Scoping study of research-to-action priorities for the Reversing Environmental Degradation in Africa and Asia (REDAA) programme: Eastern and Southern Africa

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About the report

This scoping paper was written to inform and enhance the focus and research direction for the Reversing Environmental Degradation in Africa and Asia (REDAA) programme. It was commissioned by the International Institute for Environment and Development (IIED). Summaries of all the scoping papers can be found at www.redaa.org/scoping-studies.

For more information about this report, contact: enquiries@redaa.org

About the REDAA programme

REDAA is a programme that catalyses research, innovation and action across sub-Saharan Africa and South and Southeast Asia, by offering grants and technical support. Funded projects are interdisciplinary, locally led and focus on solutions for ecosystem restoration, enabling people and nature to thrive together in times of climate, resource and fiscal insecurity.

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Executive summary

This study was undertaken for the Reversing Environmental Degradation in Africa and Asia (REDAA) programme. The study scoped research-to-action priorities (RTAPs) that could potentially be supported in Eastern and Southern Africa in order to generate maximum programme impact.

It asked where evidence on environmental degradation can be improved and taken up by policy makers, how tools and approaches can be developed and well used, and how governance systems can be improved for environmental restoration and sustainable natural resource management.

Our analysis focused on countries that matched four 'filter' criteria:
1) They coincide with global 'biodiversity hotspots' that had already lost two thirds of their natural vegetation.

2) They host 'Key Biodiversity Areas' that currently contribute significantly to global biodiversity, but that are under threat.

3) They contain areas that are globally important for biodiversity conservation and climate change mitigation and that also offer cost-effective restoration opportunities.

4) They are not experiencing extensive political unrest and do not have non-inclusive or restrictive policies or regimes that might make it difficult to involve local communities in RTAPs.

This narrowed our study to 11 countries: Ethiopia, Seychelles, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, South Africa, Tanzania and Zambia.

Our team undertook a literature review using Google Scholar and SCOPUS that included peer-reviewed articles, grey literature, and policy and legislative documents. We looked for information on what is driving environmental degradation in the study countries, where it is intensifying, what approaches offer hope for reversing degradation, what the governance challenges and opportunities are, and also where there are research gaps. We considered forests, drylands and deserts, grasslands and savannas, inland waters and wetlands, and coastal ecosystems. We complemented this review by interviewing ten key stakeholders drawn from ICLEI Africa's cities and wider professional networks.

Our analysis revealed broad insights into what might help reverse environmental degradation or encourage restoration across Southern and Eastern Africa, identifying various gaps and opportunities in the context of the three 'pillars' of evidence, tools and approaches, and governance.

Evidence

We found a lack of national and sub-national datasets, a lack of in-depth locally relevant research, and restoration attempts that were not really using even the limited data available. Typically, intervention and knowledge generation efforts, ranging from urban nature planning tools and policies, city biodiversity strategies and action plans, species inventories and biodiversity financing, have not been designed as scientific research projects nor for applicability beyond their own project. Collaboration with research institutions could support better use of evidence, however there remain challenges in knowledge transfer.

We highlighted opportunities to improve the use of evidence, including: improving funding for data gathering and mapping; investment in further research; better planning for research uptake; fostering partnerships and engagement platforms; a focus on evidence-based restoration practice; and investment into youth-centred initiatives. This last opportunity arises from the nexus between biodiversity's use and conservation and human development needs and opportunities.

Tools and approaches

Visualising key ecosystem services through mapping can be effective in motivating people to engage in sustainable land management, conservation and restoration. This is especially so if participatory approaches draw in knowledge and expertise from people in the target area.

Geographic information system (GIS) and remote sensing tools that offer such visualisations could help reverse environmental degradation. There is also a need for national 'standard' systems for classifying degradation, as well as standardised indicators and monitoring tools.

In some instances, degradation is at least partly driven by diffuse and distant pressures, such as urban dwellers' need for domestic fuel. Thus, there are opportunities for tools and approaches that build awareness of innovative solutions to relieve such pressures. 'Mainstreaming' biodiversity concerns into urban planning and governance could be a useful broad approach.

Governance

At present, key governance challenges include insufficient capacity and knowledge about environmental degradation among officials, and an unsuitable policy environment. Often, policies and laws supporting sustainable management are largely in place, and yet are not implemented. Environmental conditions are typically not mainstreamed into processes for economic planning, trade and investment, and environmental economics and land-use carrying capacity assessments are not

adequately considered in development permitting processes. Thus, there are opportunities to build capacity and offer technical support to local government officials, to foster participatory planning and management, and to enable integrated landscape approaches.

Five top research-to-action priorities

Our analysis led us to refine a list of 12 potential research-to-action priorities (see Table 13 in the main document for the full list). When we scored how well these fit with REDAA's guiding criteria, we identified five top topics (one under the 'evidence' theme, and two each under 'tools and approaches' and 'governance') that REDAA could focus on in Eastern and Southern Africa. These are:

- Provide technical support to stakeholders for practices that look into ecosystem-based approaches, climate change adaptation strategies, nature-based solutions and sustainable and innovative land management practices. (Tools)
- Create training for government officials and other stakeholders to enhance expertise around the topic of degradation and restoration. (Governance)
- Invest in training for youth- and women-centred initiatives on translating research into practical approaches to reverse environmental degradation. (Evidence)
- Strengthen participatory planning and management approaches to ensure interest groups and stakeholders, including Indigenous Peoples and local communities (IPLCs), civil society organisations (CSOs), and non-governmental organisations (NGOs) are represented and have their views considered during decision making. (Governance)
- Support education and awareness campaigns that increase knowledge of harmful practices and capacity for alternatives, such as efficient agricultural and energy use. (Tools)

Potential priority landscapes

By combining insights obtained from the literature review and stakeholder interviews, we identified a list of potential priority landscapes where the research-to-action priorities, if pursued through concerted initiatives, could make a major contribution to tackling environmental degradation (see Table 19 in the main document for the full list).

1 Introduction

1.1 Background and scope of the report

Environmental degradation is a global phenomenon. It results in significant loss of both biodiversity and ecosystem services. The full extent and severity of global degradation is still poorly understood, although degradation impacts on ecosystem services have been well established through research studies and practice.

Degradation processes are typically location specific and usually a direct consequence of local land management, but there is an increasing realisation that many degradation impacts are simultaneously influenced by global processes and drivers. For example, drivers of degradation include habitat change and loss (including land-use change, deforestation, watercourse modification and extraction), overexploitation, invasive alien species and pollution. These are all, in turn, driven by large-scale patterns of population growth, unsustainable consumption, urbanisation and technological change, resulting in not just local degradation, but also the global biodiversity and climate crises.

The majority of sub-Saharan African nations are guided by conventional economic thinking. Their exploitation of human power, technological and natural resources to supply goods and services has given several African nations annual economic growth of about 3.2%, and has driven up per capita incomes. While these developments have led to significant socio-economic benefits, which have improved people's quality of life and social wellbeing, many have also resulted in environmental degradation. As nations aspire to further economic growth, major economic activities such as agriculture, energy production, urbanisation and mining tend to overexploit natural resources, leading to increasingly problematic environmental impacts (Imasiku, Thomas & Ntagwirumugara 2020).

The objective of this scoping study is to identify research-to-action priorities (RTAPs) for Eastern and Southern Africa that the Reversing Environmental Degradation in Africa and Asia (REDAA) programme could potentially support. It asks where evidence can be improved and taken up, how tools can be improved and well used, and how governance systems can be improved for environmental restoration and sustainable natural resource management. The scoping also identified emerging ecosystems and degradation hotspots where RTAPs may be located. We considered information from 11 countries: Ethiopia, Seychelles, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, South Africa, Tanzania and Zambia.

1.2 Methodology

Step 1: Choosing focus countries

In order to manage the scope of this study, the analysis is focused on countries in Southern and Eastern Africa that match the following four 'filter' criteria.

1) The countries that were initially selected have a relatively high proportion of 'biodiversity hotspots'. Biodiversity hotspots are defined by Conservation International (2023) as areas with at least 1,500 endemic vascular plants and these hotspots must have 30% or less of the natural vegetation remaining.

2) The countries selected included a relatively high occurrence of Key Biodiversity Areas (KBAs). KBAs are defined by IUCN (2016) as sites contributing significantly to the global persistence of biodiversity.

3) They contain 'global priority areas for ecosystem restoration' (described by Strassburg et al. (2020) as areas important for biodiversity conservation and climate change mitigation and where costs for restoration can be minimised).

4) They are not experiencing extensive political unrest and do not have non-inclusive or restrictive policies or regimes that might make it difficult to involve local communities in RTAPs. This was utilised as the fourth filter to further refine the list of countries that were focused on in this study.

Biodiversity hotspots (filter one)

The 'biodiversity hotspots' identified by Conservation International that occur in the Eastern and Southern Africa region are:

1. The Cape Floristic Region in South Africa
2. The Eastern Afromontane Region
3. The Coastal Forests of Eastern Africa
4. Madagascar and the Indian Ocean Islands
5. The Maputaland-Pondoland-Albany Complex
6. The Horn of Africa
7. The Succulent Karoo

The countries in Eastern and Southern Africa that coincide with these hotspots are: Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Mauritius, Rwanda, Seychelles, Somalia, South Sudan, Sudan, Tanzania, Uganda, Eswatini, Malawi, Mozambique, Namibia, South Africa and Zambia (see Figure 1).

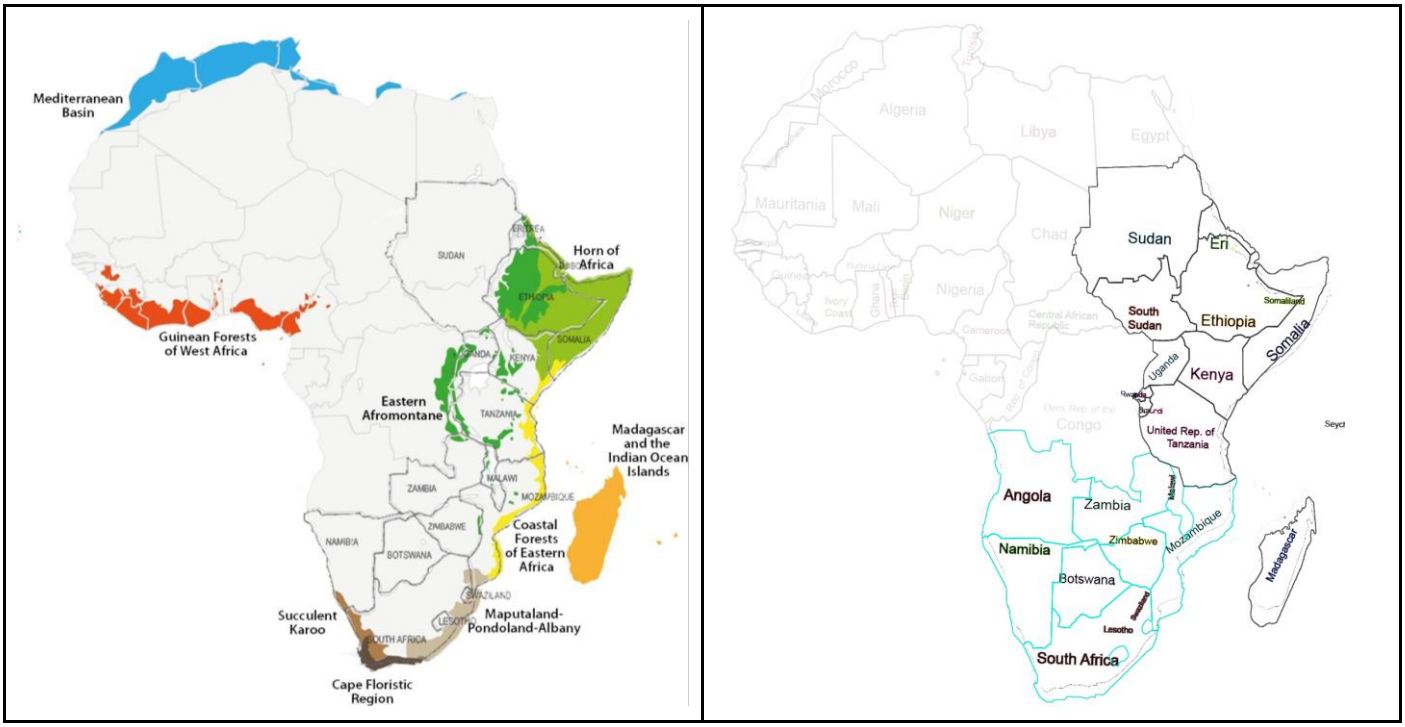
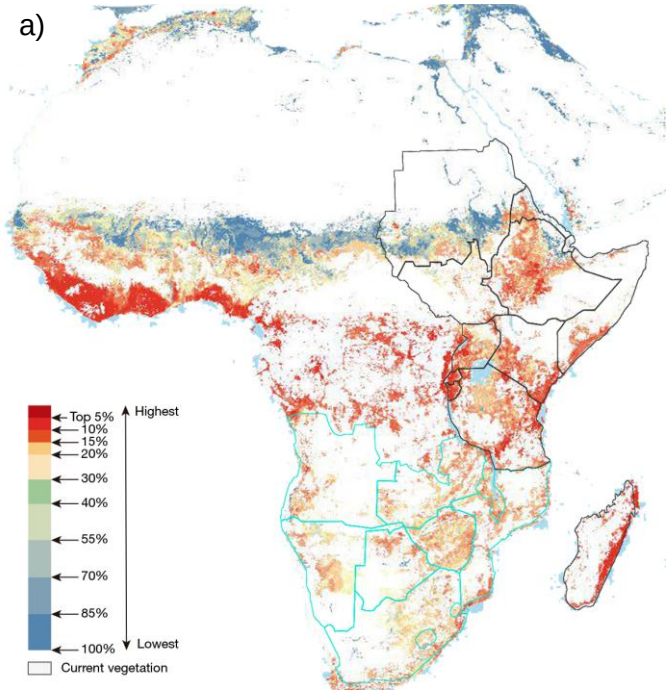


Figure 1: Global biodiversity hotspots in Africa as defined by Conservation International (2023). Image adapted from Encyclopaedia Britannica 2022.

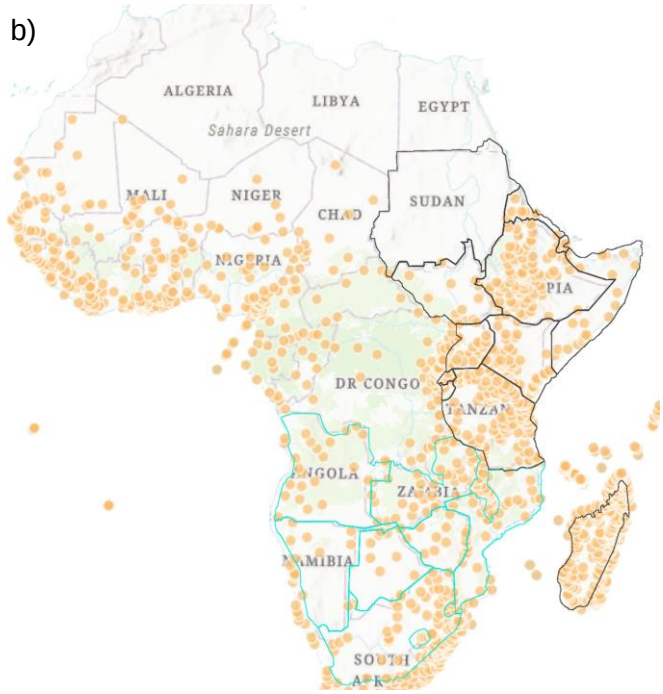
Key Biodiversity Areas (KBAs) (filter two) and restoration priority areas (filter three)

There are 1,721 KBAs in sub-Saharan Africa (Figure 2, panel b), of which 42% are covered by conserved or protected areas. However, 516 of the 1,721 KBAs face identified threats (Key Biodiversity Areas, 2023). We further filtered to show KBAs that are experiencing 'high' and 'very high' threats to biodiversity (Figure 2, panels c and d).

