Intensity ==> Contribution
Contribution x Irreversibility ==> Severity

A similar approach was adopted for the BIODEV2030 report on Benin, this time for national ecosystems. The authors interviewed experts of both species and ecosystems, and to assess the scope (percentage of ecosystem extent affected by a given threat at national level), intensity (of the threat at national level) and irreversibility.

Figure 11 Benin – Irreversibility (percentage) of Level 1 threats for ecosystems based on experts' elicitation. Source: BIODEV2030 report on Benin (2021, Figure 37, p. 62).



To reflect opposing views, the authors found an original way of presenting the results. Figure 10 shows the expert-based assessment of irreversibility for a set of Level 1 threats[28] on national ecosystems.

5.10 Strengthen the robustness of experts' elicitation process

It is important to align the experts' contributions to allow for a clear interpretation of the results. Some of the important steps that need to be completed before inviting experts for an interview include the following:

- **Clarify** in what ways experts' elicitation could help or supplement the data already known from the literature review and STAR metric approach.
- Identify and invite not only experts[29] of species/taxonomic group/ecosystem, but **also those from the impacting sectors** who may know a lot about the (root causes of the) production practices causing threats to biodiversity (use of agricultural chemical inputs, determinants of clearing forests, overfishing, incompliance with avoidance step in the mitigation hierarchy in the mining sector, etc.). Bear in mind that restoration experts, for example in the mining sector and representatives of primary industry multinationals, may not be based in

28 See Salafsky et al. (2008) to understand the three different levels of threats to biodiversity in the IUCN-CMP 3.2 classification of threats (IUCN, 2022b).

29 See Annex I – Glossary.

a given country. It is therefore important to also consider experts based beyond the country.

- Define *ex ante* the **field of expertise** of each expert to be interviewed (taxa, species, ecosystems, a sector, a method, a region, etc.).
- Deliberate *ex ante* on the representativeness of invited experts at a technical workshop. Both their affiliations and the field of expertise should be considered. Species, taxa, regions, sectors of activity, types of assessment tools and scientific approaches, etc., as well as different natural habitats types (terrestrial vs marine), could comprise a field(s) of expertise. On the other hand, it would be useful to consider experts from a range of affiliations, such as those from the academe (universities or research centres), private companies or sectors. Multiple origins of experts are an asset, but they must be transparent on where they are coming from to guarantee representativeness not only the field of expertise, but also the type of organisation supporting them.
- **Ensure transparency and promote disclosure**: for example, what school of thought does the expert's research belong to? is there a possible conflict of interests, etc.?
- Set up *ex ante* a **protocol** regarding question framing, background information, information on the use of the results, suggested method to assess the intensity of threats, etc.
- For a given combination (species X threat) or (ecosystem type X threat) in the country, refer to the Threat Impact Scoring System,[30] which will facilitate experts' statements on the threats' impacts at national level.
- As regards the **aggregation method** of experts' statements, clarify the following questions:
  - whether a weighting between experts' contributions needs to be done (to assess the trend or state of a taxonomic group for example, between experts of this specific taxon and experts of others for example) or not. In some cases, weights may be used to give more importance to certain experts when answering a question that is at the core of their expertise.
  - how many experts will be interviewed? To which specific questions?
  - how will you calculate the frequency of answers? Be transparent and write the formula.
  - will each expert make a statement on each possible combination (species X threat) and (ecosystem X threat)?
  - how will each expert manage to aggregate at national level their perception of the situations on different sites (clarify your recommendations on how to do this)

Likewise, there are simple tips to make sure that the experts' statements are **independent and neutral**, devoid of the influence of any advance data or information about a main threat or the ranking of a threat. This implies not providing, for example, a list of pressures/threats and the results of the STAR analysis, or even sharing what other experts have previously on the subject. In addition, the experts should be interviewed **separately** from one another because of the potential influence they could have on each other. A first workshop can be organised to explain the goals and rules of the exercise.

Nevertheless, at a later stage, the pooling of individual assessments is useful for revealing potential contradictions, i.e. assessments of the same subject that may differ between experts. It is thus vital to discuss such probable scenarios and understand where the gaps in assessment might be coming from. If achieving **unanimity** among experts (each expert agreeing on one specific item or question) is not a reasonable objective to reach, obtaining a **consensus** (a majority of experts agreeing) might be more reasonable.

By voluntarily not providing the experts with the STAR results before interviewing them, the possible convergence of the STAR and the experts' elicitation approaches will be the **sign of truly robust results**.

Chapter 4.3 describes ways to improve the complementarity between the STAR metric and experts' elicitation. Box 12 presents further ways to improve synergies between the two approaches.

When correctly conducted, experts' elicitation can bring a significant value-added to an assessment and be an indispensable tool, for example, in going above and beyond IUCN-CMP 3.2 classification of threats in at least two aspects:

30 For further information, please see: https://nc.iucnredlist.org/redlist/content/attachment_files/Dec_2012_Guidance_on_Threat_Impact_Scoring_Revised.pdf

Box 12 | Improving synergies between STAR metric and experts' elicitation

How can the results generated by STAR maps be optimised?

Spatial information generated through STAR results and maps is crucial. The study finds that this information was availed of in a limited manner by the BIODEV2030 reports.

One of the specific strengths of STAR metric is its ability to be spatialised, in contrast with literature review and experts' elicitation which generally adopt a national scale approach. To cover the geography of threats, it is thus recommended to map not only STAR scores (threat abatement and restoration scores) but also STAR scores of main threats. In itself, this is a key starting point reaching beyond the sole identification and ranking of main threats. The resulting information will then be used to design relevant and efficient actions that reduce threats and/or restore habitats.

(Re)assess threat intensity and spatial variation of threat intensity at national level

It is reasonable to supplement the STAR approach with other methodologies because STAR has both strengths and limitations. For example, the contribution of a threat to a species' risk of extinction is assessed globally. For the STAR metric, $C_{s,t}$ is the relative contribution of threat ***t*** to the extinction risk of species ***s*** calculated as the percentage global population decline from that threat.

Thus, $C_{s,t}$ is a global value in the STAR metric, with no information about spatial variation of that threat. This might be viewed as a limitation since a threat can be assessed globally as severe/intense (in general) for a given species, but not be considered to be severe/intense in a given national context.

Since threat intensity can also vary spatially inside a given country, variation in threat intensity across space is an issue when applying STAR at national or local scales. In this regard, that expert's elicitation would clearly target a re-examination of the threat scope, intensity and thus severity at national level (compared to global assessment out of the IUCN Red List included in the STAR metric), as well as its possible spatial variation within national boundaries. A good practice has been identified in the Benin BIODEV2030 report (see Figure 10).

(Re)assess population trends at national level

Many species considered not threatened on a global scale may be so on a national scale. They therefore deserve special attention for their sustainable conservation. It is important to clearly distinguish the trend at global and national levels based on the IUCN Red List (global) and National Red List, where available, and clearly explain their linkages. In the absence of a National Red List, it remains important to ask experts to make statements on population trends at national level to obtain a sub-set of significant species.

- spatial differentiation of threats intensity or severity within the same country (e.g. ask expert about the spatial variation of threats intensity); and
- distinction between agricultural threats. Since IUCN-CMP 3.2 typology of threats does not allow to distinguish between different types of agricultural threats, it is recommended to progress on this important topic with pointed questions, such as:

  a) What is the damage to biodiversity resulting from extensive agriculture (clearing and burning of forest land or savannahs to then put them into cultivation)?

  b) What is the damage to biodiversity resulting from the intensification of production on plots already cultivated with inputs from synthetic chemistry (herbicides, pesticides, fungicides, fertilizers, etc.)?

5.11 Combine criteria to select economic sub-sectors

Five criteria worth considering

While the link between the main threats and the key **sectors** (e.g. agricultural or mining) was easily deduced from the analysis of main threats, establishing a link between the scientific assessment

of main threats and the selection of **sub-sectors** (e.g. a specific crop value chain such as maize) has proven to be a challenge during the project.

This selection of sub-sectors happened during workshops when authors of the assessments presented their results and stakeholders discussed them.

At national level, when stakeholders discussed and selected sub-sectors, they combined science-based criteria with other aspects, such as social and economic, existence of umbrella organizations and sub-sectors representatives, willingness to commit, medium term expected growth of the sub-sector, etc.

In some cases, the stakeholders did not select sub-sectors consistently with the assessment of threats. Although this might be due to a variety of reasons, it may not be a big issue.

The collective decision to prioritise a specific sub-sector for biodiversity mainstreaming was the result of both scientifically established evidences and more political considerations (potential consequences for the economic actors).

The selection of sub-sectors was mostly based on five criteria:

1) data on pressures on biodiversity triggered by the sub-sector;

2) social importance and size of the sub-sector for current and potential economic development;

3) existence of umbrella organisations of the sub-sector allowing for a mobilisation;

4) willingness to advance and commit by actors of a given sub-sector; and

5) the governance of the sub-sectors.

Three country examples are presented below.

In the BIODEV2030 report on **Madagascar** (2021), for example, a combination of criteria not only related to impacts and dependence on biodiversity has been applied. To select sub-sectors capable of making voluntary and quantified commitments with dedicated actors that can be monitored in the medium and long term (2030–2050), two ad hoc sets of criteria related to the actors and data of a given sector were used:

- criteria reflecting the existence of an umbrella organisation, their flexibility to develop and express their interests through appropriate representatives, as well as the capacity of the actors to commit to actions for biodiversity; and
- criteria reflecting the existence of data either on pressures to biodiversity or on biodiversity itself that is relevant for the sub-sector selected. Indeed, to be able to assess the sector's current and future impacts on biodiversity, it is helpful to establish a baseline. This baseline allows to assess future potential positive impacts on biodiversity of a sub-sector that would change its business model by adopting more biodiversity-friendly production practices.

The choice of a sub-sector has also considered the desired quality of its governance. For example, during an interview, the CBD National Focal Point for Madagascar, Rantonirina RAKOTOARIDERA, said:

> Regarding the choice of sectors, we crossed several criteria, beyond the results of the scientific diagnosis of the threats. During meetings with experts and technicians, a prioritization was made. There was a lot of hesitation and back and forth. Lots of sectors were identified. For example, forests and mines. We could have chosen the logging sector because there is a lot of data available. In the end, we chose sectors "not directly piloted" by the Ministry of the Environment (case of the logging sector). (Translation by the author)

In this country, the choice of selecting sub-sectors that are not directly regulated by the Ministry in charge of the Environment has been considered as a way forward to mainstream biodiversity into economic sectors and non-environmental public policies.

Similarly, the BIODEV2030 report on **Burkina Faso** has identified the 'hunting' sector as the main IUCN-CMP Level 2 threat in terms of STAR Threat abatement score. However, following a workshop to discuss the findings, it has been decided not to select it since there is no corresponding well-organised 'sector' to mobilise and engage with (BIODEV2030 report on Burkina Faso, 2021).