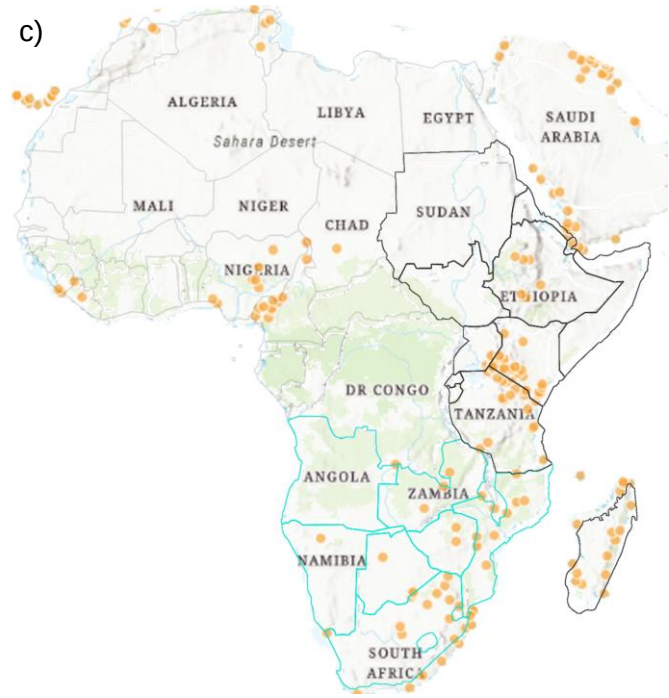
When viewed alongside Strassburg et al.'s (2020) high-priority restoration areas, our initial list of 20 countries is reduced to 12 countries: Ethiopia, Seychelles, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, South Africa, Tanzania, Zambia, and Uganda. All 12 of these countries coincide with 'biodiversity hotspots', contain KBAs experiencing high or very high threats to biodiversity and contain high-priority restoration areas.



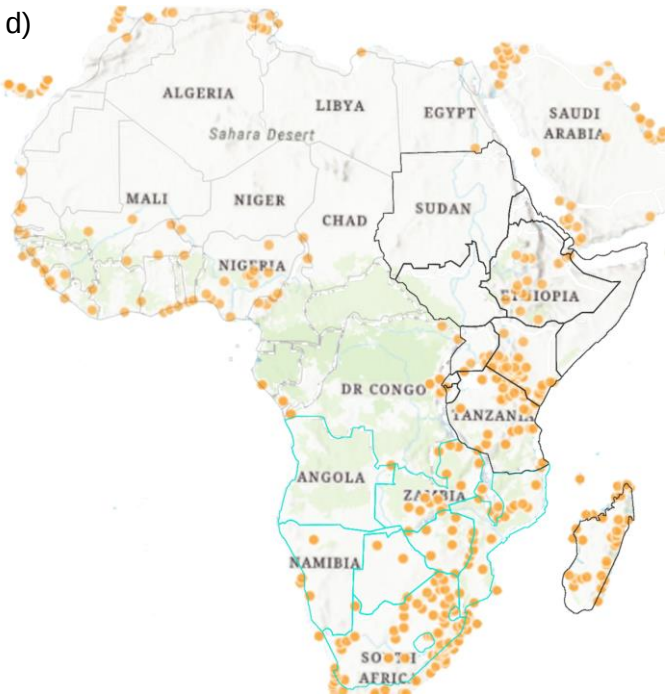
Strassburg et al.'s (2020) priority areas for restoration (red areas indicate high-priority locations)



KBA's in Eastern and Southern Africa (represented as orange circles)



KBA's in Eastern and Southern Africa experiencing 'very high' threats on biodiversity (represented as orange circles)



KBA's in Eastern and Southern Africa experiencing 'high' threats on biodiversity (represented as orange circles)

Figure 2: Priority areas for restoration (Strassburg et al., 2020) and the KBAs across Southern and Eastern Africa (Key Biodiversity Areas, 2023).

Non-inclusive policies (filter four)

The selection process then filtered out countries undergoing political unrest and those that had policies that currently do not promote equity and the empowerment of marginalised and vulnerable groups. These non-inclusive and restrictive policies or regimes might make it difficult to involve local communities in RTAPs. These included South Sudan, Sudan and Somalia. Information from Uganda was initially considered but, while the team were conducting their research the Ugandan government adopted The Anti-Homosexuality Act of 2023, further extending the criminalisation of same-sex conduct within the country. This Act violates several international human rights agreements. The team made the decision to discontinue further analysis of information from Uganda.

From this exercise, we chose 11 countries: Ethiopia, Seychelles, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, South Africa, Tanzania and Zambia.

Step 2: Literature review

Focusing on these 11 countries, we then undertook a literature review using Google Scholar and SCOPUS. We were seeking to understand several aspects: what is driving environmental degradation across Southern and Eastern Africa; where degradation is intensifying; programmes and tools for restoration and sustainable natural resources management for various ecosystems; governance structures and issues; and also research gaps. We considered forests, drylands and deserts, grasslands and savannas, inland waters and wetlands, and coastal ecosystems. We identified 184 relevant papers, including peer-reviewed articles, grey literature, and policy and legislative documents.

Where possible, our review cites up-to-date research, and we prioritised publications between 2012 and 2023. However, finding literature and case studies on best practices was quite challenging for most of the scoping study countries, where research on environmental degradation is limited. (The exception is South Africa which has had considerable research and environmental interventions.) We tried to address this with stakeholder engagement (see below), but data gaps persisted. Nonetheless, these gaps did allow us to highlight where research-to-action is needed.

Step 3: Stakeholder engagement

Following the literature review, we interviewed key stakeholders drawn from ICLEI Africa's cities and wider professional networks. A snowball sampling method was used, selecting stakeholders from the 11 countries using existing networks of experts and key informants in the fields of biodiversity research, management and environmental degradation. A total of 20 individuals were approached and, from these, 10 KIs were interviewed. The range included government officials, private sector representatives,

academics and NGOs. Most of the 10 non-KIs were from government institutions with institutional restrictions on releasing data.

There were also other limitations to this stakeholder engagement work. For example, certain categories of KIs from Indigenous Peoples and local communities and from NGOs could not be easily identified in some locations. Other issues were missed interviews, different time zones, language and accent barriers, and limitations by KIs in answering specific questions. For example, KIs from academia were not able to provide information related to government policy and practice, while other KIs were not best placed to answer questions requiring scientific knowledge/evidence.

All potential KIs were given the option to respond to guiding questions (see Annex 1) via e-mail (written) or through a live online engagement. Most KIs chose an online discussion which produced rich and detailed information according to each Key Informant's field of expertise and experience. The interviews centred around gathering context-specific understanding of key hotspots in the selected countries as well as capturing ongoing initiatives in the selected countries that were aiming to reverse environmental degradation.

Due to the short time frame of the study, it was not possible to arrange formalised ethical clearance for interviews, although that would be typical for a research project. KIs were made aware of this, and those who agreed to respond did so voluntarily. Responses reflected individual knowledge and experience which did not necessarily reflect the views of their respective organisations. All KIs were assured anonymity.

After conducting the interviews, further literature was identified to explore whether the arguments made by the KIs could be strengthened or corroborated and to fill gaps in the interviews identified in our literature review.

Step 4: A preliminary list of priority landscapes and research-to-action priorities

By combining insights obtained from the literature review and stakeholder interviews, we identified a preliminary list of potential priority landscapes within the 11 focus countries in Southern and Eastern Africa. Insights from the literature review and stakeholder engagement also let us formulate recommendations across the themes of evidence, governance and tools (see Section 3), which were fine-tuned into a preliminary list of 12 research-to-action priorities (RTAPs) (see Table 13).

Step 5: Shortlisting potential research-to-action priorities

To help shortlist potential RTAPs for the REDAA programme, the ICLEI team scored each of the 12 RTAPs against a list of eight evaluation criteria provided by IIED:

1. Scale-appropriateness. The issue can be usefully addressed with the scale of support that may be possible from the REDAA programme, for example a grant of ~GBP50,000 to GBP100,000 over six to 24 months, or a grant of between ~GBP200,000 and GBP1.5 million over four years.

2. Time frame fitting. The issue can be completely addressed within six months to four years, or a significant contribution to addressing the issue can be made and verified within six months to four years.

3. Value for money. The way in which the issue is addressed will provide good returns on investment, benefits to costs and value for money.

4. Site-specific impact. If the issue was addressed it would have a major impact in a specific place.

5. Cross-cutting impact. If the issue was addressed it would have a major impact on systems or processes that affect many places.

6. Locally led. The issue is best addressed by locally led action, especially action led by local communities and Indigenous Peoples.

7. Intersectional. The issue is best addressed through intersectional understanding and empowerment of vulnerable groups, including Indigenous Peoples, women, youth, migrant workers, landless labourers, and displaced peoples.

8. Cross-disciplinary and multi-stakeholder. The issue is best addressed by fostering multi-stakeholder and cross/trans-disciplinary collaborations.

RTAPs were scored on a scale of 1–5 for how well they met each criterion (a maximum of 40 points were awarded for each RTAP). Higher scores indicate where a criterion might be well met by the RTAP, and lower scores indicate where a criterion may not be well met by the RTAP (see Tables 15–17). From this process, the five top-scoring RTAPs were shortlisted (see Table 18).

Step 6: Identifying potential priority landscapes across Southern and Eastern Africa

The likely effectiveness in tackling environmental degradation of the five top-scoring RTAPs in each of the priority landscapes in the preliminary list was then considered. It was concluded that one or more of the five RTAPs, if pursued through concerted practical initiatives, could make a useful positive contribution in all the landscapes in the list. These potential priority landscapes thus identified in Southern and Eastern Africa are presented in Table 19.

2 Country-specific reviews of socio-economics, biomes and types of degradation

This section brings together analysis from the literature review and stakeholder engagement. It creates a profile on each country, which examines the socio-economic status and the various types and drivers of environmental degradation occurring.

For each country, we have compiled information into a table that summarises socio-economic statistics and then looks at degradation in: drylands and deserts, grasslands and savannas, inland waters and wetlands, coastal and marine ecosystems, and forests, as appropriate. We also attempt to identify the various types of degradation taking place in each country, and we have included, in italics, comments from the Key Informant Interviews (see Annex 1 for the questionnaire). Addressing degradation effectively requires an understanding of the causes and drivers of biodiversity loss thus this section also highlights activities that contribute as direct or indirect drivers to environmental degradation in various biomes. Better understanding the links between drivers and environmental degradation will foster an evidence base for best practices on restoration, governance, tools and approaches, development, planning and implementation (IPBES, 2018).

2.1 East African countries

Table 1: Kenya country profile

Country	Kenya
Socio-economic statistics	GDP per capita[1] (US dollars) (2023): **2.19 thousand** Gini[2] coefficient[3] (2021): **38.7** Human Development Index[4] (HDI)[5] (2021): **0.575** Population (2023)[6]: **55.10 million** Land area (km^2) (2023)[7]: **569,140**

[1] GDP per capita data in Tables 1–11 sourced from World Economic Outlook, 2023

[2] The Gini coefficient measures inequality on a scale from 0 to 1. This can sometimes be shown as a percentage from 0 to 100% where higher values indicate higher inequality.

[3] Gini coefficient values in Tables 1–11 sourced from World Bank Data, unless otherwise indicated.

[4] Human Development Index (HDI) sets a minimum and a maximum for each dimension of health, knowledge and standard of living, expressed as a value between 0 and 1. The higher a country's human development, the higher its HDI value.

[5] HDI data in Tables 1–11 sourced from UNDP Human Development Reports, 2023.

[6] Population data in Tables 1–11 sourced from Worldometer, 2023.

[7] Land area data in Tables 1–11 sourced from Worldometer, 2023.

Socio-economic status	Agriculture remains the economic and livelihood backbone of most of the study countries. In 2016, 75% of Kenya's population worked in the agricultural sector, including livestock and pastoral activities (Ministry of Environment and Natural Resources (MENR), 2016). Over 75% of agricultural output was from small-scale, rain-fed farming or livestock production (MENR, 2016).
Ecosystems and degradation	***Country-specific degradation in drylands and deserts*** Drylands comprise about 80% of land in Kenya (Harmsen, 2018). Traditionally, the drylands of Kenya are vast and rich in biodiversity and natural resources, but in recent decades have seen increased human pressure on forests and woodlands that has created conditions conducive to degradation, deforestation and desertification, thus reducing national tree cover to all time unacceptable levels (Hitimana, Mengich & Kuria, 2022). The drylands environment poses formidable problems for sustainable development. Among these are unpredictable and severe drought, desiccation or aridification due to persistent drought, and dryland degradation or desertification (Hitimana, Mengich & Kuria, 2022). Land degradation in the dry lands of Kenya, poses a threat to the livelihoods of those who depend on ecosystem services and goods (Mulinge et al., 2015). Overgrazing is the major cause of desertification in the drylands. Other factors that cause desertification include urbanisation, climate change, overuse of groundwater, deforestation, natural disasters, and tillage practices in agriculture that make soils more vulnerable to wind (Hitimana, Mengich & Kuria, 2022). In the drylands around Lake Turkana and Eastern Province, the main driver of land degradation is the extension of cropland onto marginal lands (Mulinge et al., 2015). ***Country-specific degradation in grasslands*** The majority of Kenya's vast area consists of grassland, which make up more than 80% of the country and are mainly found in the Rift Valley (Nzau, Mwangi & Kinyenze, 2018; Wachiye et al., 2022). This is home to approximately four million pastoralists, who make up more than 10% of Kenya's population, plus other rangeland users (Nzau, Mwangi & Kinyenze, 2018). The grasslands contain approximately 50% of the total livestock population, primarily within the pastoral communities. The main driver of grassland degradation is overgrazing, which results in excessive removal of vegetation cover (Wachiye et al., 2022). Thus, an increasing number of pastoralists in Kenya are losing their livelihood due to grassland degradation, which has an impact on the Kenyan economy and food supply (Nzau, Mwangi & Kinyenze, 2018). The results of grassland degradation include both reduced productivity and less resilience of host species, leading to invasion by unpalatable species (Nzau, Mwangi & Kinyenze, 2018). ***Country-specific degradation in inland waters and wetlands*** Kenya is home to six wetland types: riverine; lacustrine; palustrine; estuarine; marine; and constructed wetlands. Wetlands occupy approximately 3–4% of the

country's land area (Ministry of Environment and Mineral Resources (MEMR), 2012). Kenya's national report on the Ramsar Convention of Wetlands, made to the 12th Conference of the Parties (COP) for the Convention on Biological Diversity cited the major drivers of degradation of wetlands in Kenya as: encroachment especially from agriculture, urbanisation and expansion of human settlements; deforestation of major water catchment areas; pollution consisting of industrial effluent, agricultural and domestic waste in wetlands and proliferation of alien invasive species; overgrazing and overexploitation of wetland; over-abstraction of ground and surface water; and limited local communities' knowledge on need for wise use of wetlands (Kiprono, 2015).