In **Kenya**, STAR analysis showed high scores in highlands (BIODEV2030 report on Kenya, 2020). Nevertheless, during the workshop organised to present and discuss the results of the assessment, stakeholders have chosen to work on other regions and landscapes (drylands). The decision was made in spite of a well-informed process. Although it might appear as surprising, the apparent discrepancy just illustrates that **collective decision-making sometimes combines scientific evidence with other types of criteria**. In this case, social concerns might have influenced the selection of drylands, which is 80% of the national territory. Non-biodiversity related concerns may have prevailed at the crucial point of choosing the sub-sectors and regions to further work on. Nonetheless, the final choice does not mean that the work to be done in the drylands of Kenya will have no positive impacts on biodiversity. On the contrary, because the decision was made by well-informed stakeholders, their engagement may be greater and the new production patterns may last longer.

Handle tensions between science and stakeholders' interests

One of the relevant questions to address is what should be done when stakeholders are in total disagreement with the team of scientific and technical experts' prioritisations that are science-based? The challenge is to properly address the trade-off between science identifying the sub-sectors with the most harmful production practices and political choices by the stakeholders who would like, for many reasons, to select or not to select a specific sub-sector. This is a matter of collective efficiency. None of the two following situations is optimal: (i) stakeholders discarding the sub-sectors with the most harmful productive practices; (ii) authors of the assessment of main threats imposing on stakeholders which sub-sectors to select, without listening to their concerns and interests. Finding the right balance between science and politics is key.

When chairing a workshop with both the authors of the assessment and the stakeholders, it is necessary to **maintain a constructive tension** between the interests of the stakeholders (which often will not be aligned with a better integration of biodiversity) and the results of the assessment.

Governance must allow for an open, inclusive and fair discussion between the team of scientific and technical experts (authors of the assessment) and stakeholders. A good representation of the scientific results, such as the STAR score maps showing where actions could have the highest impact on reducing species extinction risks, must be ensured. The authors of the assessment should be allowed to bring back the main results of their analyses in the flow of the discussion between stakeholders.

Likewise, to maximise **ownership and buy-in** of stakeholders, it might be also attractive for economic sectors (i.e. private sector) to identify how they could **positively contribute and seize opportunities** for nature, instead of only hearing that they have to reduce their pressures on biodiversity (even if it is true). It needs to be clear that the assessment stage is the right moment to identify, rank and prioritise main threats to nature and opportunities for the private sector (small businesses, investors, large companies) to contribute to nature restoration (by offsetting its own or other's activities).

Finally, full disclosure of the criteria applied by the stakeholders during the discussions is recommended not only in cases where the results of the assessment of threats do not seem to have been fully considered). This would improve transparency in decision-making.

5.12 Facilitate a participatory and inclusive governance

Information about good production practices, possible changes in bad production practices, distribution of benefits and costs of such a shift is asymmetrically distributed among actors. This is one of the reasons why a participatory and inclusive approach for stakeholders and experts' mobilisation is needed and has been applied, even if at various degrees, in all BIODEV2030 pilot countries. In that sense, the BIODEV2030 project has been following Dasgupta (2021), when he said:

> Information required for managing ecosystems is asymmetrically distributed: much is uniquely understood and best managed by local communities, but important perspectives are also held among national governments, international organisations and along global supply chains. Institutional arrangements that enable sustainable engagement with ecosystems are 'polycentric'. They pool knowledge

> and perspectives among and across different levels – global, regional, national and local – and from different organisations, communities and individuals. In doing so, they enable relevant information to flow, and allow for collaborative planning, participation and coordination. (p. 4).

It is key to distinguish between different types of actors: experts and stakeholders. Experts possess technical and/or scientific knowledge and knowhow, while stakeholders are main actors invited to discuss results and express their specific interests and concerns. This distinction is useful because it avoids confusion between scientific credibility (provided by experts) and social legitimacy (expressed through stakeholders).

The different types of actors associated with the study should bring specific inputs to the process and deliver a scientifically robust results, relevant to public/private policy or decision making and legitimate in the eyes of stakeholders. Scientists must reinforce credibility, government or private organisations representatives must reinforce the relevance of the results for decision making and stakeholders must reinforce the legitimacy of the results. Thus, and even if it is not that simple,

- **scientists and experts** (in ecology, GIS, economics, social scientists,[31] etc.) should focus mainly at increasing the **credibility** of the results by: i) clarifying the accuracy of data and advantages and limits of different methods; and ii) providing clear scientific- and evidence-based data on a given topic when some stakeholders are tempted to distort the facts or minimise the level of confidence of an established knowledge (for example, on the relative importance of threats to biodiversity of a given agricultural production practice);
- the need for **relevance** for decision-making must be reminded by the **main (end) users** of such assessments (private organisation representatives, governments, donors and civil society organisations); and
- the **stakeholders** must be invited at the beginning of the study to express their concerns related to the links between economic production and biodiversity. As the final results of the study are shared, they should be asked to address the results: how will the results be integrated into their behaviour/practices in the future? The more they feel associated with the study and the results and conclusions, the higher t**he ownership** of the whole process, and the better they will endorse, buy-in and commit in favour of biodiversity.

Setting up a governance structure

A **steering committee** should be formed to ensure the proper conduct of the study, or project, and arbitrate between the actors involved. The committee is expected not to have any vested interests, rather aim to reinforce the relevance of the study for policy and actors' decision making. It is in charge of writing, publishing the TORs, monitoring the team of scientific and technical experts and making them deliver what is expected in the TORs. It is a small and executive group of persons who have a clear vision of the goals and what is required to reach them. The CBD National Focal Point must be associated in the steering committee.

In the final report, the steering committee shall ensure all recommendations are accurate and action-oriented: there should be a subject (which institution(s) should be involved?), an indication of the timeline (date, framework, period) and objective(s) and a proposed methodology (how the institution will proceed).

The **group of stakeholders** should be large and open: public and private actors from different Ministries, economic sectors and NGOs. It can take the form of a national platform. Each stakeholder can express its own point of view (national, sectoral, social, economic, religious, or any other specific concern). The stakeholders' group can be gathered at the scoping stage, but the steering committee must have the mandate to integrate, or not, suggestions made by the stakeholders' group. In Guyana's BIODEV2030 report, facing time constraint, a particular stakeholder-centred and participative approach was followed for the identification and ranking of main threats (see Box 13) (CEMCO Inc. & BIOTOPE, 2022). It was an innovative way of setting up a governance structure, although it is recommended to bring experts and distinguish them

31 Skills in social sciences are crucial, for example anthropologists with expertise on issues related to valuation of nature's contribution to people, sustainable use of wild species, etc.

Box 13 | A stakeholder-centred and participative approach: the case of Guyana

Contributed by: Devon Dublin (WWF-Guyana)

The stakeholder-centred approach relies heavily on the stakeholders for the majority of the information that was needed to generate the study, rather than relying wholly on published specialised knowledge available in scientific journals. The stakeholder-centred approach can also be considered as a bottom-up approach, which involves extensive consultations with most, if not all, the relevant stakeholders. Thus, the process is semi-structured: in each of the interaction between the consultants* and the stakeholders, the process is mostly led by the stakeholders and only guided by the consultants.

The consultants chose to use this approach because they were faced with analysing multiple sectors in a very limited timeframe, which ordinarily would not have been able to be completed without an extension. The data for some of the sectors were mostly disaggregated due to a lack of organisation, which caused several difficulties.

A more accurate contextualisation of the circumstances was developed as the stakeholders were more involved and consulted. Although scientific journals are specialised peer reviewed knowledge, that might have been applicable in some way to the context or situation, the information still might not be ideal. In Guyana for example, although there were some scientific journals that could help, the information was not localised and specific to the national context since similar studies were never conducted in Guyana. The consultants therefore sought to get more localised information that would fit the circumstances instead of relying on scientific journals which would not give sufficient incite on Guyana in certain cases.

In that case, it might be necessary to build a more localised dataset that will directly reflect the national situation: that is what the consultants decided to do.

In addition, the stakeholders felt more included in the process and were therefore encouraged to increase their participation. In Guyana, the most common complaint from potential stakeholders is that they do not feel like they are involved in the process.

Many said that they are usually briefly consulted and not kept in the loop, so they do not know what the outcomes of the project are and do not get a chance to review what was done.

There were several positive outcomes to using this approach:

- The stakeholders were more willing to participate since they felt more included;
- There was a higher acceptance of the output since the report used the stakeholder views of the various sectors as a foundation;
- The most impacting economic sectors were selected based on the views and perceptions of the stakeholders that work within those domains.

* Consultants refer to those engaged by the WWF-Guyana to conduct the assessment of main threats to biodiversity in Guyana.

from stakeholders to clearly maximise simultaneously (scientific) credibility and legitimacy in the eyes of all stakeholders.

To reinforce relevance and legitimacy of the public sector, it is important to involve different Ministries other than the Ministry in charge of environment. Informing, educating and communicating, including among members of the same government, is key. Going beyond national consultations by involving regional players may also be required to prepare local implementation of actions. As one CBD National Focal Point stated during an interview:

> We thought at the start of the project that it was important that the Ministry of the Environment is not the only one involved, that it was necessary to involve the Ministry of Territorial Development (spatial planning) and the Ministry of Economy (strategic planning of productive activities). BIODEV2030 has made it possible to strengthen the ownership of these issues by the actors. Usually, before BIODEV2030, the actors were less integrated. There, they saw that other actors from other sectors are doing things and acting for biodiversity, because they are already forced to do so or in a more voluntary way. We talked and we understood that. (…) The key contribution

of BIODEV2030 is to allow to group different actors around the same table. This must continue. We need to set up a national biodiversity committee. The problem is the misunderstanding or ignorance. It is therefore necessary to strengthen IEC (information, education, communication). Some actors came to see and come back, it shows their interest. (…) Yes, there is a need for regional consultations. We did some, but not enough. We need resources and relays, such as regional focal points". (Translated by the author) (Rantonirina RAKOTOARIDERA, CBD National Focal Point for Madagascar).

Strengthening ownership of the results by stakeholders requires time

In each country, the assessment of main threats relied on a combination of three types of methods: literature review, use of the STAR metric (scores and maps) and experts' elicitation. **Conducting interviews with national experts contributed to the ownership of the results of the study**.

In the case of the approach pursued by WWF-France, it was marked by the highly participatory process of building the TORs and validating the results, where the key actors of the project were involved throughout the study. In the case of IUCN, the use of national scientific and technical experts facilitated the approval and ownership of the results. At the beginning though, the first round of offers did not match the methodological quality level expected. Overall, the time that was needed to carry out the study of the main threats took longer than expected (five to seven months, instead of three to four months).

Profile of members of the scientific and technical experts

In any study of this magnitude, it is key to have a team of scientific and technical experts with a rigorous scientific background (not necessarily in ecological sciences, as it can also be in agricultural sciences or economics, social scientists, etc.). The key skill in this study is to be able to combine different methodologies, data and datasets, and identify clearly and quickly what are their advantages and disadvantages. **Experience shows it could also be useful to have one or more expert(s) of specific economic sectors** (agriculture, mining, fishing, forestry, etc.) right from the beginning, to help establish the link between threats and biodiversity data and the sectors' practices that contribute to biodiversity erosion.

Likewise, it is also key to publish the call for tenders in the **appropriate platforms or websites** to ensure that the specific skills match what is needed at each step of the project. Ecological scientists, agronomists, natural resources economists and sectors' experts are needed in the first step of a project like BIODEV2030 (assessment of main threats to biodiversity). In particular, sector experts knowledgeable of production practices (and their internal logic and determinants) are needed when establishing the links between main threats and main (sub-)sectors, as it is a key moment before designing possible voluntary commitments.

In further steps of a 'BIODEV2030-like' project, such as discussing and negotiating with stakeholders and decision makers, the voluntary commitments and the enabling conditions (for example new public policies), cross-cutting skills in negotiation, along with strong interest for nature and biodiversity protection, will be necessary.

6 Setting the way for countries' main threats assessment

Anni Spratt/Unsplash

Inspiring other countries

The BIODEV2030 project has been a unique and unprecedented experience: mainstreaming biodiversity in key economic sectors in 16 countries following a science-based and multi-stakeholders dialogue approach.

The first step of BIODEV2030 consisted of an assessment of main threats to biodiversity, which lasted less than one year. Three methodologies – literature review and other data sources, STAR metric and experts' elicitation – were combined by teams of scientific and technical experts in each country. On the basis of the assessment, national stakeholders used several criteria to select at least two sub-sectors to move on to the next steps of the project.

The project resulted in valuable learnings not only for current BIODEV2030 countries, but also for a range of actors, such as development banks, government agencies or Ministries, scientific and technical experts and NGOs.

In particular, we learned the following:

- Combining methodologies is challenging, but with concrete guidelines, it is feasible to:
  - quickly and robustly identify and rank main threats to biodiversity at national (and if needed, sub-national) level, and
  - identify economic sectors and sub-sectors at the root of production practices exerting pressure on nature and driving those threats.

- There are cross-cutting and generic lessons but no 'one size fits all' rule. Countries are different in terms of the quality and quantity of existing data and reports, level of organisation of economic sectors, or stakeholders' willingness to commit to ambitious and science-based targets.

For those who wish to follow a similar approach, we have structured a list of steps and tools, which are linked to the recommendations of this study (see Chapter 5). Table 23 describes the step by step process: three preparation steps (referred to as P1, P2 and P3), seven steps for the identification and ranking of main threats (referred to as IR1 to IR7) and finally two steps (S1 and S2) for selecting sectors and sub-sectors.

Table 23 Overview of the proposed steps and tools based on the study's recommendations

STEPS		RECOMMENDATION NO.*	TOOL(S) AND INSPIRING GOOD PRACTICES
P	PREPARATION		
P1	– Gather all relevant data, databases, tools, academic literature, institutional and technical references at global, national and sub-national levels. – Clarify the logical articulation between steps, the strengths and limitations and validity domains of each method.	1	– Tables 1, 2, 3 and 4 as examples – Box 3 on the IUCN Red List and National Red Lists – Boxes 4, 5 and 9 on the STAR metric
P2	– Ex ante, think of the complementarity of different approaches: review of existing literature, STAR metric, experts' elicitation (on ecosystems, taxa, threats, sectors).	1	– Table 11
P3	– Consider a broad range of biodiversity values. Adopt a conceptual framework to clarifies biodiversity values and stick to it. – For example, be aware and reflect, with stakeholders, on the different societal goals such as conserving species vs. conserving ecosystem services (or nature's contributions to people) and the consequences they have on resources (human and financial) allocation.	2, 11	– IPBES, UK NEA, French NEA (Efese) programme conceptual frameworks – IPBES (2022) assessment on 'values'
IR	IDENTIFICATION AND RANKING OF MAIN THREATS		
IR1	– Use all relevant information on threatened species and on threatened ecosystems, using global or national data sources.	4, 5	– IUCN Red List, National Red List, Red List Index and The IUCN Red List of Threatened Ecosystems™
IR2	– If possible, build a transition matrix to describe land-cover changes using the IUCN Global Ecosystems Typology, to understand main forces driving them.	8	– IUCN Typology of Ecosystems, national or ESA-NASA satellite data
IR3	– Identify main threats to biodiversity mentioned in the literature (scientific, technical, institutional and government plans and strategies). – Convert the main threats identified in the literature review into the IUCN-CMP classification of threats version 3.2. – Organise the knowledge derived from the literature review using the DPSIR framework.	3	– Adapt the DPSIR framework to the situation – IUCN-CMP classification of threats version 3.2
IR4	– Calculate estimated total national STAR scores (threat-abatement and restoration scores) and map them.	6, 7	– STAR metric, IBAT, Boxes 4 and 5
IR5	– Compare STAR maps with maps on Protected Areas, KBAs, spatial distribution of main economic activities (agriculture, mining, livestock, forestry, fisheries, urban expansion, etc.)	6, 7	– STAR metric, IBAT, Boxes 4 and 5 – WDPA, WDKBA – GIS tools
IR6	– Calculate STAR scores per threat so as to rank main threats using the STAR metric but remaining aware of the associated limitations. – Take this ranking as a starting point to be challenged by the literature review and the experts 'elicitation.	6, 7	– STAR metric, IBAT, Boxes 4, 5 and 9
IR7	– Identify and invite experts (different profile than stakeholders). Include traditional knowledge holders. – Interview experts with very clear "rules of the game" (independence between them, not providing them with the prior results coming from the STAR metric to avoid bias, etc.) – Involve specialists of biodiversity but also specialists of threats, pressures, regions and specialists of the most likely impacting economic sectors. – Explore "dead angles" and/ or challenge the results coming from STAR, the literature and other sources.	9, 10, 11, 12	– Use Expert-based Threat Assessment Tool (EbTAT) (see, for example, BIODEV2030 reports for Kenya and Fiji) – See Tables 21 and 22, Figure 11

* The recommendation numbers listed in this column refer to Chapter 5.

Table 23 (continued)

STEPS	MAIN THREATS IDENTIFIED PER APPROACH	RECOMMENDATION NO.	TOOL(S) AND INSPIRING GOOD PRACTICES
S	SELECTION OF PRIORITY (SUB-)SECTORS		
S1	– Clarify whether, at national scale, stakeholders prefer focusing on species conservation (with a special attention to species threatened at global level) or on species threatened at national level and/or on some (understand which ones) ecosystem services conservation. – This analysis can help understand why stakeholders can have a tendency not to follow the assessments' conclusions when selecting sectors (for example when those assessments are too focused on species' conservation, and not enough on nature's benefit to people).	2, 11, 12	– Review of the existing national biodiversity plans, programs, policies containing biodiversity conservation targets
S2	– Once the main threats are identified and ranked, combine other criteria to select economic sub-sectors. – Build discussion between stakeholders on the ground of the science-based assessment of main threats and suggested links with main economic sectors.	11, 12	– Facilitation techniques for allowing all legitimate stakeholders to express their interests and concerns – Allow for a variety of criteria (beyond the assessment results then) to be used to select sectors for biodiversity mainstreaming – Ensure transparency regarding the reasons for this selection

Source: Author.

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Annex I — Glossary

The most frequently used concepts in BIODEV2030's first step are presented in this annex.

Aggregate impacts: Total impacts summed up across sectors and/or region are known as aggregate impacts. Measures of aggregate impacts include the total number of people affected, change in net primary productivity, number of systems undergoing change or total economic costs.

Agricultural intensification: Practices intended to produce higher crop yields without increasing cultivated land area.

Assessment of main threats to biodiversity: the aim of the first step of the BIODEV2030 project, also called the "assessment of main threats to biodiversity", is to (i) assess the current state of each country's biodiversity, (ii) identify and rank the key threats (pressures) that affect the country's state of biodiversity, (iii) identify the underlying direct and indirect drivers of those threats, and the economic sectors associated with those drivers (iv) provide recommendations to address key environmental challenges. A pragmatic approach was followed: instead of conducting a "National biodiversity and ecosystem services assessment",[32] we encouraged the simple and inexpensive use of existing tools and knowledge such as the existing literature at national level (like the National Biodiversity Strategy and Action Plans and the National Reports to the Convention on Biodiversity), The IUCN Red List of Threatened Species™, the IUCN-CMP 3.2 classification of main threats to biodiversity, the STAR metric,[33] and rounds of expert interviews. Those were the key ingredients of this BIODEV2030 first step in each of the 16 countries.

Biodiversity: "biological diversity means 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. (UN, 1992, Article 2)

Direct threats are "the proximate human activities or processes that have impacted, are impacting, or may impact the status of the taxon being assessed (e.g. unsustainable fishing or logging). Direct threats are synonymous with sources of stress and proximate pressures. Threats can be past (historical, unlikely to return or historical, likely to return), ongoing, and/or likely to occur in the future." (Salafsky et al., 2008, p. 2; IUCN, 2022b). The classification system is hierarchical and structured with three different levels, from coarse to fine scale. Each first level entry (such as Threat *2. Agriculture and aquaculture*) is subdivided into several second level entries (for example, Threats *2.1 Annual crops and non-woody perennials*, *2.2 Wood and pulp plantations*, *2.3 Livestock* and *3.4 Marine and freshwater aquaculture*); and these in turn are subdivided into third level entries (e.g. *2.1.1 Shifting agriculture*). The classifications are designed to be comprehensive, consistent and exclusive for the first and second levels. The third level, on the other hand, is on a much finer scale and therefore only contains a few illustrative examples rather than complete lists of threats and actions."(Salafsky et al. 2008, p. 7).

DPSIR (drivers, pressures, state, impact and response model of intervention) has been proposed as the reference overall conceptual framework for describing the interactions between society and the environment: adapting the DPSIR conceptual framework to this study, we relate the threats (Pressures in the DPSIR framework) in relation to their causes (Drivers) and their effect on the condition of biodiversity (State).

Endemic: Native to, and restricted to, a particular geographical region. Highly endemic species, those with very restricted natural ranges, are especially vulnerable to extinction if their natural habitat is significantly disturbed.

Ecosystem: A dynamic complex of plant, animal and microorganism communities and their non-living environment interacting as a functional unit. It is the sum total of all the abiotic and biotic processes going on in an ecosystem that transfer energy and matter

32 Guidelines by UNEP-WCMC here: National Ecosystem Assessments UNEP-WCMC

33 See Mair et al. (2021a) and Boxes 5, 6 and 10.

within and between ecosystems (e.g. biogeochemical cycles, primary production, etc.). (CBD, Art. 2, 1992).