Inland waters in Kenya are subjected to water pollution (Mulinge et al., 2015). The erection of infrastructure on steep slopes, buildings with improper drainage systems and the reduction of infiltration rates due to deforestation are all contributing to soil degradation (Mulinge et al., 2015). Eroded soil carries pesticides and other pollutants, which wash into water bodies, and the sedimentation and pollution cause damages to freshwater, in turn reducing the water quality and making the water unfit for human consumption. It also makes catchment areas less able to support river flows (Mulinge et al., 2015). Water bodies in Kenya such as Lake Baringo, Lake Olbollosat and Winam Gulf have suffered increased sedimentation due to soil erosion. This further reduces the surface area of these water bodies (Mulinge et al., 2015). A freshwater lake, Lake Naivasha, located within the Rift Valley of Kenya, is subjected to invasive fish species. Some carp species, introduced intentionally or accidentally, managed to make their way into the lake (Mutethya et al., 2021). Muthethya et al. (2021) list at least eight different carp species that have been introduced from as far back as 1929. The lake originally only had one native carp species, which has now gone extinct due to predation from the invasive species (Mutethya et al., 2021). The invasive carp do well in the lake's degraded habitats (Mutethya et al., 2021), which have resulted from eutrophication, pollution, overexploitation and swamp clearance (Hickley et al., 2015; Yongo et al., 2021; Mutethya et al., 2021). Furthermore, carp also increase turbidity (Mutethya et al., 2021). This has several negative impacts on aquatic ecosystems, including decreased light penetration, depressed growth of water plants (excluding microalgae, which may flourish) and reduced ability of piscivorous fish (fish-eating organisms) and planktivorous fish (plankton-eating organisms) to forage (Mutethya et al., 2021).

Key Informant Four told us there is a lack of rehabilitation of quarry sites in Ganze and Kilfi North areas in Kenya. This occurs on multiple scales and arises from quarrying and mining activities. Kilifi South, specifically in Mtwapa and Rabai areas, in Kenya, are subjected to air pollution due to cement manufacturing factories and industries.

Country-specific degradation in forests

Many forests in Kenya are subjected to deforestation. The key drivers include: a pressure for more water infrastructure (as seen in water towers being built in the

	Rift Valley's Mau Forest (Baker & Miller, 2013; Mulinge et al., 2015); the uncontrolled and illegal logging and clearing of trees to meet domestic and commercial demand for charcoal and wood for fuel (for example in west Pokot, Marakwet and Turkana); illegally growing bhang (a form of cannabis) in forest areas (Mount Kenya); removal of protected forest; and forest fires (Mount Elgon) (Mulinge et al., 2015). Additionally, population growth has increased the demand for food, which has led to the expansion of agricultural land into forest land (Mulinge et al., 2015). Furthermore, deforestation decreases rainfall infiltration rates into soil, and the resultant run-off and erosion has further implications for water quality (Were et al., 2013; Mulinge et al., 2015). Dryland coastal Arabuko Sokoke Forest, Taita Hills and gallery forests along Nzeeu River in Kitui County are fragile forest ecosystems in Kenya that are subjected to population pressure, land-use pressure, and deforestation with associated loss of species, habitats and ecosystem services (Nzau et al., 2022). Illegal logging poses a major threat to these forest ecosystems (Nzau et al., 2022). Arabuko Sokoke forest experienced rapid urbanisation, lack of land-use planning, and immigration (Nzau et al., 2022). Due to the planting of exotic eucalyptus trees in Taita Hills, several springs have dried up (Nzau et al., 2022). The gallery forests are fragmented, invaded by alien plant species, and significantly modified through human activities (Nzau et al., 2022). Dakatcha Woodland in Kenya is exposed to deforestation (Ruuska, 2013). A major driver is a demand for charcoal and firewood, which led to clearing and uncontrolled logging specifically within the forests dominated by *Cynometra*, *Brachylaena* and *Brachystegia* species (Ruuska, 2013), locally called Mfunda, Muhuhu (or Muhugu) and Mhiri, respectively (World Agroforestry, n.d.). Additional drivers for deforestation in these woodlands are encroachment onto the woodlands through shifting cultivation, agricultural expansion, fires caused by burning charcoal, and unsustainable levels of hunting bushmeat (Ruuska, 2013). The Mau Forest within the Rift Valley is subject to deforestation (Albertazzi et al., 2018). The drivers for this degradation include wood extraction, agriculture and infrastructure development, influenced by political factors (Albertazzi et al., 2018). Since colonial rule through the different regimes, natural resources, their use and their conservation have been a part of the political struggle (both on ethnic and electoral grounds), as well as a means and an end in the power relations between the stakeholders (Albertazzi et al., 2018). For instance, the Mau Forest is the ancestral land of the marginalised Ogiek tribe who have been at the centre of socio-environmental conflicts in forest management, which have seen them file various claims against the government in national and international courts (Albertazzi et al., 2018). *Key Informant Four told the study that terrestrial forests in Dakatcha woodlands, Gede Forest and Mwangea Hills are subjected to large scale degradation. The key drivers being an increase in the demand for forest resources, harvest of trees to acquire charcoal for household and commercial purposes, high levels of poverty, agricultural activities that are unsustainable, and the inadequate implementation of legislation.*

	Country-specific degradation in coastal marine ecosystems The Kenyan coast covers approximately 600 kilometres along the Indian Ocean, and has coastal and marine ecosystems with rich and diverse marine life that support economic activities, as well as the livelihoods of 2.7 million people (International Fund for Animal Welfare, n.d.). The coastal and marine environment is supported by various ecosystems and biodiversity resources including estuaries and deltas, coastal sand dunes and beaches, terrestrial and coastal forests, mangroves, seagrass beds, rocky habitats and coral reefs, as well as pelagic and deep-water ecosystems (Government of Kenya, 2017). The coast region has experienced increased socio-economic development causing threats and impacts on the coastal and marine environment including pollution, physical alteration and destruction of habitats, invasive species, which are accelerated by climate change and variation (Government of Kenya, 2017). The impacts of human settlements and developments have caused the ecosystems to diminish in size and species diversity, further reducing their provision of ecosystem services necessary for sustainability (Government of Kenya, 2017). The main drivers of change in these ecosystems are overuse by an increasing human population, economic development and climate change (Government of Kenya, 2017). *Key Informant Four told the study the coastlines along Mtwapa creek and Malindi and Kilifi municipalities are exposed to marine pollution. This occurs on numerous scales, with the primary sources of degradation being littering of marine ecosystems, encroachment of riparian areas, unsustainable fishing practices, and pollution from plastic and municipal waste. In Kenya, mangrove forests within Kilifi, Lamu and Mombasa counties are exposed to moderate deforestation. The predominant drivers are due to an over-reliance on forest products, high poverty levels, inadequate implementation of legislation and unsustainable agricultural practices*.

Table 2: Tanzania country profile

Country	**Tanzania**
Socio-economic statistics	GDP per capita (US dollars) (2023): **1.33 thousand** Gini coefficient[8] (2019): **51.4** Human Development Index (HDI) (2021): **0.549** Population (2023): **67.44 million** Land area (km^2) (2023): **885,800**

[8] Gini coefficient source: World Economics, 2023

Socio-economic status	In Tanzania, agriculture, which accounts for about 25% of GDP, provides employment for about 80% of Tanzanians (Willeman et al., 2017; Wineman et al., 2020; Gupta, 2020). Tanzania is the second most populous among the countries in the study, with a comparatively high GDP (the third after South Africa and Ethiopia), but significant wealth inequality and a low Human Development Index[9]. The impact of population, combined with economic activities (particularly agriculture) on the country's vast land area makes Tanzania susceptible to significant environmental degradation. In recent years gold production has increased to about 35% of exports (African Growth and Opportunity Act (AGOA), 2023c)
Ecosystems and degradation	***Country-specific degradation in drylands*** About 61% of Tanzania is classified as dryland, comprising arid, semi-arid and dry sub-humid areas (Wells and Winowiecki, 2017; Willemen et al., 2018). According to Tanzania's third report on the implementation of the United Nations Convention to Combat Desertification (UNCCD), close to two thirds of the country's drylands are seriously degraded (World Bank Group, 2019). The extent and magnitude of degradation varies across regions, determined by the type and intensity of the economic activities driving the degradation (World Bank Group, 2019). For instance, there is far greater degradation in the agroecological zones in the plateau, semi-arid and southern highlands, than in the other agroecological zones in the country (World Bank Group, 2019). High deforestation and agricultural expansion coupled with poor farming practices and overgrazing are among the key causes of land degradation (World Bank Group, 2019). As a result, soil fertility is being lost, in turn undermining smallholder farmers' food security (World Bank Group, 2019). The country has one of the largest livestock populations on the African continent, estimated at over 100 million livestock in 2016, but marked by low productivity rates (World Bank Group, 2019). The impact of declining soil fertility on crop productivity has been found to be particularly critical in the dryland areas, as evidenced in parts of the Dodoma region, where major on-farm production constraints have often been attributed to low soil fertility (Swamila et al., 2020). Keeping large herds of livestock, coupled with seasonal movements from the large herds of livestock in search of greener pastures, is detrimental to drought-prone, semi-arid environments and leads to desertification through soil compaction, and wind and water erosion (World Bank Group, 2019).

[9] According to the UNDP Human Development Reports Data Reader's Guide, the cutoff-points are HDI of less than 0.550 for low human development, 0.550–0.699 for medium human development, 0.700–0.799 for high human development and 0.800 or greater for very high human development (hdr.undp.org)

Country-specific degradation in grasslands and savannas

The savanna biome encompasses a range of habitats, from open grasslands to deciduous woodlands (Wiethase et al., 2023). In Tanzania, savannas are spread across several ecological regions including the Central Zambezian Miombo Woodlands, Eastern Miombo Woodlands, Itigi-Sumbu Thicket, Northern Acacia-Commiphora Bushlands and Thickets, Serengeti Volcanic Grasslands, Southern Acacia-Commiphora Bushlands and Thickets, Victoria Basin Forest-Savanna Mosaic, East African Halophytics, and Zambezian Flooded Grasslands (Sawe, 2017). In Tanzania 76% of degradation has been reported to have been experienced in grasslands (Kirui, Mirzabaev & von Braun, 2021).

Major causes of land degradation in Tanzania are overgrazing, poor cultivation practices (including fire mismanagement) and deforestation. These are exacerbated by rapid population growth, rural poverty, climate change, an unclear land tenure system and conflicting government policies (Willemen et al., 2018). The main limitations for the sustainability of Tanzania's grasslands are extensive crop cultivation and livestock population grazing (Kavana et al., 2022). Agricultural expansion to feed the growing population leads to the restructuring and disruption of previously stabilised grassland ecosystems, while livestock grazing in communal lands removes plants and exposes bare land (Kavana et al., 2022).

Country-specific degradation in forests

Tanzania's forests cover approximately 45.7 million ha, or about 55% of the country's total land area, as of 2022 (Nzunda & Yusuph, 2023). Tanzania contains a large portion of a globally important biodiversity hotspot, known as the 'Eastern Arc Mountains and East African Coastal Forest' hotspot (Burgess et al., 2017). The East African Coastal Forest Hotspot runs along the Tanzanian and Kenyan coasts from the border with Somalia in the north to that with Mozambique in the south. Of the original 30,000 km^2, just 2,000 km^2 (i.e. 6.7%) of the hotspot remains (Burgess et al., 2017). Forest habitat continues to be lost and degraded. An estimated 36% of forested land has been degraded (Kirui, Mirzabaev & von Braun, 2021). Outside forest reserves, major causes of forest degradation include heavy pressure from agricultural expansion, livestock grazing, development of human settlements, firewood and charcoal production, uncontrolled fires, timber extraction, development of infrastructure/industry, encroachments from refugee camps, and more recently, the introduction of large-scale agriculture for biofuel production (Nzunda & Yusuph, 2023).

A study done in Masito-Ugalla ecosystem, in the Kigoma Region, in the western part of Tanzania, found that close proximity of the refugee camps to forest reserves was a key contributing factor to environmental degradation and deforestation, with both refugees and locals encroaching upon the forest reserves, primarily to collect firewood or wood for construction, or to clear areas for cultivation (Makunga & Misana, 2017). There has been increased investment in biofuel production from crops such as jatropha, oil palm and sugar cane, with large-scale biofuel investments involving plantations of up to tens of thousands of hectares (Sulle & Nelson, 2013).

Habitat loss is threatening ever more species. The government-managed forest reserve network has expanded slightly but has low effectiveness. There has also been rapid development of village-owned forest reserves. Although usually small, they are an important addition to the areas being managed for sustainable resource use, and also provide tangible benefits to local people (Burgess et al., 2017).

Country-specific degradation in coastal marine ecosystems

The Tanzanian coastline covers a stretch of approximately 1,424 kilometres (885 miles) from the Kenyan border in the north to the Mozambican border in the south (Agulhas-Somali Current Large Marine Ecosystem Project (ASCLME), 2012; World Bank Group, 2019). The country is highly endowed with the biological diversity found in its coastal and marine ecosystems. It is endowed with: coastal forests – with endemic tree species – covering about 70,000 ha; extensive coral reefs covering about 3,580 km^2 supporting artisanal fisheries and coastal tourism; and seagrass beds (Yanda, Mabhuye & Mwajombe, 2021). Other coastal resources include: beaches, which provide key ecological and economic services such as breeding, nesting and feeding sites for marine and bird species, act as buffer zones against wave action, and are sites for recreational and touristic activities; and fishery resources found along banks and coral reefs (Yanda, Mabhuye & Mwajombe, 2021). Tanzania has five coastal regions, which as of 2019 were home to approximately 10 million people whose livelihoods depended directly on the integrity of coastal and marine ecosystems (World Bank Group, 2019). Most communities along the coastline earn their livelihoods from fishing to some extent, with marine fisheries primarily occurring within 40 miles of the coast. The country has rich fishing grounds, home to more than 1,755 species, of which 46 are of commercial importance (World Bank Group, 2019).

Most of the coastal and marine resources are under immense degradation pressures from rapidly growing human activities (Yanda, Mabhuye & Mwajombe, 2021). Various human-induced activities threaten the sustainability of coastal and marine resources including illegal and destructive fishing practices, live coral and sand mining, intensive trampling on seagrasses, and municipal wastewater (Yanda, Mabhuye & Mwajombe, 2021). There are also threats from clearing of mangrove and other coastal forests for commercial and domestic purposes – such as for aquaculture ponds, timber, industrial development, fuelwood, and construction materials (Yanda, Mabhuye & Mwajombe, 2021). Environmental degradation coupled with pollution along the coastlines and in the marine areas, together with a decline in biodiversity, are both evidenced by decreasing yields of fish, deteriorating conditions of coral reefs, and a steady reduction of the coastal areas covered by mangroves and forests (World Bank Group, 2019). These anthropogenic pressures are exacerbated by climatic-induced pressures owing to the country's high vulnerability to climatic-induced changes, especially rising sea level and increasing ocean temperatures (Yanda, Mabhuye & Mwajombe, 2021).

Country-specific degradation in inland waters and wetlands

Tanzania is rich in wetland resources, which include the great lake system, inland drainage systems, major river networks and deltaic mangrove areas (Vice President's Office, 2014). About 10% of the country's land is covered by wetlands, of which 5.5% is presently Ramsar sites (United Republic of Tanzania Vice President's Office, 2014; Materu, Urban & Heise, 2018). Among them include Malagarasi/Muyovosi (32,500 km^2), Lake Natron Basin (2,250 km^2), Kilombero valley floodplain (7,950 km^2) and Rufiji-Mafia-Kilwa (5,969.7 km^2) (Vice President's Office, 2014). Wetlands in Tanzania can be classified into seven categories, namely: highland headwater wetlands; freshwater estuarine wetlands; internal drainage wetlands; rivers and inland floodplain wetlands; marine and coastal wetlands; man-made wetlands; and rift system wetlands (Vice President's Office, 2014). Wetlands have significant economic, social, cultural and biological values and contribute substantially to livelihoods and the socio-economy of the country, but they are fast degrading and disappearing due to exploitation of wetlands resources (Vice President's Office, 2014; Yusuph, 2018). Thus, the Government of Tanzania ratified the Ramsar convention on wetlands in 2000, recognising the need to use wetlands wisely, as primary natural resources, providing ecosystem services, and having biological values (Yusuph, 2018).

The sustainability of the wetlands in Tanzania is threatened by overcultivation and over-extraction of natural resources (Materu, Urban & Heise, 2018). Other major

	threats include economically destructive fishing methods, beach erosion and excessive sedimentation caused by deforestation and overgrazing of catchment areas particularly, within the Great East African Rift Valley system as well as highlands headwater wetlands (Vice President's Office, 2014).

Table 3: Madagascar country profile

Country	Madagascar
Socio-economic statistics	GDP per capita (US dollars) (2023): **529.56** Gini coefficient[10] (2019): **50.8** Human Development Index (HDI) (2021): **0.501** Population (2023): **30.33 million** Land area (km^2) (2023): **581,780**
Socio-economic status	Madagascar's economic dependence on agriculture raises severe concerns around deforestation and erosion, which are also exacerbated by bushfires, slash-and-burn clearing methods, and the use of firewood as the primary fuel source (Clark, 2012). Madagascar produces over 80% of the world's vanilla, making its reliance on this product for the majority of its foreign exchange a key source of risk (Clark, 2012).
Ecosystems and degradation	***Country-specific degradation in inland waters and wetlands*** Madagascar is rich in freshwater wetlands and has about 2,000 km^2 of lakes and more than 300 km of rivers and streams located in 256 catchments. Freshwater wetlands are rich in biodiversity and exhibit a high degree of endemism (Lammers, 2020). The country is one of the poorest in the world and livelihoods are often wetland-dependent, with half of the population overall and 65% of the rural population dependent on unimproved water sources, such as rivers and lakes (Bamford et al., 2017). Wetlands also supply most of the country's staple foodstuff, rice, the majority of which is grown in wetlands cleared of their natural vegetation, either in lowland rainfed systems or irrigated systems planted on alluvial soils (Bamford et al., 2017). However, conservation activity has focused almost entirely on forests, and as a result, the country is losing natural wetlands faster than forest (Bamford et al., 2017). Since 1960, the highland regions have lost 60% of wetlands, compared to 20% of forests.

[10] Gini coefficient source: World Economics, 2023

A rapid survey of 37 wetlands conducted by Bamford et al. (2017) found that 82% of marsh at the sample sites had been cleared for agriculture. Furthermore, recent comprehensive assessments of the status and distribution of Madagascar's and the Indian Ocean islands' freshwater species have found that nearly half (43%) of the whole freshwater biota is threatened with extinction while distribution and conservation status information is lacking for almost one quarter (23%) of species (Máiz-Tomé, Sayer & Darwall, 2018; Lammers, 2020).

Conversion to rice farming is the main cause of the loss of natural wetlands (Bamford et al., 2017). Overexploitation, invasive species introduction, water pollution, flow modification, habitat degradation and destruction have led to a faster and stronger decline of species in freshwaters than in marine and terrestrial ecosystems (Lammers, 2020). The introduction of non-indigenous species (invasive species) in Madagascar's water bodies is reducing the variety of freshwater fish species (Rakotomanana et al., 2013). Furthermore, the removal of trees and vegetation increases soil erosion. This could compromise the water quality of wetlands and their ability to accommodate fisheries activities (Rakotomanana et al., 2013).

Country-specific degradation in forests

Madagascar has a high rate of deforestation. Time-series analysis of Landsat images empirically show that Madagascar, which covers an area of about 59 million ha (230,000 square miles), has lost 4.85 million ha of tree cover since 2000, equivalent to a 25% decrease in tree cover, and a gross estimate of 2.52 gigatonnes of carbon dioxide-equivalent greenhouse gas emissions (Suzzi-Simmons, 2023). Rakotomanana et al. (2013) highlight that the loss of indigenous forests is the main threat to Madagascar's biodiversity. Deforestation in these forests is predominantly due to human intervention. The primary cause for deforestation is the slash-and-burn practice for pasture and subsistence agriculture, which also leads to uncontrolled fires (Suzzi-Simmons, 2023; Rakotomanana et al., 2013). Historically and culturally known as tavy, the process involves setting vegetation alight after being cut down, creating potential land for rice cultivation (Suzzi-Simmons, 2023). In Madagascar, Makira Natural Park and Masoala forests are subjected to shifting cultivation (slash and burn) practices (Zaehringer et al., 2016). Other drivers of deforestation include clearing of native forest for agricultural land (for both small-scale and large-scale agriculture), illegal logging of trees which facilitates the development of human settlement and infrastructure, mining, and the illegal exploitation of timber (Rakotomanana et al., 2013). Collecting fuel wood (including

for charcoal production) and, in certain sites, forest clearing for mining also contribute significantly to deforestation (Suzzi-Simmons, 2023).

Key Informant Six told the study Madagascar is exposed to deforestation, and the primary drivers include the production of charcoal, logging of trees, and mining activities (such as Ambatovy mine, which degraded a large portion of primate habitats in the east). The same Key Informant also said there is a massive movement of people from the southern region to the northern region in Madagascar, placing increasing pressure on forest resources. These people do not have an immediate means of income, and this results in unsustainable practices, trash spillage, habitat loss and insecurity.

Country-specific degradation in coastal marine ecosystems

Madagascar has about 2 million ha of coastal wetlands, over 95% of which are along the west coast; these include wetlands of the coastal plain, flood plains and coastal lakes, some of which have only a relict connection to the sea (Cooke et al., 2022). The island has a coastline extending over 4,500 km and presents a wide variety of marine and coastal habitats including coral reefs, islands, seagrass meadows and mangroves (Ramahery, Rahagalala & Rakotomalala, 2021). The coastal areas constitute about 51% of Madagascar's whole jurisdictional territory and present major ecological as well as economic interests for the 65% of Malagasy people who live near the coast (Ramahery, Rahagalala & Rakotomalala, 2021).

Marine and coastal habitats in Madagascar are threatened by hyper-sedimentation, coastal development, physical destruction of littoral zones (land up to the high water mark, which is often exposed to the air, and is often interchangeable with the term intertidal zone), overexploitation of marine and coastal resources, extractive activities, pollution, destructive fishing practices and overfishing, as well as climate-change threats such as the rise of seawater temperature and extreme weather events (Ramahery, Rahagalala & Rakotomalala, 2021; Cooke et al., 2022). Decline in the health of the coral reefs of Madagascar is attributed primarily to climate change, sedimentation from watershed-based pollution, and fishing (Cooke et al., 2022). Coral cover declined from 50% in 1998 to 30% in 2016, and algal cover increased from 15% to 30% over the same period (Cooke et al., 2022). Over a period of almost 20 years (1998–2016), most reef-dependent carnivorous and corallivore reef fish species have declined (Cooke et al., 2022).

Declines in large areas of seagrass bed is attributed to industrial shrimp trawling using large ocean-going vessels along the north-west coast, which has been causing direct damage to the plants and also removes fishes and other mobile fauna. Resource declines also occur from harmful and illegal fishing activities on

	the shore, such as beach seining practised by the locals. Beach seine nets (very fine mesh non-selective nets) directly uproot seagrasses from the lagoon floor and release sediment into the water column, limiting light penetration and seagrass regeneration. When predatory fish are removed by fishing, herbivorous sea urchins such as *Tripneustes gratilla* can boom in numbers, decreasing seagrass coverage. Pressure on seagrass is further exacerbated by local mangrove cutting, which increases siltation and water turbidity (Cooke et al., 2022). Drivers for mangrove degradation and loss include the development of shrimp farms along the coast (Rakotomanana et al., 2013), expansion of agriculture and increased demand for fuel and timber (Cooke et al., 2022). The effects of global climate change, such as sea-level rise and an increase in the frequency and intensity of tropical storms, are also predicted to lead to mangrove loss (Cooke et al., 2022). *Key Informant Six told the study that wetland ecosystems in Madagascar become a 'waste land', due to 'trash leaks' which are, in fact, one of the most frequent drivers of environmental degradation in urban and peri-urban areas.* ***Country-specific degradation in drylands*** Drylands are found in western, southern and northern Madagascar (De Block et al., 2018). The coastal strip of south-western Madagascar is the driest part of the country, with a notably erratic distribution of rainfall, seasonally, spatially and annually (Aronson et al., 2018). The south-western dry forests and spiny thickets have been highly fragmented throughout this region due to overexploitation of wood, bark and fibre by local people, especially for charcoal production, which remains the main source of cooking fuel in cities across the country (Aronson et al., 2018). Today spiny thicket, deciduous forest and woodland form a highly fragmented patchwork in south-western Madagascar, but they were formerly more abundant and had much stronger ecological connections across the region and to the much larger north that encompasses most of the western half of Madagascar (Aronson et al., 2018). Due to its distinct geography, Madagascar is susceptible to periods of drought (Faliarivola et al., 2022). The southern region – known as the 'zone semi-aride' – is especially vulnerable to shifting weather patterns, and during the drought of 2019–2021 saw sandstorms (known as tiomena or 'red winds') damage topsoil already affected by delayed rains and deforestation (García et al., 2023). ***Country-specific degradation in grasslands*** Grasslands (including wooded grassland, tapia and palm savannah) are extensive in Madagascar, covering at least 65% of the island not including cultivation

	(Vorontsova et al., 2016). Grasslands are mostly distributed in the western (52.5%) and central (38.1%) parts, but are also present in other regions, in southern (4.8%), eastern (3.9%), Sambirano (0.6%) and high mountains ecoregion (0.2%) (Vorontsova et al., 2016). The grasslands are far from a homogenous landscape but are shaped by the contrasting processes of fire and grazing that promote their differentiation (Solofondranohatra et al., 2020). The grasslands are a source of livelihood for Madagascar's traditional pastoral society – the country has around 7–10 million zebu cattle (Joseph, Rakotoarivelo & Seymour, 2023). As a country that suffers food insecurity, Madagascar relies on livestock-based pastoralism (and consequently palatable rangelands) for insurance against natural disasters and crop failure (Joseph, Rakotoarivelo & Seymour, 2023). However, intensive and ubiquitous traditional rangeland preparation by Malagasy pastoralists through annual landscape-scale human-lit fires is a major driver of grassland degradation (Joseph, Rakotoarivelo & Seymour, 2023). Studies have shown that Malagasy dominant grass species are fire-adapted with poor forage value, suggesting current burning practices negatively impact both biodiversity and pastoralism (Joseph, Rakotoarivelo & Seymour, 2023). Decreasing rangeland palatability caused by human-lit fires in a society suffering food insecurity emphasises the need to re-evaluate pastoralist burning practices (Joseph, Rakotoarivelo & Seymour, 2023).

Table 4: Mauritius country profile

Country	**Mauritius**
Socio-economic statistics	GDP per capita (US dollars) (2023): **11.75 thousand** Gini coefficient (2017): **36.8** Human Development Index (HDI) (2021): **0.802** Population (2023): **1.30 million** Land area (km^2) (2023): **2,030**
Socio-economic status	Mauritius is the main island of the Republic of Mauritius, which is also composed of Rodrigues island and the coral archipelago of Agaléga and St Brandon (Anisimov, Magnan & Duvat, 2020). Mauritius island is the largest (1,868 km^2, 93% of the country's total land area) and the most populated (96% of the 1,265,637 inhabitants), and is also the economic hub of the country, known since the 1980s as

	an 'economic miracle' (Anisimov, Magnan & Duvat, 2020). Since independence in 1968, the country has successfully diversified its economy, from an agricultural (sugar cane) based monoculture inherited from colonial times to a diverse, upper-middle-income economy with strong tourism, financial and industrial sectors (including textiles and apparel), and more recently having a surge in cyber activities and finance (Tandrayen-Ragoobur & Kasseeah, 2018; Anisimov, Magnan & Duvat, 2020).
Ecosystems and degradation	***Country-specific degradation in forests*** Mauritius is subjected to deforestation, with native forest areas reduced from 85% in the 1700s to under 2% by the late 1990s (Iranah et al., 2018). The environmental history of Mauritius has seen various decision makers (Dutch, French and British) occupy the island (Sultan, 2016). Their decisions have actively contributed to deforestation and soil erosion (Sultan, 2016) through the logging of ebony trees and the conversion of forests to agricultural land, predominantly for sugar cane plantation (Sultan, 2016; Baret et al., 2013). Native forests that survived exist in fragments and are exposed to possible extinction due to the disappearance of natural dispersers and pollinators and increased distance from source populations (Iranah et al., 2018). Invasive alien species, many of which have been introduced through the Pamplemousses Botanical Garden (Baret et al., 2013), constitute a further major threat to Mauritius forests ecosystems (Iranah et al., 2018). Furthermore, the lack of regulations and law enforcement has led to high extinction rates and endangered species (Baret et al., 2013). Population growth pressures have led to further removal of forests for human settlements, road infrastructure, and additional agricultural land (Sultan, 2016). ***Country-specific degradation in coastal marine ecosystems*** Mainland Mauritius has a coastline of 322 km (83% of which are made of sandy beaches) and is surrounded by 150 km of protective coral reefs which occupy an area of about 300 km^2 and enclose a lagoon area of around 243 km^2 (Anisimov, Magnan & Duvat, 2020; Leckraz, 2021). Despite their significance, the marine and coastal ecosystems such as mangroves, seagrass beds and coral reefs face a wide array of threats including overexploitation of resources, erosion, siltation and pollution, coastal development, invasive alien species, and climate change (Leckraz, 2021). The coastal and marine ecosystems along Mauritius are subjected to deforestation, low to moderate levels of soil erosion, eutrophication, and the loss of biodiversity. The initial removal of trees from the lowland coastal forests took place in the areas

	surrounding the harbours in Mahebourg (GrandPort District) and Port Louis (Norder et al., 2017) and were cut down for exportation. Agricultural areas expanded predominantly along the coastal areas (Norder et al., 2017). The removal of natural vegetation along the coast to make way for sugarcane cultivation further contributed to deforestation along the coast (Norder et al., 2017). The coastal areas are exposed to low to moderate soil erosion. Soil loss affects marine ecosystem services as sediments washed into the sea raise nutrient concentrations and turbidity (Norder et al., 2017). The heavy reliance on fertiliser to alleviate the effects of soil loss has also led to high concentrations of phosphorus and nitrogen in coastal waters, causing eutrophication in the coastal zone (Norder et al., 2017). This damages tourism and fisheries along the coast. Giant tortoises, which once grazed the grasses and herbs that existed along the coastal area, were hunted to extinction for their meat (Norder et al., 2017). To conserve marine biodiversity, the Mauritian government has put in place an integrated coastal zone management policy framework and recognised climate change adaptation as a priority (Duvat, Anisimov & Magnan, 2020). The government has further established a system of Marine Protected Areas comprising fishing reserves[11], marine parks[12] and marine reserves[13] in the waters around Mauritius and Rodrigues (Leckraz, 2021). *Key Informant Nine told the study an increase in tourism numbers in the coastal areas places additional pressure on these environments, leading to more waste on the coasts and also contributing to mangrove loss.* ***Country-specific degradation in inland waters and wetlands*** Mauritius is an island state in the Indian Ocean which is surrounded by seawater and which contains 25 major river basins (Mamoun, Nigel & Rughooputh, 2013). The river systems combined with the diverse topography of the island have given rise to numerous wetlands, particularly along the coast, and include estuaries, marshes, mangroves and floodplains (Mamoun, Nigel & Rughooputh, 2013). The wetland classes include marshes and swamps (the predominant wetland class representing 38% of the total natural wetland surface area), depressions, estuaries, mangrove, reservoirs, floodplains, marine coasts and lakes (Mamoun, Nigel &

[11] Fishing reserves are meant to protect the fish, fisheries resources and critical habitats. Fishing methods are controlled and fishing gears are limited. Only basket trap and line fishing are allowed.