Ecosystem restoration: Recovery of the structure, function and processes of the original ecosystem. According to IUCN (2021, p. 49), restorative actions are "actions to prevent, halt and reverse the degradation of ecosystems. Examples of restorative actions can include reducing emissions from deforestation; halting ecosystem degradation; conserving, sustainably managing and enhancing forest carbon stocks; reducing vulnerability and increasing adaptation to climate change; restoring the structure, function and composition of ecosystems, landscapes and seascapes; improving sustainability of agriculture and fisheries; and rehabilitating mined and polluted areas."

Ecosystem service: The benefits people obtain from ecosystems. These include provisioning services such as food and water production; regulating services such as flood and disease control; cultural services such as spiritual, recreational and cultural benefits; and supporting services such as nutrient cycling that maintain the conditions for life on Earth (Millennium Ecosystem Assessment, 2005).

Expert: A person who has acquired great skill through experience and/or practice. A person chosen for his proven knowledge and responsible for carrying out examinations, findings or assessments of fact (expertise).

IBAT: IBAT is the Integrated Biodiversity Assessment Tool (IBAT) resulting from a multi-institutional programme of work involving BirdLife International, Conservation International, IUCN and UNEP-WCMC. IBAT provides a basic risk screening on biodiversity. It draws together information on globally recognised biodiversity information from a number of knowledge Products: The IUCN Red List of Threatened Species, the Key Biodiversity Areas (priority sites for conservation) led by BirdLife and The World Database on Protected Areas (covering nationally and internationally recognised sites, including IUCN management categories I–VI, Ramsar Wetlands of International Importance and World Heritage sites) led by UNEP-WCMC. Through an interactive mapping tool, decision-makers are able to easily access and use this up-to-date information to identify biodiversity risks and opportunities within or close to a project boundary.[34]

IUCN Red List of Threatened Species™. Listing of the extinction risk status of the world's flora and fauna administered by IUCN. The IUCN Red List of Threatened Species™, known as the IUCN Red List, is the world's most comprehensive inventory of the global extinction risk 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.

Key Biodiversity Areas (KBA): Sites contributing significantly to the global persistence of biodiversity (IUCN, 2021).

Mainstreaming biodiversity: "(b)iodiversity mainstreaming is generally understood as ensuring that biodiversity, and the services it provides, are appropriately and adequately factored into policies and practices that rely and have an impact on it." For example, "many of the Aichi Biodiversity Targets (ABTs) are relevant to mainstreaming, namely the four (ABTs) under Goal A: ABT 1 on awareness of the value of biodiversity, ABT 2 on integrating biodiversity values into development and poverty alleviation strategies and plans (decision X/6), and national accounting systems, ABT 3 on addressing incentives, including subsidies, harmful to biodiversity and creating positive ones; and ABT 4 on promoting sustainable consumption and production as well as many other that have linkages to specific economic sectors, such as for instance ABT 6 (sustainable management of fisheries), ABT 7 (agriculture, aquaculture and forestry)…" And it is worth noting that: "At the fourteenth Conference of the Parties (COP 14), a long-term strategic approach to mainstreaming (LTAM) was established. Parties to the Convention and numerous stakeholders have already undertaken significant efforts and made progress in mainstreaming biodiversity but recognize the importance to make further progress, namely to have the mainstreaming of biodiversity implemented by governments, the private sector, indigenous peoples and local communities, and other major groups and stakeholders across cross-cutting and sectorial

34 To discover IBAT, create an account on: https://www.ibat-alliance.org/. Country profiles are also available on IBAT: https://www.ibat-alliance.org/country_profiles. IBAT organises regular webinars and trainings for users to get familiar with the tool. To arrange a training, please contact ibat@ibat-alliance.org

policies. To facilitate this LTAM, the Parties decided (decision 14/3) to "establish an Informal Advisory Group on Mainstreaming of Biodiversity, to advise the Executive Secretary and the Bureau on further development of the proposal for a long-term approach to mainstreaming biodiversity (…)". (CBD Secretariat [website])

Nature-based Solutions (NbS): Actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits (WCC-2016-Res-069-EN).

Species: A group of interbreeding individuals with common characteristics that produce fertile (capable of reproducing) offspring and which are not able to interbreed with other such groups, that is, a population that is reproductively isolated from others.

Stakeholder: Stakeholders are people or organizations who either (a) stand to be affected by the project or (b) could 'make or break' the project's success. They may be winners or losers, included or excluded from decision-making, users of results, participants in the process. (World Bank, n.d., Guidance Note: Stakeholder Analysis)

STAR metric: STAR stands for the "Species Threat Abatement and Restoration". It is a spatially explicit metric based on the IUCN Red List data. STAR scores are currently calculated based on the data of mammal, birds and amphibian species classified as Near Threatened (NT), Vulnerable (VU), Critically endangered (CR) and Endangered (EN) species. The scores quantify the relative contribution that actions to abate threats or restore natural habitat could make towards reducing the extinction risk of species globally.[35]

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.

35 See Mair et al. (2021a).

Annex II – Economic indicators of the 16 BIODEV2030 pilot countries

Current and past gross domestic product (GDP) and GDP per capita levels

The GDP, i.e. the size of the economy that partially depends on population size, is also a key indirect driver of biodiversity loss at national level, through increased (natural) resources use (Otero et al., 2020). The latter is true even if (a growing share of) imports do contribute to GDP growth and not to the impacts on biodiversity at national level. A higher GDP is obtained through a combination of higher domestic consumption, more investments, more government expenditures and more exports, all factors reinforcing domestic production, which is a good thing in terms of development, but that can have, *ceteris paribus*, negative consequences for biodiversity if environmental damages of growth remain unaccounted for.

Table 24 shows that in the 40 years period between 1980 and 2020, the GDP has been multiplied by a factor comprised between 2.1 (Fiji) and 12.9 (Viet Nam) and nine out of the 16 countries have experienced a multiplication by four. In the 2000-2020 period, the GDP growth accelerated, (compared with the 1980–2000) in all but four countries (Congo, Fiji, Tunisia and Viet Nam).

GDP per capita is also a key indirect driver of biodiversity loss as it shapes the level of individual consumption and the types of consumed and demanded goods and services. For example, when GDP per capita increases, so does meat consumption (Sans & Combris, 2015) and the meat production systems' impacts on biodiversity can be significant. Considering those possible correlations, we note that the IMF data reveal that between 1980 and 2020, GDP per capita has been multiplied by a factor comprised between 0.6 (a reduction occurred in Madagascar) and 7.2 (Viet Nam). It only decreased in Gabon and Madagascar, and doubled or more in seven out of 15 countries.

Future national development pathways will surely be contrasted among the 16 countries, and they will potentially differ from the past and known patterns of the today's developed countries. However, if GDP growth remains coupled with biodiversity loss at national scale, the GDP is an important indicator to consider, if only to raise awareness and prepare and implement policies to decouple more effectively economic growth from biodiversity and ecosystem erosion.

Table 25 shows some indicators related to the relative importance of the primary sectors (agriculture, forestry and fishing) in the 16 countries' economies (share of GDP and total employment).

Future population growth will make GDP grow and with this structure of economy (relative importance of primary sectors relying on land activities), the land uses related impacts on biodiversity might grow.

Table 24 Current and past GDP and GDP per capita in 1980, 2000 and 2020

COUNTRY	GDP (CONSTANT PRICES, NATIONAL CURRENCY) (IN BILLIONS)*				GDP PER CAPITA (GDP IS EXPRESSED IN CONSTANT INTERNATIONAL (2017) DOLLARS PER PERSON)**			
	2020	RATIO 1980–2000	RATIO 2000–2020	RATIO 1980–2020	2020	RATIO 1980–2000	RATIO 2000–2020	RATIO 1980–2020
Benin	8 706	1.8	2.4	4.3	3 317	1.0	1.3	1.3
Burkina Faso	9 052	2.3	3.0	6.8	2 158	1.3	1.7	2.2
Cameroon	16 609	1.6	2.2	3.4	3 496	0.9	1.3	1.1
Congo	3 936	2.4	1.2	2.8	4 029	1.3	0.7	1.0
Ethiopia	1 990	1.7	5.4	9.0	2 757	0.9	3.6	3.2
Fiji	9	1.7	1.3	2.1	11 408	1.3	1.1	1.5
Gabon	5 642	1.4	1.6	2.2	15 123	0.9	0.9	0.8
Guinea	72 256	2.0	2.5	5.0	2 514	n.a.	1.6	n.a.
Guyana	1 498	1.2	2.5	2.9	18 671	1.2	2.4	2.8
Kenya	8 715	1.8	2.3	4.1	4 793	1.0	1.4	1.3
Madagascar	20 542	1.2	1.6	2.0	1 436	0.7	0.9	0.6
Mozambique	667	1.9	3.4	6.5	1 230	1.2	2.0	2.4
Senegal	13 368	1.8	2.2	3.8	3 321	1.0	1.3	1.3
Tunisia	67	2.3	1.6	3.7	9 615	1.5	1.3	2.0
Uganda	126 836	2.6	3.4	8.6	2 457	1.3	1.8	2.4
Vietnam	4 987 554	3.7	3.5	12.9	10 332	2.5	2.9	7.2

* Base year is country specific.
** Data are derived by dividing constant price purchasing-power parity (PPP) GDP by total population.

Source: IMF (2021).

Table 25 Relative importance of agriculture, forestry and fisheries sectors in the economy (percentage of total GDP (left) and employment (right))

	PERCENTAGE OF TOTAL GDP				EMPLOYMENT					
COUNTRY	1980 %	2000 %	2020 %	COUNTRY	1980		2000		2019	
					MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Benin	35	24	27	Benin	n.a.	n.a.	54	42	46	30
Burkina Faso	28	25	20	Burkina Faso	n.a.	n.a.	84	76	30	21
Cameroon	29	17	15	Cameroon	n.a.	n.a.	63	70	40	48
Congo	12	5	9	Congo	n.a.	n.a.	40	44	35	32
Ethiopia	54.7 (in 1981)	45	35	Ethiopia	n.a.	n.a.	83	68	73	59
Fiji	20	15	15	Fiji	n.a.	n.a.	34	24	22	8
Gabon	7	6	6	Gabon	n.a.	n.a.	28	59	21	46
Guinea	23.8 (in 1986)	21	24	Guinea	n.a.	n.a.	67	76	59	62
Guyana	21	30	17	Guyana	n.a.	n.a.	31	11	20	8
Kenya	28	29	35	Kenya	n.a.	n.a.	40	58	50	59
Madagascar	35 (in 1995)	31	24	Madagascar	n.a.	n.a.	75	79	68	60
Mozambique	34.4 (in 1991)	19	26 (in 2019)	Mozambique	n.a.	n.a.	71	91	60	80
Senegal	19	16	16	Senegal	n.a.	n.a.	47	44	34	25
Tunisia	14	10	12	Tunisia	n.a.	n.a.	20	23	15	9
Uganda	72	28	24	Uganda	n.a.	n.a.	63	77	68	77
Vietnam	40.2 (in 1985)	25	15	Vietnam	n.a.	n.a.	64	66	36	38
Agriculture, forestry and fishing, value added (% of GDP) (World Bank, 2021)				Employment in agriculture, female (% of female employment) and male (% of male employment) (modelled ILO estimate) (World Bank, 2021)						

Source: World Bank (2021)

Annex III – Ecological indicators in the 16 BIODEV2030 pilot countries

It is useful to recall that "confidence intervals (shown in grey) are calculated to consider the number of Data Deficient species in each group and the uncertainty over exactly when changes in status occurred, given that assessments are repeated only at multi-year intervals, and therefore the precise value for any particular year is uncertain." (IUCN, 2022a [website]).