[12] Marine parks are reserved for conservation, education and research, controlled recreation, awareness creation and limited extractive use in specific zones.

[13] Marine reserves are meant for conservation, education, research, recreational use and awareness creation. Extractive uses are not permitted therein except with the written authorisation of the responsible authority. They are only found in Rodrigues Island.

	Rughooputh, 2013). Most wetlands are situated in the eastern coastal plains (42 wetlands), northern coastal plains (31) and south-eastern coastal plains (22) (Mamoun, Nigel & Rughooputh, 2013). Approximately two-thirds of the wetlands are under private ownership with the largest private ownership occurring in the northern region (Laurance et al., 2012). Natural freshwater wetlands form an integral component of biodiversity and provide many ecosystem services that benefit both people and wildlife (Ministry of Agro-Industry and Food Security, 2015). These wetlands are often used for recreational and fishing activities but also for religious purposes (Mamoun, Nigel & Rughooputh, 2013). Despite the country signing the Ramsar Convention in 1997, wetlands are still being rapidly converted, with a 60% loss of wetlands in the northern region of the country since 1980 (Laurance et al., 2012). The history of wetland loss is closely linked to the residential, industrial and agricultural development, and more recently, the increasing demand in land capacity for the construction of hotels, Integrated Resort Scheme (IRS) projects, business parks and residential areas (Mamoun, Nigel & Rughooputh, 2013). Freshwater resources are also threatened by dumping of solid waste in rivers, heavy use of agrochemicals in nearby agricultural fields, sewage disposal, and backfilling of coastal wetlands (Ministry of Agro-Industry and Food Security, 2015). Climate change is expected to further exacerbate the situation due to decreasing rainfall and rising temperatures (Ministry of Agro-Industry and Food Security, 2015).

Table 5: Rwanda country profile

Country	**Rwanda**
Socio-economic statistics	GDP per capita (US dollars) (2023): **1.03 thousand** Gini coefficient (2016): **43.7** Human Development Index (HDI) (2021): **0.534** Population (2023): **14.09 million** Land area (km^2) (2023): **24,670**
Socio-economic status	In Rwanda, agriculture accounts for 63% of export earnings, with some mineral and agro-processing (AGOA, 2023d). Rwanda's main sources of foreign exchange are tourism, minerals, coffee and tea (AGOA, 2023d). Food production in the country does not keep up with the demand, therefore requiring food imports (AGOA, 2023d).

Ecosystems and degradation	***Country-specific degradation in grasslands and savannas*** Rwanda lost 175.75 ha of grasslands from 2000 to 2015 (from 1,846.47 ha in 2000 to 1,670.72 ha in 2015 according to Bizimana, 2018). The land mass in Rwanda has diverse vegetation, with mosaics of grasslands/bushlands/forests found in the southern parts, and herbaceous vegetation/grassland savannah occurring as the main type of vegetation in the eastern province (Ndayisaba, 2017). Grasslands are found in two of the ecological regions, namely, the Ruwenzori-Virunga Montane Moorlands, which have montane grasslands and shrublands, and the Victoria Basin Forest-Savanna Mosaic, which has tropical and subtropical grasslands, savannas, and shrublands (Misachi, 2017). Key hotspots of grasslands degradation include Kirehe and Kayonza, Ngororero and Rutsiro, Nyaruguru, Huye and Gisagara, and Nyagatare, all of which are experiencing land cover shifting from grass to cropland. In Rubavu, grassland is being replaced with artificial land cover (built environment) (Bizimana, 2018). The eastern and south-eastern regions of the Eastern Savannah and Eastern Plateau ecological zones (land degradation hotspots in Rwanda) are subjected to natural and biological degradation. They suffer from overgrazing, deforestation, which leads to the conversion of natural savannah to agricultural grassland, and artificial surfaces (built environment). Improper land management by replacing natural vegetation by the built environment and croplands, is making land less productive (Bizimana, 2018). ***Country-specific degradation in inland waters and wetlands*** Rwanda is facing increasing degradation of watersheds and water bodies as a result of unsustainable land-use practices driven by the demands of intensified socio-economic development and continuing population pressures (Rwanda Environmental Management Authority (REMA), 2017). Wetlands in Rwanda have historically been a source of water, wild foods and medicines; but with the increase in population during the 1980s, views on wetlands shifted, with more interest in their potential as fertile lands that can contribute to national food production, particularly for rice and fish farming (Uwimana, van Dam & Irvine, 2018). The use of wetlands for food security, while positive, brings detrimental environmental impacts because of the alteration or destruction of wetland ecosystems and biodiversity, and associated impact on their regulating ecosystem services. This has led to changes in water quality, not only in Rwanda's streams, rivers and lakes, but also for the Kagera river, the main tributary that flows into the transnational Lake Victoria (Uwimana, van Dam & Irvine, 2018). Sediment and nutrients being washed off agricultural areas can also contribute significantly to freshwater eutrophication

(Uwimana, van Dam & Irvine, 2018). The sustainable use of water in areas such as agriculture and hydropower thus require more vigilant attention by policymakers in order to safeguard this indispensable resource (REMA, 2017).

Climate change effects have also contributed to the drying of water bodies (small lakes) near the summits of volcanic mountains of the Volcanoes National Park and an altitudinal shift in species distributions (REMA, 2017). Pressures from expansion of urban settlements are another factor. Urban settlements are expanding along the shores of Lake Kivu in the 'Western lowlands of Lake Kivu border ecological zone' (a land degradation hotspot in Rwanda), removing vegetation, which leads to soil erosion (Bizimana, 2018).

Key Informant Eight told the study the Rubavu district within the Western province is exposed to water erosion, especially associated with the Sebeya, Pfunda, Gitsimbi and Mutura Rivers. Water runoff, landslides and flooding are all problems.

Country-specific degradation in forests

From 2001 to 2022, Rwanda lost 43.1 kha of tree cover, equivalent to a 8.7% decrease in tree cover since 2000. In this same time period, Rwanda lost 501 ha of humid primary forest, making up 1.2% of its total tree cover loss. The total area of humid primary forest in Rwanda decreased by 0.93% in this time period. It is crucial to monitor national land-use planning and carbon accounting, as these primary forests offer multiple ecosystem services (Global Forest Watch, 2023c).

High pressure from anthropogenic activities drives deforestation and forest degradation in Rwanda, with high economic growth and infrastructure development particularly exacerbating pressure on forests (Ntare, Mutesi & Nyandwi, 2018). High population density also places enormous pressure on natural resources and existing protected areas, leading to biodiversity loss (REMA, 2017). Agriculture and animal husbandry, overharvesting of forest products, infrastructure development, urbanisation, artisanal mining practices and limited forestry extension services are driving forest degradation. The underlying causes include high population growth, poverty, lack of awareness, limited alternative sources of energy, and imbalanced wood supply and demand (Ntare, Mutesi & Nyandwi, 2018; Nyiramvuyekure, 2022). Population growth and the resulting increased demand for agricultural land has reduced forest acreage (Bikorimana, Mupenzi & Mudatsikira, 2023). Rwanda has experienced a 22.36% population growth between 1992 and 2018, compared with a deforestation rate of 15.47% (Bikorimana, Mupenzi & Mudatsikira, 2023). The share of cropland, arable land, land areas equipped for irrigation, and agriculture areas under organic agriculture have

	greatly increased by 18.48%, 26.33%, 15.47% and 60.37%, respectively, between 1992 and 2018 (Bikorimana, Mupenzi & Mudatsikira, 2023). Other drivers of forest degradation are induced fire, pests and diseases, and poor silvicultural treatments (Nyiramvuyekure, 2022). Land Degradation Neutrality indicators have shown deforestation trends in the different ecological zones of Rwanda (Bizimana, 2018). For instance, the natural/semi-natural forest land cover of the 'south-western Lowlands of Imbo and Impara ecological zone' (a land degradation hotspot in Rwanda) has been undergoing conversion into grassland and cropland over the period between 2000 and 2015. The area has been subjected to a decline in the productivity of the land. Drivers for this degradation include overexploitation, soil erosion, inadequate farming practices, and fragmented and clustered settlement on 'high slide' (sloped land) (Bizimana, 2018). The 'Western Highlands of the Congo–Nile Watershed Divide ecological zone' (a land degradation hotspot in Rwanda) is subjected to soil erosion through biological and water degradation. This degradation is a result of deforestation (which has decreased vegetation cover on steep slopes) and mining activities. Furthermore, habitat loss has reduced flora biodiversity, and biomass is in decline due to forest felling and unsuitable farming practices, such as forest-to-grass-and-crop, or grass-to-crop conversions (Bizimana, 2018). The 'Western lowlands of Lake Kivu border ecological zone' (a land degradation hotspot in Rwanda) is subjected to deforestation and a decline in land productivity due to population growth and the removal of natural vegetation to accommodate cropland and human settlement (Bizimana, 2018). The Central and Southern Rwanda of Plateau Central and Mayaga and Peripheral Bugesera ecological zones (land degradation hotspots in Rwanda) are experiencing conversion of forest, grassland and cropland to human settlements. In the process, natural vegetation is removed, exposing the soil to erosion. A lack of off-farm activities, poverty and population pressure also drive deforestation and soil exploitation in this area (Bizimana, 2018). The 'City of Kigali of Central Plateau ecological zone' (a land degradation hotspot in Rwanda) is subjected to high erosion. In this hilly topography, urbanisation has caused deforestation (through unplanned and planned urban areas as well as informal and formal settlements). Precipitation 'runoff' is driving up soil erosion, resulting in waterway pollution and the loss of soil (Bizimana, 2018). *Key Informant Eight told the study that the Rubavu district within the Western province is exposed to deforestation due to inadequate energy for cooking. The interviewee*

	further noted that secondary cities and the city of Kigali are subjected to this issue, which has implications for the climate in the long run.

Table 6: Ethiopia country profile

Country	Ethiopia
Socio-economic statistics	GDP per capita (US dollars) (2023): **1.47 thousand** Gini coefficient (2015): **35.0** Human Development Index (HDI) (2021): **0.498** Population (2023): **126.53 million** Land area (km^2) (2023): **1.000 million**
Socio-economic status	Ethiopia is the second most populous country in Africa but remains one of the poorest (The World Bank, 2023b; AGOA, 2023a). Government investment in infrastructure, as well as sustained progress in the agricultural and service sectors, has contributed to an annual growth rate of between 8% and 11% (AGOA, 2023a). Over the past 15 years, the average annual growth has been nearly 10% per year, one of the highest rates in the world (The World Bank, 2023b). More than 70% of Ethiopia's population is still employed in the agricultural sector, and this sector is the principal source of GDP (AGOA, 2023a). Ethiopia is diversifying exports. Commodities such as gold, sesame, khat, livestock and horticulture products are becoming increasingly important (AGOA, 2023a).
Ecosystems and degradation	***Country-specific degradation in drylands and deserts*** More than 85% of the land in Ethiopia is estimated to be moderately to very severely degraded, and about 75% is affected by desertification (Gebreselassie et al., 2016; Wassie, 2020). Recent estimates from satellite imagery (Gebreselassie et al., 2016) reveal that land degradation hotspots, which cover about 23% coverage of land area in Ethiopia, have experienced biomass decline over the course of the last three decades. In the Ethiopian Highlands, 14 million ha are badly eroded. This land is no longer able to support vegetation, and is losing its organic matter (Atlhopheng et al., 2018). The drivers of desertification in Ethiopia are population growth (which requires more farmland), deforestation, overgrazing, detrimental farming practices (particularly small-seed crops that require a fine tillage), and charcoal production from public forests and woodlands (Gebreselassie et al., 2016; Tessema & Getachew, 2022).

Due to land shortage and lack of alternative livelihoods, farmers cultivate lands that have slopes of more than 60% and shallow stony soils prone to erosion (Gebreselassie et al., 2016). Slopes of more than 30% should not normally be used for agricultural purposes, but rather allocated to natural vegetation or forestry (Gebreselassie et al., 2016).

Country-specific degradation in grasslands and savannas

The savanna grasslands of southern Ethiopia are a combination of arid and semi-arid environments with unpredictable patterns of rainfall and fluctuating forage productivity due climate variability and climate change (Bora et al., 2020). Land degradation and diminishing grassland resources put many pastoral communities at risk of food insecurity (Bora et al., 2020). In traditional pastoral systems, grasslands and pastoral communities are interdependent, as grazing is often necessary to maintain the herbaceous plant community structure (Bora et al., 2020). Both natural and human-induced degradation, individually and in combination, and are known to induce rangeland degradation (Abdulahi, Hashim & Teha, 2016).

The major drivers of rangeland degradation in Ethiopia include climate change, overgrazing, recurrent drought, rangeland cultivation, bush encroachment, human population pressures, shortage of rainfall, inappropriate uses of land resources, soil erosion and decline of traditional resource management institution (Abdulahi, Hashim & Teha, 2016).

Country-specific degradation in inland waters and wetlands

Ethiopia is endowed with different kinds of wetland resources, estimated to comprise more than 58 different types, covering about 18,587 km^2 – 1.5 to 2% of the total land mass of the country (Giweta & Worku, 2018). These wetlands are distributed in almost all ecological zones across the country. They include swamps, fringes, marshes, rivers, lakes, flooded areas, reservoirs, seasonal plains, and valley bottom wetlands. Furthermore, in the flood plains of Wabe-Shebelle, Dawa, Awash, Gibe, Baro and Abay, riverine types of wetlands are very common. Overall, Ethiopia has 12 river basins, which include Danakil basins, Awash, Baro-Akobo, Wabe Shebele, Abay, Ghenale-Dawa, Tekeze, Omo-Ghibe, Ogaden basin, Ayisha basin, and Rift Valley Lakes (Giweta & Worku, 2018).

Wetlands degradation in Ethiopia has multidimensional causes that include both anthropogenic and natural factors, though the anthropogenic factors are the dominant ones (Zekarias et al., 2021). The wetlands ecosystems are threatened due to shortage and expansion of cropland (a shift of farmers from upland to wetland-based crop production), overgrazing, shrinkage of grazing land, sedimentation, use

	of lake water for irrigation, invasive plant species (water hyacinth), inadequate land tenure policies and land-use systems, and overuse of ecosystem services, underlain by rapid population growth (Zekarias et al., 2021). According to Giweta and Worku (2018), population growth and the concomitant demand for additional arable land are the main drivers of human encroachment into the wetlands. Other drivers of wetland degradation are: rapid urbanisation, industrialisation and environmental pollution; overexploitation of resources and unsustainable land-use practices; inadequate intersectional planning among relevant institutions; agricultural intensification and extension of illegal agriculture; lack of incentives (considering the social and cultural aspects of communities living near wetlands); and climate change effects (Giweta & Worku, 2018). Limited protection of wetlands and lack of a legal framework on the use and abuse of wetland resources are also major contributors to wetland degradation (Zekarias et al., 2021). Some of the major degraded wetlands are Choke mountain catchment, Rift Valley Lakes (Lake Ziway watershed), Lake Alemaya (in the eastern part of Ethiopia), Awash River Basin, Lake Tana, Koga catchment, Lake Hawassa and Lake Basaka (Giweta & Worku, 2018). ***Country-specific degradation in forests*** In Ethiopia, deforestation continues to affect the volume/frequency of rainfall, which in turn increases peoples' risks (for example of famine or other environmental disasters) in what is a rapidly growing population (Oljirra, 2019). Over the past 50 years, 98% of forested areas have been lost (Oljirra, 2019). From 2002 to 2022, Ethiopia lost 84.1 kha of humid primary forest, making up 18% of its total tree cover loss in the same time period (Global Forest Watch, 2023b). Total area of humid primary forest in Ethiopia decreased by 4.5% in this time period (Global Forest Watch, 2023b). The deforestation contributes to soil erosion, which in turn impacts agricultural activities. The major cause of deforestation in Ethiopia is rapid population growth, which leads to an increase in the demand for crop and grazing land, wood for fuel, and construction (Gebru, 2016). New settlements in forests have converted forested land into agricultural and other land-use systems (Gebru, 2016). Ongoing deforestation in Ethiopia has thus been seen to be caused by agricultural expansion, formal and informal logging for firewood and construction materials, industrial use, overgrazing and forest clearing for cultivation (Gebru, 2016; Oljirra, 2019). The rate of deforestation is further aggravated by the: lack of a forest protection and conservation policy; lack of a viable land-use policy and corresponding law; absence of a strong forest administration system capable of arresting the rapidly increasing rate of deforestation; absence of civic education and of efforts to ensure communities participate in forest protection and

	conservation and share the benefits; and failure to clearly demarcate and enforce the boundaries of natural forest reserves (Gebru, 2016).

Table 7: Seychelles country profile

Country	Seychelles
Socio-economic statistics	GDP per capita (US dollars) (2023): **20.89 thousand** Gini coefficient (2018): **32.1** Human Development Index (HDI) (2021): **0.785** Population (2023): **107.66** Land area (km^2) (2023): **460.0**
Socio-economic status	In Seychelles, economic growth has been led by the tourism sector, which directly employs about 26% of the labour force and directly and indirectly accounts for more than 55% of GDP. Tuna fishing is also important. The government has moved to reduce the dependence on tourism by promoting farming, fishing and small-scale manufacturing (Moody's Analytics, n.d.), as well as the development of the offshore financial, information and communication sectors and renewable energy (Country Reports, n.d.).
Ecosystems and degradation	***Country-specific degradation in forests*** In Seychelles, deforestation and forest degradation can be traced to two main phases of historic forest loss– commercial logging of timber between 1770 and circa 1820 and then between circa 1910 and the 1970s for cinnamon extraction and distillation (Etongo et al., 2021). Therefore, historical events such as unsustainable harvesting of timber and forest products have played a major role in removing vegetation and thereby exacerbating the impacts of climate change on the exposed topsoil layer (Etongo et al., 2021). Deforestation and forest degradation is severe given the country's total landmass spread across 115 islands, with intense land-use competition from multiple uses (Etongo et al., 2021). Land degradation in Seychelles occurs predominantly due to forest fires, clearing of forest for development purposes (agriculture, including plantations; housing; tourist facilities; infrastructure), impacts of invasive alien species, unsustainable agriculture, construction practices and landslides/rock falls (Dookhun, 2018). Dry weather conditions due to the extended period of drought during the dry season

	coupled with the availability of flammable materials in the forest create ideal conditions for forest fires to occur (Etongo et al., 2021). *Key Informant Three told the study that forest fires are a major threat in Seychelles as the abundance of alien invasive vegetation allows these fires to catch and spread at an alarming rate.* ***Country-specific degradation in coastal marine ecosystems*** A major problem facing the Seychelles islands is the decline in the quality and the value of its marine protected areas. The marine environment in Seychelles plays a significant role in supporting the two most important economic sectors: tourism and fisheries. In 2021, tourism directly or indirectly generated about 72% of GDP and about 30% of employment. The fishing industry accounted for about 17% of GDP and 15% of employment in 2021. Coastal degradation is being driven by the fisheries and tourism sectors, which increase pressure on coastal and marine natural resources and are reaching unsustainable levels (Seychelles Trade Portal, 2021). Additionally, agricultural activities, pollution along the coasts, invasive species and climate change also contribute to coastal degradation. *Key Informant Three told the study that development related to increased use of beaches has led to significant vegetation loss.* Seychelles possesses some of the most threatened ecosystems in the world (Philpot, Gray & Stead, 2015) and has suffered from several disasters in the past four decades. Coral reefs were altered significantly by the 1998 Indian Ocean Warming, during which Seychelles suffered massive coral bleaching (Etongo & Gill, 2022). Episodes of coral bleaching and increased coastal flooding due to climate-related sea-level rise have continued (Etongo & Gill, 2022). Marine pollution and overfishing also threaten the marine ecosystem (Philpot, Gray & Stead, 2015). Marine pollution is largely attributed to discharges from large vessels (Philpot, Gray & Stead, 2015) and plastic waste from industrial fishing (Loupe, 2021).

2.2 Southern African countries

Table 8: South Africa country profile

Country	South Africa
Socio-economic statistics	GDP per capita (US dollars) (2023): **6.19 thousand** Gini coefficient (2018): **67.0** Human Development Index (HDI) (2021): **0.713** Population (2023): **60.41 million** Land area (km^2) (2023): **1.213 million**
Socio-economic status	South Africa has the highest GDP among the countries selected as part of the scoping study. However, increasingly severe domestic constraints led to a slowing of GDP growth from 4.7% in 2021 to 1.9% in 2022. Additionally, mining production in the country fell while manufacturing production stagnated, in the context of regular power outages and increased transportation bottlenecks. In terms of services, sectors including financial, transport and domestic trade remained key drivers of growth. South Africa remains a dual economy with one of the highest and most persistent inequality rates in the world. Furthermore, socio-economic challenges were further exacerbated by rising fuel and food prices, which disproportionately affected the poor as the level of inflation averaged 6.9% in 2022 (World Bank, 2023a).
Ecosystems and degradation	***Country-specific degradation in drylands and deserts*** In Southern Africa, a hyper-arid strip extends along the length of the Namibian coast and into the extreme north-west of South Africa (Knight & Holmes, 2018). Roughly 91% of South Africa's landscape is drylands, which makes the region highly susceptible to degradation such as desertification (Department of Forestry, Fisheries and the Environment (DFFE), 2018). The direct and the indirect drivers of this degradation include population growth, climate change, unsustainable land use, land degradation and growing urban areas, which increase pressure on productive land resources. Competition for productive land increases due to the growing demand for food, fodder and mineral resources, as well as raw materials for industrial and energy use. Other drivers are overgrazing, urbanisation and changes in agricultural practices (Knight & Holmes, 2018). A contributor to South Africa's GDP is mining (DFFE, 2018). However, mines damage the soil and underlying structure of the land by producing chemicals that pollute

soil and water (DFFE, 2018). In 2018, a total of 326,000 ha of cultivated land was taken up by mines and prospecting was taking place on a further 439,000 ha (DFFE, 2018).

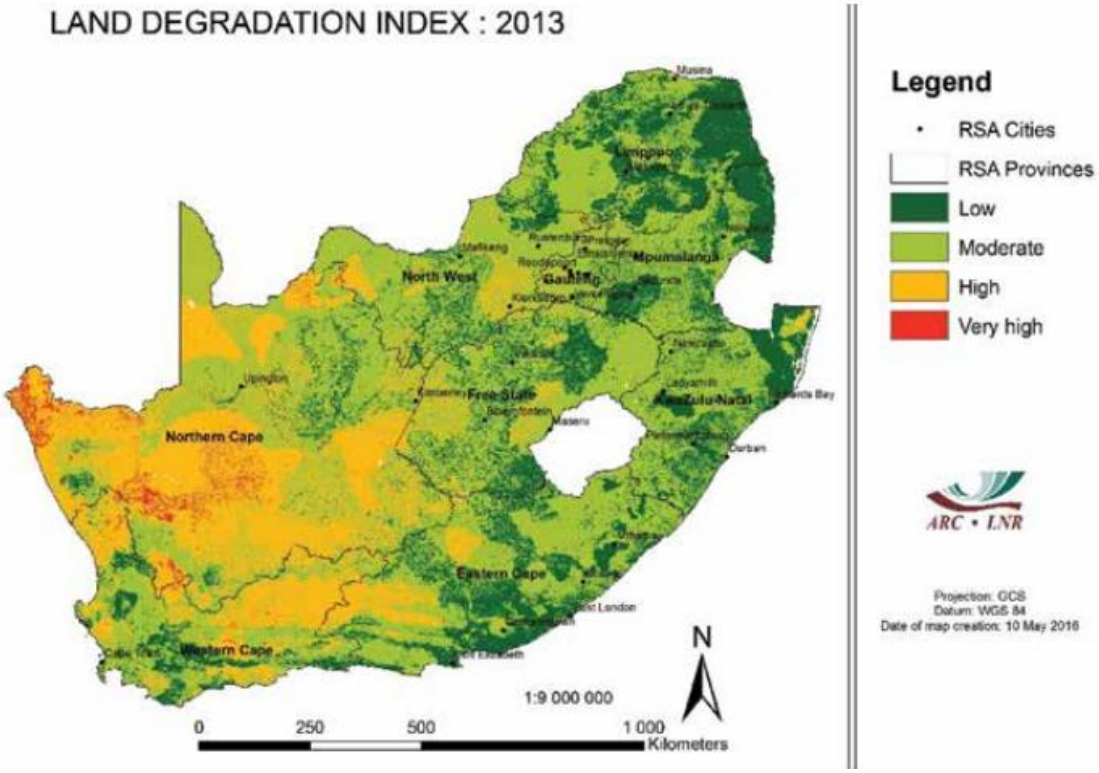


Figure 3: Land degradation index, South Africa (DFFE, 2018)

Figure 3 shows a land degradation index. This was developed by combining indicators that include indexes of aridity, wind and water erosion, and soil pH. The map shows that most parts of the country experience low to medium degradation, whereas large parts of the Northern Cape, North West and Eastern Cape Provinces experience high degradation (DFFE, 2018).

Country-specific degradation in grasslands and savannas

In the grasslands and savanna biome in South Africa, specifically the northern part of the country, the key drivers of degradation are clearing for croplands and the expansion of human settlements (Ludwig, Meyer & Nauss, 2016). Bush encroachment has devastating impacts on the rangeland carrying capacity for cattle and other preferential grazers. Species composition changes, grass biomass decreases, erosion increases and the water table is lowered. Overgrazing and overuse of plant resources result in a loss of vegetative cover leading to soil erosion (von Maltitz et al., 2019). Mapping gullies can provide a secondary source of information as to where overland erosion may be taking place. Rates of loss are

	highest in the southern and eastern coastal regions, in the interior Highveld grasslands and in the savannas of Limpopo and Mpumalanga (Skowno, Jewitt & Slingsby, 2021). *Key Informant Two told the study the collapse of the valley bushveld was a major problem with a lot of projects already involved.* ***Country-specific degradation in inland waters and wetlands*** In South Africa, invasion of alien plants is perceived as the country's greatest wetland degradation threat. Invasive plants in waterways reduce national streamflow by 2.9%, with far higher hydrological impacts in some of the country's critical catchments (Skowno, Jewitt & Slingsby, 2021). The Fynbos and grassland biomes are exceptionally vulnerable to invasive *Prosopis* species found over widespread areas of the Northern Cape province, especially along water courses (Von Maltitz et al., 2019). *It was also noted by Key Informant Two that there is a knowledge gap between loss of wetlands and their link to peatlands.* Furthermore, in South Africa, there is a lack of knowledge about the ecosystem services value of peatlands. Therefore, policy and management decisions are not formulated using a good knowledge base and thus may ultimately lead to the further destruction of both these important ecosystems (Grundling et al., 2017). ***Country-specific degradation in forests*** *Key Informant Two noted that South Africa does not have a sound research-based understanding of degradation, but has some clear problems and existing projects. Tackling alien invasive species takes massive resources, particularly in the Cape area (and is very costly as a public works approach).*

Table 9: Zambia country profile

Country	Zambia
Socio-economic statistics	GDP per capita (US dollars) (2023): **1.44 thousand** Gini coefficient (2019)[14]: **38.3**