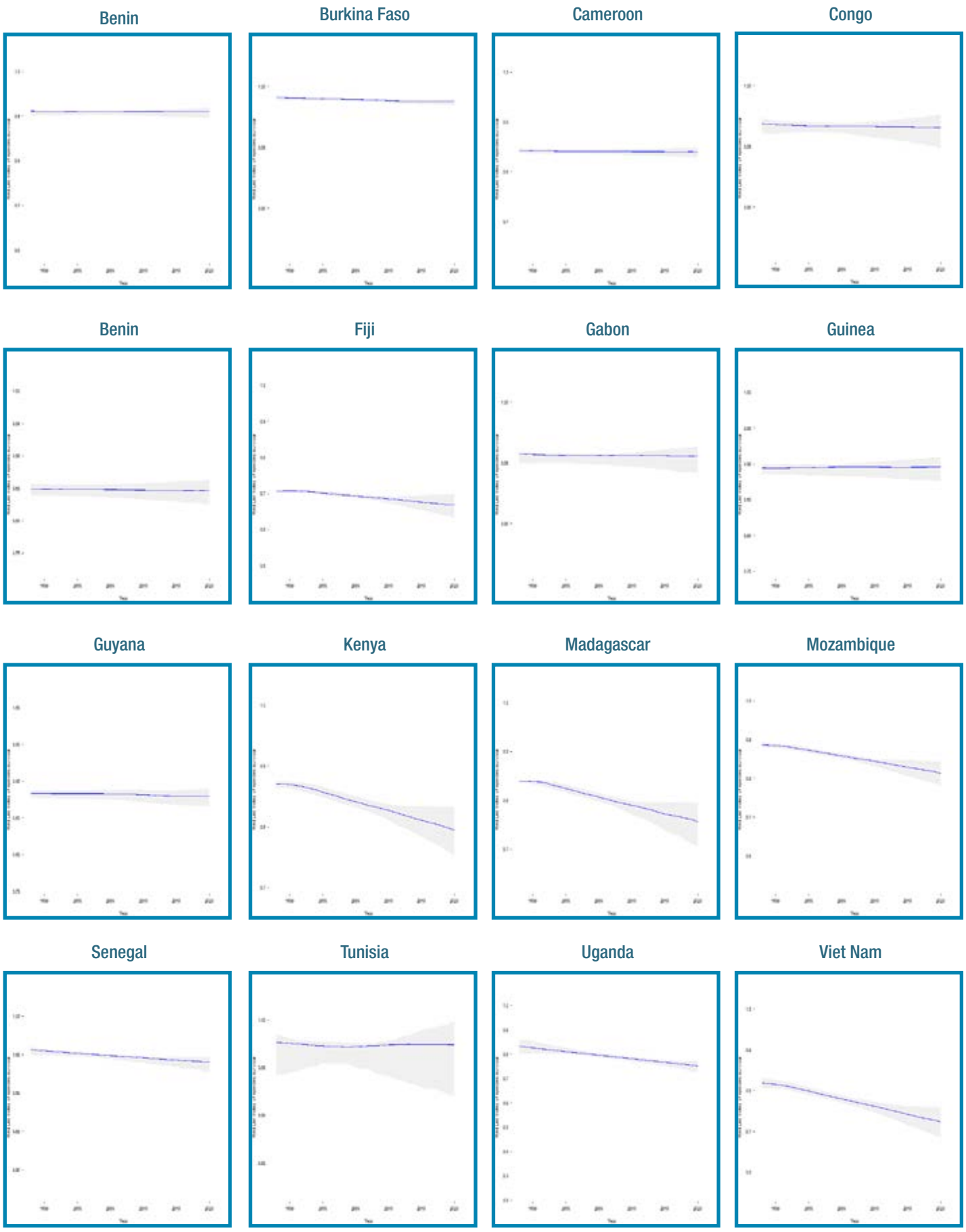
According to Brooks (2022) (pers. comm.), "the global RLI downscaled to national levels is a robust indicator of national performance in contributing towards global goals, because those species with only marginal distributions in the country count for very little (because of the weighting for % range in country), whereas endemic count very highly".

Table 26 Number and coverage of protected areas and threatened species in the 16 BIODEV2030 countries

COUNTRY	TOTAL NUMBER OF PROTECTED AREAS	TERRESTRIAL PROTECTED AREAS COVERAGE (%)	MARINE PROTECTED AREAS COVERAGE (%)	TOTAL PROTECTED AREAS COVERAGE (%)	NUMBER OF SPECIES ASSESSED	NUMBER OF THREATENED SPECIES (VU, EN, CR)	PERCENTAGE OF THREATENED SPECIES (VU, EN, CR) AMONG ASSESSED SPECIES (%)
Benin	64	29.6	0	23.5	2 773	127	4.6
Burkina Faso	112	16.4	0	16.4	1 404	46	3.3
Cameroon	49	11.0	10.9	11.0	5 386	935	17.4
Congo	34	36.8	3.1	33.3	3 319	167	5.0
Ethiopia	100	16.1	0.0	16.1	2 615	198	7.6
Fiji	146	5.4	0.9	1.0	2 837	346	12.2
Gabon	62	22.4	28.8	25.1	3 672	344	9.4
Guinea	126	35.8	0.5	24.9	3 502	391	11.2
Guyana	5	8.5	0.0	5.2	3 736	126	3.4
Kenya	411	12.4	0.8	10.6	5 764	652	11.3
Madagascar	171	7.5	0.9	3.1	7 737	3 058	39.5
Mozambique	58	29.5	2.2	18.0	5 436	492	9.1
Senegal	127	25.4	1.1	14.6	2 980	170	5.7
Tunisia	148	7.9	1.0	5.2	1 556	129	8.3
Uganda	711	16.1	0.0	16.1	3 426	306	8.9
Vietnam	209	7.6	0.6	2.9	6 534	764	11.7

Source: IBAT (n.d., Country profiles).

Figure 12 **Red List Index for the 16 BIODEV2030 countries.** Source: IUCN Red List Index.



Annex IV – Clouds of words generated from the BIODEV2030 reports

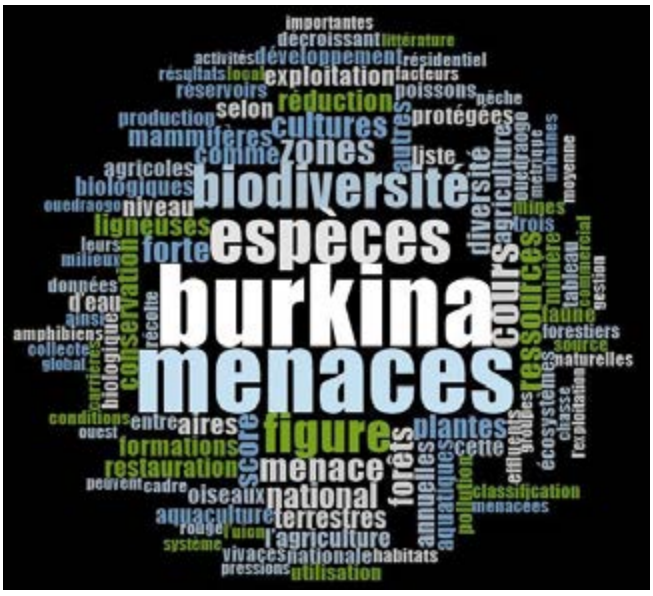
The NVivo tool was used to generate clouds of words containing the most frequently used words in the reports. The inputs came from:

- eight BIODEV2030 reports for the eight "IUCN" countries: Benin, Burkina Faso, Guinea, Ethiopia, Fiji, Kenya, Mozambique, Senegal.
- seven BIODEV2030 reports for seven out of the eight "WWF-France" countries: Cameroon, Gabon, Guyana, Madagascar, Tunisia, Uganda, Viet Nam. The report for Congo was missing at the moment of the analysis.

Thus, there were 15 reports from which generated 15 clouds of words (and its associated Table 28). Figures 13 to 21 show the clouds of words and their associated table with the 20 most frequent words.

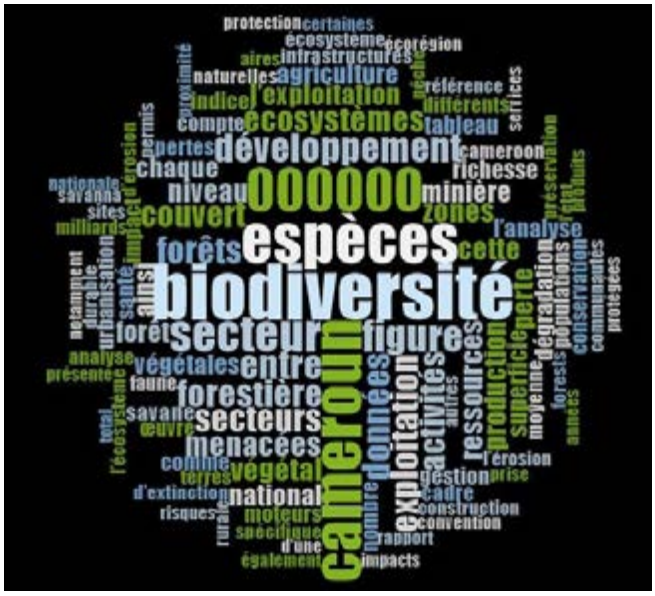
Figure 13 Benin and Burkina Faso – Clouds of words for the BIODEV2030 reports.
Sources: BIODEV2030 report on Benin and Burkina Faso (2021).

Artwork by Mariana Saba (IUCN).



Artwork by Mariana Saba (IUCN).

Figure 14 Cameroon and Ethiopia – Clouds of words for the BIODEV2030 reports.
Sources: BIODEV2030 report on Cameroon and Ethiopia (2021).

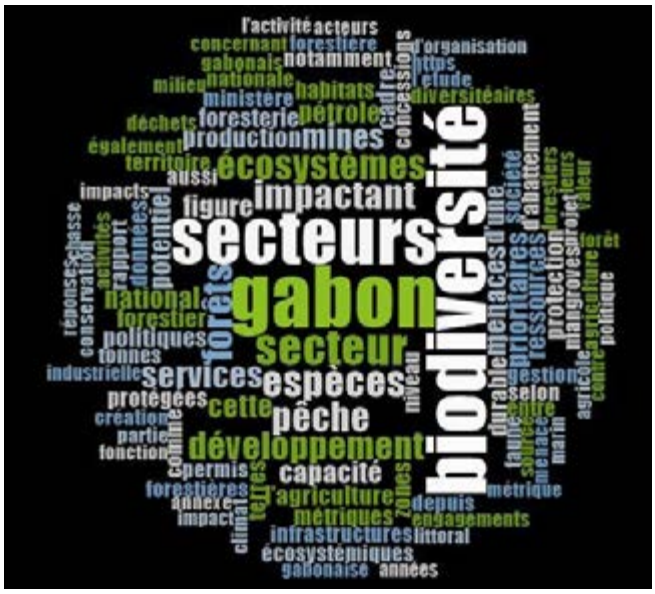


Artwork by Mariana Saba (IUCN).

Artwork by Mariana Saba (IUCN).

Figure 15 Fiji and Gabon – Clouds of words for the BIODEV2030 reports.
Sources: BIODEV2030 report on Fiji and Gabon (2021).

Artwork by Mariana Saba (IUCN).



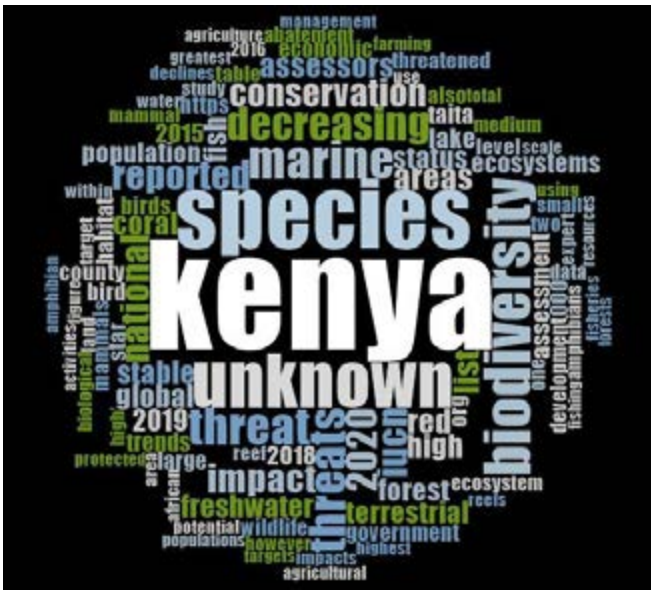
Artwork by Mariana Saba (IUCN).

Figure 16 Guinea and Guyana – Clouds of words for the BIODEV2030 reports.
Sources: BIODEV2030 report on Guinea and Guyana (2021).

Artwork by Mariana Saba (IUCN).

Artwork by Mariana Saba (IUCN).

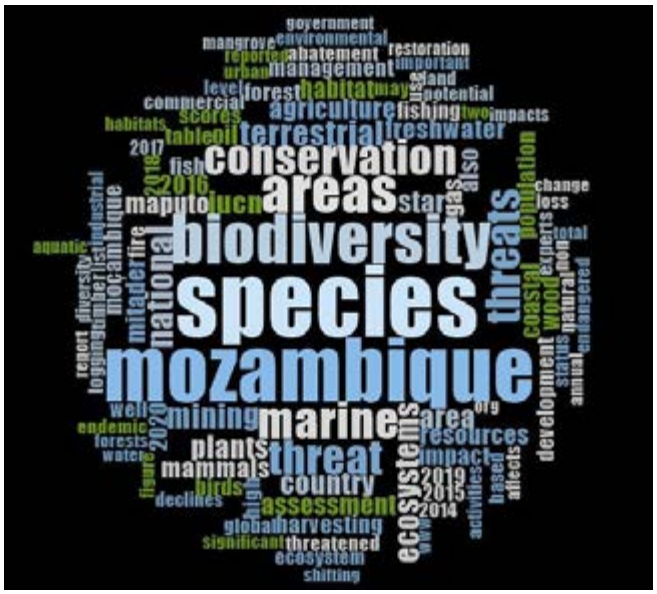
Figure 17 Kenya and Madagascar – Clouds of words for the BIODEV2030 reports.
Sources: BIODEV2030 report on Kenya and Madagascar (2020).



Artwork by Mariana Saba (IUCN).

Artwork by Mariana Saba (IUCN).

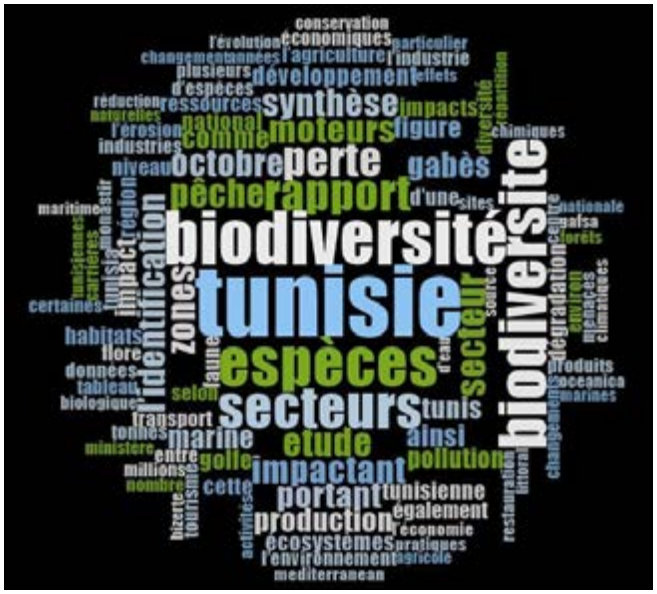
Figure 18 Mozambique and Senegal – Clouds of words for the BIODEV2030 reports.
Sources: BIODEV2030 report on Mozambique and Senegal (2021).



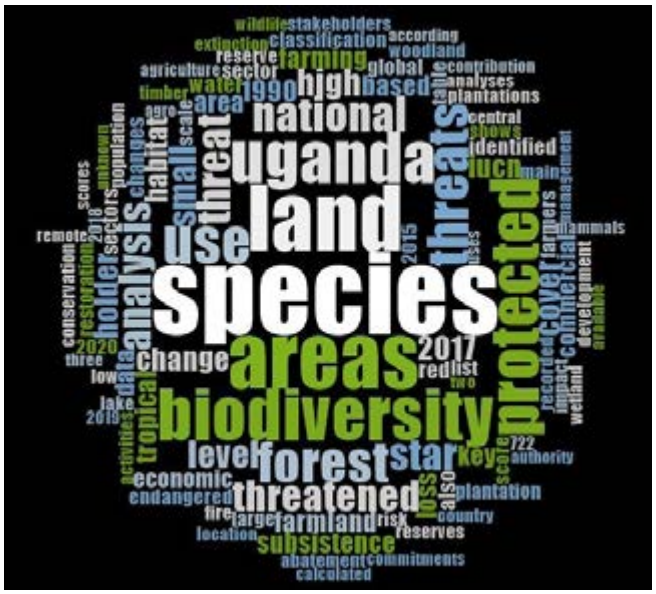
Artwork by Mariana Saba (IUCN).

Artwork by Mariana Saba (IUCN).

Figure 19 Tunisia and Uganda – Clouds of words for the BIODEV2030 reports.
Sources: BIODEV2030 report on Tunisia and Uganda (2021).

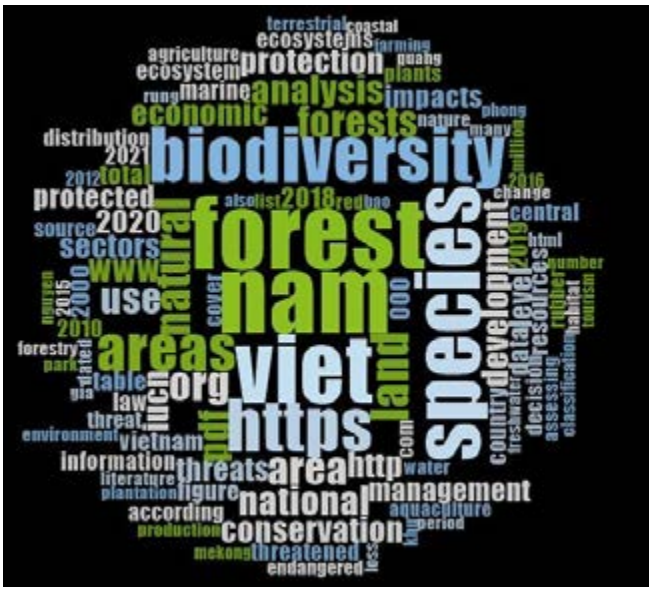


Artwork by Mariana Saba (IUCN).



Artwork by Mariana Saba (IUCN).

Figure 20 Viet Nam – Clouds of words for the BIODEV2030 reports.
Source: BIODEV2030 report on Viet Nam (2021).



Artwork by Mariana Saba (IUCN).