[14] Gini coefficient source: World Economics, 2023

	Human Development Index (HDI) (2021): **0.565** Population (2023): **20.57 million** Land area (km^2) (2023): **743,390**
Socio-economic status	Zambia has a noticeably low GDP, very high level of wealth inequality, and a relatively low population of around 19 million given its large land mass. Zambia is endowed with abundant natural mineral resources and its economy is heavily reliant on the mining sector, which contributes around 10–14% of the country's GDP (Banda, 2022). Copper mining, in particular, has been a significant contributor to the country's economic growth, accounting for around 70% of its export earnings (Banda, 2022). The highly extractive nature of Zambia's economy places the country at significant risk of environmental degradation.
Ecosystems and degradation	***Country-specific degradation in inland waters and wetlands*** Mining in Zambia contributes significantly to the country's GDP. However, despite this contribution, copper mining has produced massive perverse effects on the environment (Muma et al., 2020). The mining operations in the Copperbelt all lie within the catchment of the Kafue River, which provides water for domestic uses, irrigation and fishing (The World Bank, 2015). Kafue's watershed is the most developed in the country, and the river is coming under rising threat from pollution as well as competition for water utilisation. The major cities in the Copperbelt region receive their domestic water supply from the Upper Kafue River, and concern for potentially contaminating mining activities is always present. The Kafue River and its branches are also used for irrigation as well as for providing local communities with fish (Lindahl, 2014). The impacts of mining activity are quite significant. Runoff and leakage from waste rock dumps and tailings dams can cause widespread impacts downstream (The World Bank, 2015). The Kafue River has shown highly elevated concentrations of dissolved copper and cobalt within the mining areas (The World Bank, 2015). Elevated concentrations of dissolved sulphur can be traced all the way down to the confluence with the Zambezi River (The World Bank, 2015). Chemical spillage and leakages from various mining sites contaminate water bodies in the surrounding mining townships and rural areas (Muma et al., 2020). Although the contamination is concentrated in hotspots closer to mining operations, secondary particles are resuspended and transported downstream (The World Bank, 2015). This has resulted in a serious food security threat, as farmers are unable to safely irrigate their crops or provide water for their animals, and the food produced on the contaminated land endangers biodiversity and the health of both human and

	animal life, and affects residents' economic livelihood (Muma et al., 2020). The contaminated agricultural food crops often grow and yield poorly with low-quality harvestable products because of soil acidification and siltation caused by mining and metallurgic industries (Muimba-Kankolongo et al., 2022). The impacts of mining activity are specifically seen in Kankoyo Township in Mufulira District through the degraded physical structures of buildings, dust, air pollution, and surface and groundwater pollution (Muma et al., 2020). ***Country-specific degradation in forests*** Forest cover is estimated to be 61% of the total land area in Zambia (Sedano et al., 2022). The country is one of the most forested in Africa, but also has one of the highest rates of deforestation and degradation in the world, estimated at 250,000–300,000 ha of forest loss per annum (Mulenga, Nkonde & Ngoma, 2015). Between 2001 and 2021, Zambia lost 2.07 Mha of tree cover in total, equivalent to an 8.6% decrease in tree cover, and 766 Mt of carbon dioxide-equivalent emissions (Global Forest Watch, 2023). An estimated 58% of all tree cover loss in this period has occurred in three regions, namely, North-Western, Copperbelt and Luapula Provinces, with North-Western having the most loss at 525,000 ha compared with an average of 207,000 ha (Global Forest Watch, 2023). The underlying drivers of deforestation have been identified as high poverty levels, low employment opportunities, brick making, tobacco curing, insecure tenure rights, low institutional capacity in the forest management sector (poor funding, low staffing levels, lack of reliable transport for monitoring) and lack of synergy among the various policies and acts of legislation (Mulenga, Nkonde & Ngoma, 2015). Land clearance for agriculture has been cited as the primary cause of forest cover loss, driven indirectly by population growth (Day et al., 2014). Charcoal production has often been described as a byproduct of agricultural expansion, rather than a direct driver of deforestation. However, in a study by Sedano et al. (2022) to document tree cover loss in three Zambian forest reserves, forest degradation was attributed directly to charcoal production with a high degree of certainty, as evidence of kiln scars was found in more than 85% of sites sampled with high-resolution remote sensing imagery across the study areas (Sedano et al., 2022). Charcoal is the main cooking energy in Zambia for more than 75% of urban households (Sedano et al., 2022). Across the country, the main immediate drivers of deforestation/forest degradation include wood fuel demand and consumption, charcoal production, declining agricultural productivity,

	infrastructure development, fires, and inappropriate land and forest management systems (Day et al., 2014; Mulenga, Nkonde & Ngoma, 2015). *Key Informant Seven told the study that large-scale deforestation/land degradation from mining and other extractives, and large-scale commercial agriculture were major environmental forest degradation issues. Some major hotspots include: mining projects in protected areas or ecologically significant sites, such as a mine in Lochinvar National Park which has expanded beyond the approved licence area without any environmental approvals; a large-scale open-cast mine in Lower Zambezi National Park that is proceeding with questionable environmental and social governance issues and standards; and large-scale commercial agriculture in the Bat forest next to Kasanka National Park.* ***Country-specific degradation in grasslands*** Grasslands covers 27% of the land in Zambia covering 164,263.37 km^2.The greatest loss in soil organic matter (SOC) was incurred during the change in land use from tree cover and grassland to cropland in the period between the years 2000 and 2015. The challenges of land degradation encompass various spheres such as land tenure, direct and indirect drivers, and institutional and legal frameworks (Government of the Republic of Zambia, 2019). Conservation strategies influence land cover. Protected areas are expected to have intact forest cover and stable grasslands compared to areas that are not protected. It is found that in protected areas with less than 15 years of protection there was a likelihood for the recovery of land from grasslands to secondary forests (Phiri, 2019). Other protected areas such as wildlife management areas also highlighted a reversion of grasslands to secondary forests after a disturbance.

Table 10: Mozambique country profile

Country	**Mozambique**
Socio-economic statistics	GDP per capita (US dollars) (2023): **647.14** Gini coefficient (2019): **50.5** Human Development Index (HDI) (2021): **0.446** Population (2023): **33.9 million** Land area (km^2) (2023): **786,380**

Socio-economic status	Mozambique grew at an average annual rate of 6–8% in the decade leading up to 2015: one of Africa's strongest performances (AGOA, 2023b). In spite of these gains, about half the population remains below the poverty line and subsistence agriculture continues to employ the vast majority of the country's workforce (AGOA, 2023b).
Ecosystems and degradation	***Country-specific degradation in drylands and deserts*** Small-scale agriculture has been noted to be a main contributor to deforestation in the country (AGOA, 2023b). Mozambique is largely covered by the Miombo–Mopane ecoregion, part of the 'presumed drylands' (FAO, 2022). The past three decades have been characterised by growing population and unsustainable land-use practices in the Miombo–Mopane woodland region, resulting in increased deforestation and land degradation (FAO, 2022). Key drivers include unsustainable farming practices and overgrazing, firewood gathering, and production of charcoal (FAO, 2022). The growing urban markets for products such as charcoal, timber and tobacco have resulted in even more forest clearing and degradation. According to FAO (2022), biomass accounts for 60–90% of energy consumption in the southern African Miombo and Mopane ecoregions (Maquia et al. 2019), which includes Mozambique, and thus energy consumption represents a significant driver of forest and canopy-cover loss. Desertification and land degradation increase the risks of drought, which are a recurrent hazard in Mozambique (The World Bank, 2019). ***Country-specific degradation in grasslands and savannas*** In 2016, Mozambique's second most abundant land class cover was grassland/savannah (20.6%) after forests (58.2%) (Cianciullo et al., 2023). Grassland/savanna covered a land area of 16.9 Mha covering mainly Niassa (14.5%), Tete (14.1%) and Sofala (11.9%) areas (Cianciullo et al., 2023:). However, between 2001 and 2016, grassland/savannah areas had experienced the greatest loss in land cover with a 5.7% decrease (Cianciullo et al., 2023). An analysis of land cover at the ecoregion level shows the greatest change as having occurred in the Miombo woodland and coastal areas, where a significant reduction of the forest and grassland/savannah and an increase of cropland has been observed (Cianciullo et al., 2023). Mozambique is undergoing significant land productivity changes, part of which is a loss in grasslands productivity resulting from human activities and climatic variabilities (Montfort et al., 2021). Grasslands, along with forest and cropland were the main land-use categories that displayed significant Normalised Difference Vegetation Index (NDVI) trends (decreases and increases) between 2000

and 2016, with the decline in grassland productivity representing 17.7% of the overall decrease trend (Montfort et al., 2021).

Country-specific degradation in inland waters and wetlands

Mozambique is home to part of the Zambezi wetlands. The country has aquatic ecosystems of recognised national, regional and international importance, among which the Niassa Lake and the Zambezi Delta are the most obvious examples (Ministry of Land, Environment and Rural Development (MLERD), 2015). The main types of aquatic and wetland ecosystems are the rivers and their riparian zones (about 100 river basins covering more than 50 km^2), deltas, natural lakes, artificial lakes created by dams, ponds and marshes (MLERD, 2015). Wetlands comprise 1.9% of land cover in Mozambique (around 1.5 Mha) mostly found in the Tete, Sofala and Zambezia provinces, which hold 23.1%, 18.2% and 14.2% of the country's wetlands respectively (Cianciullo, 2023). Wetlands have decreased, with a 1.9% decrease recorded between 2001 and 2016 (Cianciullo, 2023). Human subsistence activities are considered as the main causes of the direct loss and degradation of natural ecosystems (MLERD, 2015). Agricultural practices currently used by most of the Mozambican population are rudimentary, and therefore unsustainable, with many farmers relying on river and stream banks and beds to practice agriculture during the dry season, or in drought years. This causes the removal or degradation of riparian, wetland and aquatic ecosystems (e.g. the loss of riverine forests and wetlands, and pollution of rivers and streams) (MLERD, 2015). Pollution of aquatic systems is one of the main causes of aquatic systems degradation (MLERD, 2015). Demand for wet areas for agriculture results in immediate ecological alteration of ecosystems, which undermines the species (migratory birds, plants and animals) that depend on these habitats for their existence (MLERD, 2015).

Country-specific degradation in forests

Forests represent the largest land cover in Mozambique, covering 58.2% of the land cover and about 47.9 Mha (Cianciullo et al., 2023). Provinces with the most forest cover include Niassa (18.3%), Tete (13.5%) and Cabo Delgado. Human activities remain the dominant factor in land productivity change in Mozambique, the main ones being forest degradation and deforestation (Montfort et al., 2021). A large majority of land productivity decrease (61%) is due to human factors; 19.7% involves only climatic variables; and 19.4% is explained by both climate and human factors (Montfort et al., 2021).

Illegal and legal logging, firewood and charcoal production and fires are the most important causes of forest degradation while shifting cultivation is the major cause

	of deforestation (Montfort et al., 2021). Drivers include commercial agriculture, indigenous slash and burn cultivation practices, and logging for timber in response to population growth and urbanisation (Montfort et al., 2021). Controlled and uncontrolled fires are widespread in Mozambique and are reported to impact 30 million ha of forest and 38% of other land each year (Montfort et al., 2021). The Zambezia and Nampula provinces are particularly characterised by deforestation, forest degradation and fires (Montfort et al., 2021). These provinces have the country's highest rural population density and had the country's highest deforestation rates between 2003 and 2013 (Montfort et al., 2021). The greatest change in land cover has been observed in the Miombo woodland and coastal areas (Cianciullo et al., 2023). Between 2001 and 2016, about 6.2% of forest cover was lost in the country (Cianciullo et al., 2023). *Key Informant Five told the study the displacement of natural forests (especially in the Nampula, Zambeze and Manika provinces) is a major issue.* ***Country-specific degradation in coastal marine ecosystems*** Coastal and flooded vegetation represents one of the major ecoregions of Mozambique, and includes: the Zambezian flooded grasslands, the Zambezian coastal flooded savanna, the Southern Swahili coastal forests and woodlands, the Southern Africa mangroves, the Maputaland coastal forests and woodlands (Cianciullo et al., 2023). The greatest land cover change in the country has been observed in the Miombo woodland and coastal areas, where there has been significant reduction of the forest and grassland/savannah and an increase of cropland**.** Settlement has increased mainly in the coastal area (WWF, 2023). The coastal ecosystems in Mozambique face critical risks such as erosion, uncontrolled development, unsustainable utilisation of resources, and habitat degradation (Kapuka & Hlásny, 2021). Factors causing vegetation loss include illegal logging of mangrove forests and coastal erosion (Ballut-Dajud, 2022). Climate change impacts increase the potential loss of coral reefs in some parts of the Mozambique coast, with increased risks of coral bleaching due to high temperatures, more light and variable water flows (Kapuka & Hlásny, 2021). Progressive coral bleaching means Mozambique needs to determine priority areas for conservation, particularly in the southern part of the country (Kapuka & Hlásny, 2021). Measures aiming to protect the coral reef require complex strategies, including improved watershed and waste management and reduced air pollution in the most vulnerable coastal areas (Kapuka & Hlásny, 2021).

Table 11: Malawi country profile

Country	Malawi
Socio-economic statistics	GDP per capita (US dollars) (2023) **579.7** Gini coefficient (2019): **38.5** Human Development Index (HDI) (2021): **0.512** Population (2023): **20.93 million** Land area (km^2) (2023): **94,280**
Socio-economic status	Landlocked Malawi ranks among the world's most densely populated and least developed countries (Moody's Analytics, n.d.). The economy is predominantly agricultural and accounts for about one-third of GDP and 80% of export revenues (Moody's Analytics, n.d.). The country's agricultural industry and high population density on a relatively low national land mass increases the risk of environmental damage (Moody's Analytics, n.d.).
Ecosystems and degradation	***Country-specific degradation in drylands and deserts*** Malawi falls entirely in the Miombo-Mopane ecoregion, which is a dryland ecoregion, and comprises the main ecosystems of the 'Zambezian' region of Africa (FAO, 2022). Mozambique's vegetation is characterised mostly by miombo and mopane woodlands, as well as other various forms of thicket and dry forest (FAO, 2022). Miombo–Mopane woodlands cover the transboundary region extending from the west coast of Africa in Angola to the east coast in Mozambique and the United Republic of Tanzania and stretch over eight countries, these include Malawi, Zambia, Angola, Burundi, the Democratic Republic of the Congo, Mozambique, the United Republic of Tanzania, and Zimbabwe (Gumbo et al., 2018; FAO, 2022). Mozambique is part of the 'presumed drylands', represented by dryland forests and woodlands that are dominant across Southern Africa's semi-arid and dry sub-humid (or tropical dry) parts (FAO, 2022). Presumed drylands have an aridity index greater than or equal to 0.65 and are characterised by dryland features (FAO, 2022). The Miombo-Mopane woodlands face severe pressure of desertification, with the main drivers being unsustainable use of drylands resources, conversion to agriculture and widespread maladaptive practices, domestic and commercial extraction of timber, and land clearing for biofuels. These changes are driven by population growth, poverty and inequality, and exacerbated by climate change (FAO, 2022).