Table 27 21 most frequent words in the 15 (out of 16) BIODEV2030 reports

RANK	BENIN	BURKINA FASO	CAMEROON	ETHIOPIA	FIJI	GABON	GUINEA	GUYANA
1	espèces	Burkina	biodiversité	species	Fiji	Gabon	Guinée	sector
2	Bénin	menaces	Cameroun	Ethiopia	species	biodiversité	espèces	biodiversity
3	menaces	espèces	espèces	biodiversity	threats	secteurs	menaces	Guyana
4	figure	biodiversité	000000	threat	biodiversity	secteur	biodiversité	mining
5	biodiversité	figure	secteur	areas	marine	espèces	menace	forests
6	forêts	cours	figure	star	threat	forêts	écosystèmes	sectors
7	faible	zones	développement	threats	areas	impactant	ressources	impact
8	conservation	menace	entre	ecosystem	IUCN	pêche	autres	figure
9	moyen	forte	données	national	forest	écosystèmes	infrastructures	oil
10	liste	ressources	exploitation	IUCN	level	développement	diversité	ecosystems
11	écosystèmes	cultures	forestière	endemic	terrestrial	services	tableau	change
12	niveau	forêts	secteurs	area	native	mines	habitats	activities
13	rouge	national	forêts	total	figure	cette	selon	coastal
14	zones	score	couvert	forest	list	menaces	cette	results
15	selon	plantes	activités	country	STAR	prioritaires	forestière	criteria
16	forte	diversité	écosystèmes	livestock	expert	capacité	score	ecosystem
17	UICN	aires	menacées	ecosystems	table	figure	figure	development
18	experts	ligneuses	zones	mammals	loss	national	exploitation	agriculture
19	global	réduction	ressources	birds	invasive	potentiel	liste	conservation
20	faune	comme	végétal	based	national	pétrole	zones	tourism
21	menace	conservation	production	assessment	assessment	ressources	transport	impacts

Table 27 (continued)

RANK	KENYA	MADAGASCAR	MOZAMBIQUE	SENEGAL	TUNISIA	UGANDA	VIETNAM
1	Kenya	Madagascar	species	espèces	Tunisie	species	forest
2	species	biodiversité	Mozambique	Sénégal	biodiversité	land	species
3	unknown	secteurs	biodiversity	menaces	espèces	areas	biodiversity
4	biodiversity	secteur	areas	biodiversité	biodiversite	biodiversity	https
5	marine	données	marine	écosystèmes	secteurs	Uganda	areas
6	threats	forêts	conservation	comme	rapport	protected	natural
7	threat	rapport	threats	zones	perte	use	forests
8	decreasing	figure	threat	cette	secteur	threats	analysis
9	2020	production	national	menace	etude	forest	national
10	IUCN	prioritaires	terrestrial	ressources	zones	national	development
11	reported	espèces	ecosystems	réduction	pêche	threat	conservation
12	impact	pêche	mining	dégradation	impactant	analysis	economic
13	national	diagnostic	IUCN	conservation	moteurs	STAR	protection
14	conservation	zones	plants	diversité	l'identification	threatened	sectors
15	areas	sélection	country	figure	synthèse	level	threats
16	list	écosystèmes	area	exploitation	octobre	small	level
17	red	l'érosion	star	faune	portant	high	protected
18	assessors	humides	agriculture	fleuve	gabès	cover	management
19	high	engagements	assessment	national	production	2017	impacts
20	coral	moteurs	Maputo	flore	marine	holder	total
21	terrestrial	conservation	resources	score	impact	change	resources

We also wanted to analyse all the reports at the same time (the fictive aggregation of the 15 reports) but some reports are written in French and other in English.[36] As the NVivo software is language sensitive, we had to follow another strategy. Since it was neither relevant nor possible to generate a cloud of words for the 15 reports taken all together, we have generated:

– a single cloud of words for the eight reports written in French (Benin, Burkina Faso, Guinea, Senegal, Cameroon, Gabon, Madagascar, Tunisia) (Figure 21); and
– a single cloud of words for the seven reports written in English (Ethiopia, Fiji, Kenya, Mozambique, Guyana, Uganda, Viet Nam) (Figure 22).

Figure 21 **Clouds of words for the eight reports in French.** Sources: BIODEV2030 country reports.

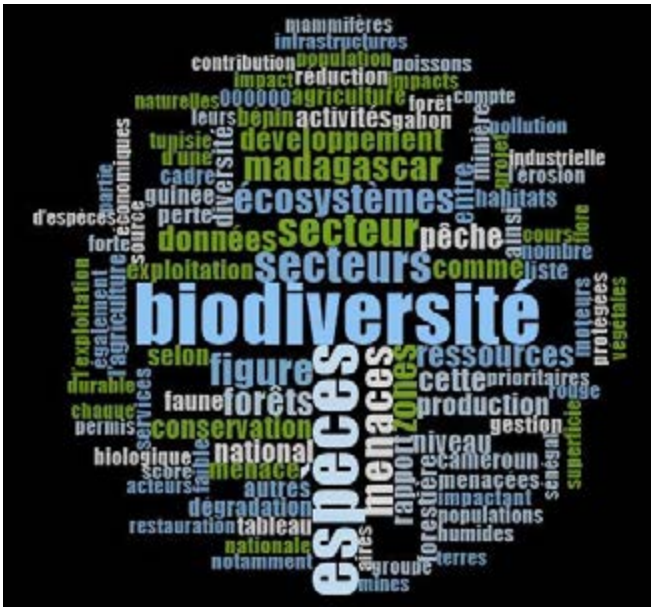
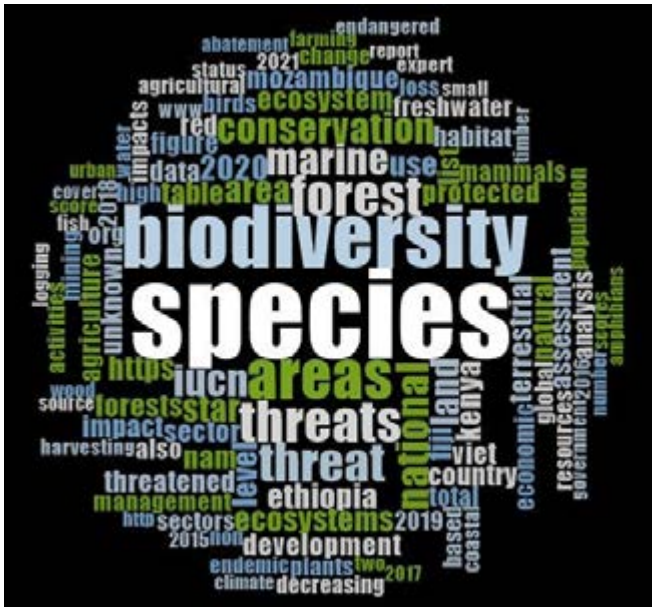


Figure 22 **Clouds of words for the eight reports in English.** Sources: BIODEV2030 country reports.



Artwork by Mariana Saba (IUCN).

36 In IUCN-operated countries, four reports are written in French – Benin, Burkina Faso, Guinea, Senegal – and four are written in English – Ethiopia, Fiji, Kenya, Mozambique. Of the eight countries operated by WWF-France, four reports are written in French – Cameroon, Gabon, Madagascar, Tunisia) and three are in English – Guyana, Uganda, Viet Nam. Thus, In total, there are eight reports were written in French and seven in English.

Table 28 20 most frequent words in different sub-sets of BIODEV2030 reports

RANK	REPORTS IN FRENCH (8)	REPORTS IN ENGLISH (7)	REPORTS IN ENGLISH		REPORTS IN FRENCH	
			IUCN (4)	WWF-FR (3)	IUCN (4)	WWF-FR (4)
1	biodiversité	species	species	species	espèces	biodiversité
2	espèces	biodiversity	biodiversity	biodiversity	menaces	secteurs
3	secteurs	areas	threats	forest	biodiversité	secteur
4	menaces	threats	areas	areas	écosystèmes	espèces
5	secteur	forest	marine	sector	figure	Madagascar
6	figure	national	Kenya	forests	menace	figure
7	écosystèmes	marine	national	national	Bénin	forêts
8	Madagascar	IUCN	Ethiopia	analysis	zones	données
9	zones	conservation	conservation	protected	Guinée	écosystèmes
10	forêts	land	Mozambique	sectors	ressources	développement
11	ressources	area	forest	natural	comme	pêche
12	données	STAR	unknown	threats	diversité	production
13	pêche	Kenya	terrestrial	development	conservation	zones
14	développement	2020	ecosystems	conservation	liste	rapport
15	conservation	level	assessment	economic	réduction	Cameroun
16	production	Ethiopia	level	level	forêts	ressources
17	national	use	ecosystem	impacts	score	Gabon
18	rapport	ecosystems	mammals	change	niveau	moteurs
19	niveau	ecosystem	impact	figure	Sénégal	national
20	diversité	terrestrial	decreasing	threatened	Burkina	activités

Sources: BIODEV2030 country reports.

Annex V – Other tools used in BIODEV2030 reports

Table 29 Other tools used in the reports of eight countries operated by IUCN

BENIN	BURKINA FASO	ETHIOPIA	FIJI	GUINEA	KENYA	MOZAMBIQUE	SENEGAL
– Global Tree Search – Atlas hydrologique du Bénin – Biodiversity Atlas of West Africa – Flore analytique du Bénin – Inventaire des reptiles de la région de la Réserve de Biosphère Transfrontalière du W – The Birds of Benin and Togo – Lezards, Crocodiles et tortues d'Afrique occidentale et du Sahara	– IUCN standard for KBA identification – Rapport IUCN on STAR for Burkina Faso (before Mair et al. (2021a)	– Mammal Species List (2021) – AmphibiaWeb – The Reptile database (2021) – Bird Checklist of the World (2021) – Birdlife Data zone: Ethiopia at a glance – FishBase (2021): all fishes reported for Ethiopia – Atlas of distribution of birds of Ethiopia and Eritrea – Atlas of the potential vegetation in Ethiopia (2010) – Catalogue of the mammals of Ethiopia and Eritrea. Revised checklist, zoogeography and conservation (1996)	– A directory of wetlands in Oceania (1993) – IUCN (2016) Guidelines for the Appropriate Use of the IUCN Red List for Business	– Zones agro-écologiques de Guinée (AFD) – Interview of a University Professor – Guide de reconnaissance des espèces d'intérêt commercial – Dictionnaire encyclopédique de la diversité biologique	– Annotated checklists of Mammals, freshwater fishes in Kenya – FishBase: all fishes reported from Kenya – Amphibian Species of the World (2020) – Amphibiaweb (2020) – Kenya Birds Checklist AVIBASE – Bird Checklist of the World – Birdlife, Datazone: East Asia/Africa flyway – Global Forest Watch (2020) – Marine regions of the world (2020) – Kenya Wetlands Atlas (2012) – Kenya Biodiversity Atlas (2015) – Birdlife: Monitoring important bird areas, a global framework – Digital Observatory for Protected Areas 3. European commission JRC (2018).	– Seagrass Atlas of the World (2003) – Checklists of vernacular plant names, of vertebrates and of mammals in Mozambique – World Atlas of Mangroves and of coral reefs – Vegetation Map of the Flora Zambesiaca Area, 1:2 000 000 (1968) – Birdlife, datazone: sea birds – Avibase – Fishbase – Sealifebase – The Atlas of Birds of Sul do Save, Southern Mozambique – GFRA (FAO, 2010)	– Annuaire sur l'environnement et les ressources naturelles du Sénégal – IUCN 2016 Standard for KBA identification

Sources: BIODEV2030 country reports.

Table 30 Other tools used in the reports of eight countries operated by WWF-France

CAMEROON	CONGO	GABON	GUYANA	MADAGASCAR	UGANDA	TUNISIA	VIET NAM
– Atlas 2007–20 Forestier du Cameroun – Atlas des Reptiles du Cameroun, 2007 – Herbier de KEW (Royal Botanical Gardens) – Carte 2016 d'occupation des sols du Cameroun – Cartes 2015 d'abondance spécifique moyenne (MSA) – Red Data Book, 2011 – IUCN 2017 Species Richness and Range Rarity Data – Global Forest Watch Méthode LCCS, FAO – Global Forest Watch Landsat 8 – GLOBIO4 – Herbier national du Cameroun – Herbier Tropenbos de Kribi – 37 tomes de la flore du Burundi, Cameroon, Congo, Gabon, et Rwanda – FWTA et FTEA – Méthode GLAD	– Atlas Forestier du Congo – Altas interactif de la CICOS – Référentiel Géographie Routier du Congo – HCV Mapping for Congo basin forests – Atlas UN Biodiversity Lab – Platform Forland – Local Biodiversity Intactness Index (LBII)	– Global Forest Watch – Observation du COMIFAC – Plateforme Plan National d'Affectation des Terres – Cartes du Gabon et des zones climatiques du Gabon, Atlas de l'Afrique, 2004 – Atlas Forestier du Gabon – World Mangrove Atlas, 1997 – Approches HCV, HCS (standard Greenpeace) – Global IFL (Paysages Forestiers Intacts) map – Cartes AGEOS nationales	– A directory of wetlands in Oceania (1993) – The GEF remote sensing analysis – Landscape Integrity Index – The GEF: least carbon storage, threatened species richness, biodiversity intactness, forest cover loss (2000-2017) – Global Wetlands v4 (CIFOR) – Google Earth	– Zones agro-écologiques de Guinée (AFD) – Will, Margret. *Manuel d'agriculture contractuelle*, 2014. – Landsat 8 – Moat, Justin et P. Smith. "Atlas of the vegetation of Madagascar". Kew, UK: R Bot. Gard, 1 January 2007. – Royal Botanic Gardens, Kew Auteur. Atlas of the vegetation of Madagascar. UK, 2007. – FAO, Base de données FAOLEX, 2021. – CIRAD, EtcTErra, ONE, WCS, FRB, et FFEM. "Maps". BioScene Mada. – Portail REBIOMA, WCS Madagascar – Atlas des récifs coraliens de France Outre-Mer – Association Vahatra, "Aires protégées terrestres de Madagascar" – Couverture terrestre de l'ICC (Climate Change Initiative) – Global Forest Watch	– National Forest Authority (NFA) dataset – Remote sensing imagery via Google Earth (protected areas)/Landsat 8	– Seagrass Atlas of the World (2003) – Le Floc'h Edouard, Loutfy Boulos et Errol Véla, 2010. Catalogue synonymique comment de la flore de Tunisie, Tunis, Ministère de l'Environnement et du Développement Durable, 2010. – Fennae, M., Ibn Tattoun, M., El Oualidi, J. 2014. Flore pratique du Maroc Vol. 3. – Hughes J. M. R., MAmouri F., Hollis T., Avis C. & Ayache F., 1997. Inventaire des zones humides tunisiennes. Direction Générales des Forêts. – Zenetos, A., Gofas, S., Russo, G. & Templado, J. 2003. CIESM Atlas of Exotic Species in the Mediterranean. Vol. 3: Molluscs. F. Briand (ed.), CIESM Publ., Monaco – FAO, FAOSTAT	– GBIF. 2021. Data occurences for Viet Nam. www.gbif.org – Le, K.K., Vo, V.C. & Vu, V.C. (eds). 1969–1976. Common plants in Viet Nam. Vols 1-6. Hanoi: Publishing House for Science and Technology. – Nguyen, N.T. 1997. Manuel on Research of Biodiversity. Agricultural Publishing House. Hanoi. – Nguyen. T.B. (ed.) et al., 2005. Checklist of Plant Species of Viet Nam. Vols. 2–3. Hanoi: Agriculture Publishing House. – Pham-Hoang. H., 1991–1993. An illustrated Flora of Viet Nam. Vols 1–3. Mekong Printing Canada. – Pham-Hoang, H., 1999–2000. An illustrated Flora of Vietnam. Ed. 2. Vols 1–3. Tre Publishing House. – Vu, V.D. (ed.). 1996. Viet Nam Forest Trees. Hanoi: Agriculture Publishing House. – Regional Land Cover Monitoring System, SERVIR-Mekong project – European Space Agency Climate Change Initiative (ESA CCI) land use and cover maps, 2015 – Amphibia Web & Reptilia Database

Sources: BIODEV2030 country reports.

Annex VI – Components of biodiversity assessed in the BIODEV2030 reports

Table 31 Components of national biodiversity assessed in the BIODEV2030 reports

COUNTRY	STATE OR INVENTORY OF TERRESTRIAL SPECIES	STATE OF TERRESTRIAL ECOSYSTEMS	STATE OF MARINE AND COASTAL SPECIES AND ECOSYSTEMS	STATE OF GENETIC DIVERSITY
Benin	Yes (mammals, birds, reptiles, amphibians, fishes (freshwater and seawater), plants, fungi, insects)	Yes	Yes	No
Burkina Faso	Yes (mammals, birds, reptiles, amphibians, vascular plants)	Yes	No	No
Cameroon	Yes (mammals, birds, amphibians)	Yes	Yes	No
Congo	n.a.	n.a.	n.a.	n.a.
Ethiopia	Yes (mammals, birds, reptiles, amphibians, fishes, plants)	Yes	No	No
Fiji	Yes (mammals, birds, amphibians, reptiles, terrest. molluscs, fishes (freshwater and seawater), plants)	Yes	Yes (including in the STAR metric extended to marine species)	No
Gabon	No	Yes	Yes	No
Guinea	Yes (mammals, birds, reptiles, amphibians, fishes (freshwater and seawater), plants, fungi, insects)	Yes	Yes	No
Guyana	No	No	No (threats to marine ecosystems but not their state)	No
Kenya	Yes (mammals, birds, reptiles, amphibians, fishes, plants)	Yes	Yes (incl. coral reefs)	No
Madagascar	No	Yes	Yes	No
Mozambique	Yes (mammals, birds, reptiles, amphibians, fishes, plants)	Yes	Yes	No
Senegal	Yes (fauna, flora)	Yes	Yes	No
Tunisia	Yes (via the link to IUCN Red List of STAR)	Yes	No (threats to marine ecosystems but not their state)	No
Uganda	Yes (mammals, birds, amphibians, reptiles, fishes)	Yes (via land cover and land use changes)	No	No
Vietnam	Yes (mammals, birds, reptiles, amphibians, fishes, vascular plants)	Yes	Yes	No

Sources: Author based on BIODEV2030 country reports.

Annex VII – Top 10 (Level 2) Threats based on STAR scores in five BIODEV2030 countries

Table 32 Benin – Top 10 (Level 2) Threats according to the country's STAR scores

TOP 10 (LEVEL 2) THREATS	BENIN	
	STAR RESTORATION SCORE	STAR THREAT ABATEMENT SCORE
Annual & perennial non-timber crops	514	2 119
Hunting & collecting terrestrial animals	457	1 851
Livestock farming & ranching	346	1 813
Logging & wood harvesting	239	994
Work & other activities	127	710
Agricultural & forestry effluents	139	559
Housing & urban areas	96	279
Dams & water management/use	150	191
Fire & fire suppression	47	140
Droughts	26	146

Sources: Based on BIODEV2030 report on Benin, with contributions from Philippe Puydarrieux and IBAT.

Table 33 Burkina Faso – Top 10 (Level 2) Threats according to the country's STAR scores

TOP 10 (LEVEL 2) THREATS	BURKINA FASO	
	STAR RESTORATION SCORE	STAR THREAT ABATEMENT SCORE
Hunting & collecting terrestrial animals	1 448	2 044
Livestock farming & ranching	1 135	1 402
Annual & perennial non-timber crops	623	1 176
Agricultural & forestry effluents	794	845
Work & other activities	601	409
Logging & wood harvesting	159	421
Housing & urban areas	202	281
Droughts	166	293
War, civil unrest & military exercises	54	369
Dams & water management/use	47	132

Sources: Based on BIODEV2030 report on Burkina Faso, with contributions from Philippe Puydarrieux and IBAT.

Table 34 Ethiopia – Top 10 (Level 2) Threats according to the country's STAR scores

TOP 10 (LEVEL 2) THREATS	ETHIOPIA	
	STAR RESTORATION SCORE	STAR THREAT ABATEMENT SCORE
Annual & perennial non-timber crops	3 588 698	272 725
Livestock farming & ranching	11 845 563	259 793
Housing & urban areas	1 797 064	119360
Agricultural & forestry effluents	1 573 802	25 581
Habitat shifting & alteration	369 760	28 266
Logging & wood harvesting	57 557	156 506
Fire & fire suppression	37 151	72 406
Hunting & collecting terrestrial animals	18 276	68 747
Problematic native species/ diseases	7 526	36 663
Droughts	12 821	24 806

Sources: Based on BIODEV2030 report on Ethiopia, with contributions from Philippe Puydarrieux and IBAT

Table 35 Guinea – Top 10 (Level 2) Threats according to the country's STAR scores

TOP 10 (LEVEL 2) THREATS	GUINEA	
	STAR RESTORATION SCORE	STAR THREAT ABATEMENT SCORE
Annual & perennial non-timber crops	26 754	110 653
Logging & wood harvesting	25 894	86 743
Mining & quarrying	23 683	68 613
Hunting & collecting terrestrial animals	11 922	35 378
Housing & urban areas	8 056	29 473
Work & other activities	3 174	10 548
Fire & fire suppression	2 335	6 700
Wood & pulp plantations	1 302	7 401
Habitat shifting & alteration	275	3 802
Livestock farming & ranching	427	3 488

Sources: Based on BIODEV2030 report on Guinea, with contributions from Philippe Puydarrieux and IBAT.

Table 36 Kenya – Top 10 (Level 2) Threats according to the country's STAR scores

TOP 10 (LEVEL 2) THREATS	KENYA	
	STAR RESTORATION SCORE	STAR THREAT ABATEMENT SCORE
Annual & perennial non-timber crops	26 754	110 653
Logging & wood harvesting	25 894	86 743
Mining & quarrying	23 683	68 613
Hunting & collecting terrestrial animals	11 922	35 378
Housing & urban areas	8 056	29 473
Work & other activities	3 174	10 548
Fire & fire suppression	2 335	6 700
Wood & pulp plantations	1 302	7 401
Habitat shifting & alteration	275	3 802
Livestock farming & ranching	427	3 488

Sources: Based on BIODEV2030 report on Kenya, with contributions from Philippe Puydarrieux and IBAT.

What are the main lessons to be taken from the UN Decade on Biodiversity 2011–2020, and how are these being evaluated ahead of COP-15 to ensure that post-2020 initiatives succeed where previous ones have not?

[...] countries need to redouble efforts to bring biodiversity into the mainstream of decision making while recognizing that the pressures threatening nature and its contributions to people can be eased only if biodiversity is explicitly factored into policies across the whole of government and among all economic sectors.

Elizabeth Maruma Mrema
Executive Secretary
UN Convention on Biological Diversity (CBD)

Source: Maruma Mrema (2021).

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