	The arid and semi-arid conditions of Malawi are a contributing factor to the high environmental degradation levels in the country (Kirui, Mirzabaev & von Braun, 2021). According to Nyirenda (2014), unsustainable human activities that take place in already-fragile areas, and that are aggravated by natural disturbance such as drought or flooding, lead to land degradation and desertification. Conditions are becoming harsh in sub-humid areas of Malawi. They are exacerbated by frequent drought and an influx of people into the drylands. Overgrazing and subdivision of land into uneconomic land parcel sizes have further worsened conditions (Nyirenda, 2014). Desertification affects almost three million people (about 30% of Malawi's population) who live on 2.8 Mha of semi-arid and dry sub-humid land areas of the country, stretching along the Rift Valley floor (Nyirenda, 2014). ***Country-specific degradation in grasslands and savannas*** Land degradation hotspots in Malawi cover about 41% of the terrestrial areas, of which grasslands form a substantial part, including flooded grasslands and savannas, and montane grasslands and savannas (Kirui, 2016). These degradation hotspots include: the Southern Rift Montane Grassland Mosaic, which has montane grassland and forests, covering the Nyika National Park and the Vipya areas; the Zambezian Flooded Grassland (perennially wet swamp grasslands covering Lake Chilwa and its surroundings and some surroundings of Lake Malawi); and the South Malawi Montane Forest Grassland Mosaic, which has Montane evergreen forests and grasslands, and covers Zomba, Blantyre, Mulanje and Thyolo area (Kirui, 2016; World Atlas, 2023). In a recent study by Kirui, Mirzabaev, and von Braun (2021) the highest proportion of degradation in Malawi was experienced in mosaic forest-shrub/grass (57%) and grasslands (56%). The most serious environmental issues include: soil erosion, deforestation, water resource degradation, threat to fish resources, threat to biodiversity, human habitat degradation and air pollution (Government of Malawi, n.d.). Direct drivers of environmental degradation include: improper management of the soil; poor agricultural practices, including use of environmentally fragile areas; deforestation and removal of natural vegetation; overexploitation of vegetation for domestic use particularly for fuel (wood and charcoal); overgrazing in areas with high cattle density; waste deposition and mining of quarry and sand; and frequent wildfires (Government of Malawi, n.d.). ***Country-specific degradation in forests*** Over the last four decades, more than half of Malawi's forests have been cut down, resulting in nearly 80% of the total land area experiencing degradation (Dan, 2020). The country has experienced the highest deforestation rate in the Southern African Development Community (SADC) region, amounting to a net loss of some 30,000 to

	40,000 ha per year (Ngwira & Watanabe, 2019). Deforestation has been highest in the northern part of Malawi where population is low (Government of Malawi, n.d.). Key immediate drivers of degradation include charcoal and wood fuel (for domestic and commercial), timber production, unsustainable agricultural methods (slash and burn with shorter rotations), mining (Kirui, 2016), and uncontrolled wildfires (Government of Malawi, n.d.). Indirect causes include population pressure and poverty (Government of Malawi, n.d.). *Key Informant Ten told the study that deforestation is a major land degradation issue. Agricultural-based activities are replacing forest reserves and protected areas are being converted to cropland. According to the Key Informant, addressing these problems would require sustainable land management, sustainable forest management, and adoption of landscape approaches to restoration.*

3 Gaps and opportunities to improve evidence, tools and governance

This section synthesises data from the literature review and stakeholder engagement to identify various gaps and opportunities in the context of evidence, tools and governance. We have sought broad insights into what might help reverse environmental degradation or encourage restoration across Southern and Eastern Africa.

3.1 Evidence

3.1.1 Evidence gaps

Stakeholders do not have sufficient evidence to tackle environmental degradation in the region.

Lack of national and sub-national datasets

Studies generally share the common disadvantage of drawing on global datasets for national and sub-national land degradation assessments. For example, few if any studies exist in Africa that use high spatial resolution datasets for the assessment of Sustainable Development Goals.

Lack of in-depth research

In general, there is a scarcity of scientific information to support knowledge about degradation and natural resource management. A study by Nyika and Dinka (2022) shows that with the exception of research from South Africa, African countries conducted limited research on the topics of sustainable natural resource management, nature-based solutions and restoration. Nyika and Dinka (2022) recommended better financing for research and for its subsequent documentation by African researchers to supplement research already conducted by developed countries. They also called for policy and institutional reforms that would support greater investment in African scholarship on sustainable natural resource management.

Similarly, a study to consolidate research undertaken on urban green infrastructure and the associated ecosystem services in sub-Saharan African cities reviewed 68 papers spanning over 20 countries. Only 38% of sub-Saharan countries had any research on urban nature. The most-represented ecosystem services were regulating and provisioning, with supporting services getting the least attention. Overall there was a lack of in-depth studies on all ecosystem services, especially supporting and cultural services (Du Toit et al., 2018).

Inadequate use of research to support restoration

Key Informants One, Three and Four noted that restoration efforts were mostly reactive and did not heavily rely on research. Further, studies that highlight the influence of restoration efforts are usually dominated by research at single sites, often over short periods of time. They cannot usefully inform restoration efforts at a larger scale. Additionally, the lack of research on restoration across various ecosystems makes it difficult to test or evaluate restoration trajectories (Jones et al. 2018). Despite success in some places, there remains a large gap between existing research and the uptake of this by government officials, the public and other organisations in their workings and policies.

Mauritius provided an example to learn from, in terms of advancing research into the fight against invasive alien plants (documented in Baret et al., 2013). Work to preserve species and restore Mauritian protected areas was supported by sound research. The research also held wider applicability for other Western Indian Ocean islands. Baret et al. (2013) noted several incorrect and entrenched ecological concepts, but also occasional improved communication between managers and researchers that contributed towards better understanding and uptake of research.

Limited documentation of project-based knowledge into research outputs

A review by Lwasa (2015) found limited published work on adaptation interventions at the local scale in Africa, and there seems to be a gap in knowledge generation between practitioners and scientists. The same is true for interventions in the urban domain. Much effort has been invested by NGOs, not for profit organisations (NPOs) and organisations such as the World Bank and WWF to address the challenges and drivers associated with urban environmental degradation and to secure and enhance urban nature in Southern and East Africa.

However, these intervention and knowledge generation efforts, ranging from urban nature planning tools and policies, city biodiversity strategies and action plans, species inventories and biodiversity financing, have typically not been designed as scientific research projects nor designed for peer-reviewed publication. They generally exist as ‘grey literature’. Their knowledge is therefore not widely available for rigorous testing or replication and remains localised, commonly within the ambit of a donor-funded project. Collaboration with research institutions could support the scientific basis and peer-reviewed publication of development work.

Challenges in knowledge transfer

Knowledge transfer has sometimes taken place through co-production techniques but scaling such knowledge for wider impact through policy means or through the transfer of scientific research to address degradation remains a challenge. An exception is a

Thematic Atlas of Nature's benefits to Dar es Salaam (Karutz et al., 2019), which shows how a science- and ecosystem-based approach can support urban greening decision making. The lesson here is that products can be evidence- and science-based but be packaged in a way that is user-friendly for practitioners. This improves scientific product acceptance and application.

3.1.2 Opportunities to improve evidence

Improving data and mapping through access to funding streams

There is a need for funding streams that let researchers source high-resolution maps. It is important to invest in periodically capturing data to build datasets that can support more informed decision making. Environmental restoration practices at the local level need to use indicators specific to developing countries instead of global indicators (Institute for Coastal and Marine Research (CMR), 2023). There is a need to fund projects that are using and developing maps and datasets and developing indicators in a diversity of biomes including inland wetlands, coastal and marine, as well as grasslands and savanna biomes.

Investment in further research

The review and stakeholder engagements reveal that there is a lack of research on ecosystem degradation. There is a lack of data and knowledge on the true extent of degradation and the extent to which these restoration projects are actually working. The South African National Biodiversity Institute Research's National Biodiversity Assessment (2018) stated that research priorities should be focused on improved foundational information (e.g. distributions, descriptions) for species and ecosystems, further work on pressures on biodiversity and ecological condition, and research for further improving the indicators used in the assessment. There is a need for scientific research into strengthening policies to inform sustainability practices (Rakotomanana et al., 2013).

Research uptake

Research uptake should be planned for as part of the research planning process, before the research begins. Continuous engagement and participatory approaches are needed. Effective planning for uptake and implementation makes ensuring buy-in, support, relevance and ownership of interventions more likely. The African Cities Research Consortium (ACRC) used an approach that incorporated city-led research teams practising the ideology of research with society. High levels of participatory activities from varied stakeholders enabled better uptake of the research findings. The approach led to increased ownership and in some cases solidified partnerships, setting the basis for uptake (Arendse, 2023).

There is a need to invest in knowledge-based relationships between those generating evidence and decision makers at different levels of governance and implementation.

Evidence-based restoration practice

Evidence-based decision making is important in environmental degradation alleviation projects. Key Informant Eight from Rwanda Key Informantreflected on the 'Sebeya catchment landscape restoration project' and the 'LAFREC Gishwati – Mukura natural forests' project funded by the World Bank, noting that known drivers of environmental degradation were not taken into consideration. Our interviewee noted the lack of planning and research for alternative fuel sources for future generations. Additionally, Key Informant Eight said the current methods of erosion control in river catchment areas ignore the hydrological and morphological dynamics of river systems. Yet restoration initiatives that simultaneously address ecological as well as social and/or local development needs are known to attract better community participation and support (Roe et al., 2019).

In order to know where to prioritise investment for restoration efforts, it is important to understand the biodiversity and the landscapes in the area. Successful ecosystem restoration efforts depend on the availability of data and information on the ecosystems, including the changes in land use and ecological integrity. A good example of this is the Dar es Salaam native biodiversity catalogue developed as part of the Integrated Action on Biodiversity (INTERACT-Bio) project. The aim of the catalogue is to inspire awareness of the uniqueness of the city's natural heritage, the role and importance of native fauna and flora for local conservation efforts, for local economies and for mitigating risks associated with climate change, food security and public health. The Catalogue was designed through assessments of the city's biodiversity and ecosystems by selecting a subset of fauna and flora species in the city, making it a useful resource for understanding current trends, threats and opportunities in the city's biodiversity (ICLEI, 2023). The project highlights the importance of working with local researchers and experts in developing scientific evidence that could direct where restoration efforts should be focused.

Involvement of women- and youth-centred initiatives within restoration projects

There is a nexus between biodiversity and social development, especially in programmes addressing land degradation issues and youth development. Perspectives and involvement of youth, women and marginalised communities are often not incorporated in large-scale restoration projects. Further, translating research outputs and implementing best practices at the local level necessitates a good understanding, training and knowledge transfer among various stakeholders including women, youth and other marginalised groups. An example is seen by the UNDP Biodiversity and Ecosystems Services Network (BES-Net) project in Malawi, which engages and upskills

young entrepreneurs in land restoration activities and business management across the three districts of Lilongwe, Dedza and Salima (UNDP, 2022). These skills have increased youth access to green jobs and enabled them to grow green enterprises focused on land restoration and climate adaptation. The Kijani Pamoja, a pan-African initiative, activates youth and the business sector with the aim of creating dense, multi-layered urban forests across Southern, Eastern and West Africa.

The issue of addressing social and economic needs together with ecological restoration is important for creating initial interest among key relevant stakeholders while upskilling stakeholders to contribute in undertaking the proposed interventions as well as provide long-term support.

Fostering partnerships and engagement platforms

Partnerships with mapping institutes can provide capacity development to stakeholders involved in environmental restoration initiatives. These partnerships could also be leveraged to improve access to high-resolution updated maps. An example is seen in Mauritius, where a holistic participatory approach, including equal representation of interest groups and stakeholders, was taken to achieve sustainable forest land management. Stakeholders' views were taken into consideration during the decision-making process along with good governance, transparency and accountability (Sultan, 2016).

Table 12: A summary of the gaps and challenges, and how these relate to opportunities.

Gaps and challenges	**Opportunities**
Lack of national and sub-national datasets	Improving data and mapping needs through access to funding streams
Lack of in-depth research	Investing in further research
Inadequate use of research to support restoration	Evidence-based restoration practice
Limited documentation of project-based knowledge into research outputs	Fostering partnerships and engagement platforms
Challenges in knowledge transfer	Research uptake Involvement of youth- and women-centred initiatives in restoration projects

3.2 Tools and technical approaches

3.2.1 'Proven effective' tools and technical approaches

Several approaches and techniques are being applied with success in addressing environmental degradation and implementing restoration in different landscapes. This section describes them – but also the challenges they still face.

Assessments of the state of research and data management

Structured assessments and reviews are useful for identifying broad trends and areas where knowledge that addresses degradation needs improving (South African National Biodiversity Institute (SANBI), 2018):

- Monitoring needs: The need to monitor degradation was evident across our study countries. Investment in existing and future strategic biodiversity monitoring programmes is essential to strengthen the ability to detect trends, plan accordingly and manage effectively. While South Africa has some robust biodiversity monitoring programmes, many involving citizen scientists, these are the exception. Resources allocated to monitoring programmes are declining and some key datasets are very old and no longer actively updated.

- Data management**:** Effective collaboration and data sharing between biodiversity data facilities, and between these facilities and the data users, is a crucial foundation for ongoing research and monitoring. Better data management and sharing would ultimately improve the quality and accuracy of biodiversity assessments and planning. It also underpins transparent science-based policy advice and decision making.

- Data, remote sensing and GIS: Remote sensing and GIS are widely used to map the extent of land degradation. A Key Informant from Mozambique noted that remote sensing is an essential tool in this country for tracking forest degradation and for prioritising areas where restoration would be most valuable. See for example the work by Buramuge et al. (2023).

  However, some criticise this approach to assessing and monitoring degradation as inaccurate. Remote sensing needs to be used as a complementary tool when tracking achievement of restoration goals. This is because in some instances remote sensing is not holistic and has range restrictions. For example, in South Africa, wetlands and inland waters are not properly recorded and monitored. Field validation in conjunction with remote sensing tools remains crucial for accurately depicting degradation as well as for confirming the rate of restoration taking place (CMR, 2023).

These views were prevalent across several interviews conducted for this study. Key Informant Two, from South Africa, said one of the shortcomings of restoration decisions is that the data measuring and mapping degradation is simplistic. Key Informant Four, from Kenya, said restoration is not being monitored and reported accurately, therefore the effectiveness of the restoration taking place is unknown. In Ethiopia there is a lack of reliable and consistent data on the extent and rate of soil degradation and similar shortcomings have been noted for Kenya and Tanzania (Liniger et al., 2019; Mulinge et al., 2015). An interesting note for South Africa was that while degradation as a process is poorly understood in this country, the problems and drivers of degradation are identifiable and some action is being taken. Projects and solutions such as the removal of invasive alien species are resulting in measurable improvements in the flow of defined ecosystem services.

Restoration techniques

- Natural forest regeneration: This is a method used to promote the growth of indigenous species in the dry forests and woodlands of Eastern and Southern Africa, using both natural and assisted regeneration. The dry forest and woodlands are usually subjected to continued pressure as they provide a livelihood to the rural communities and, in many cases, they are a source of energy (wood fuel) for African cities. In Eastern and Southern Africa, natural forest rehabilitation has used both natural and assisted regeneration to promote the growth of indigenous species. The technique is employed in situations where there are some trees left in the landscape to act as seed sources during secondary succession. Both natural and assisted natural regeneration have been reported from forest restoration work in Ethiopia, Tanzania and Uganda.

  In Southern Africa, natural regeneration associated with coppicing has also been reported, mostly in Malawi, Mozambique, Namibia, Zambia and Zimbabwe. Importantly, the success of such strategies generally depends on the ability of local people to exercise power to create inventories and manage local resources in systems of community-based natural resources management. Certain forest policies must be enabled, including (1) the full participation of communities, (2) clear land and tree tenure and (3) equitable benefit sharing (Pacheco et al., 2020). Furthermore, private forest owners can be encouraged to participate in forest conservation by removing invasive species (Iranah et al., 2018). This could also offer socio-economic benefits.

  Forest restoration costs can be reduced by hiring people from surrounding communities and utilising enhanced weeding techniques (Iranah et al., 2018). This restoration method could be replicated in other Western Indian Ocean Islands, where labour is accessible and affordable (Baret et al., 2013).

- Establishing multi-use zones for forests: Zoning forests and other preservation areas is important to halt the further loss of biodiversity. There are specific zones demarcated for conservation use and others for multi-use with limited/regulated access. For example a good practice from Kilifi County in Kenya (Key Informant Four) included creation of a community forest organisation that is involved in the management of a zone that is within a five kilometre radius, preferably where alien invasive species could be controlled through ring-barking (Baret et al., 2013) – this measure is found to be less expensive than manual felling and less harmful to native saplings and seedlings. The zone accessible to communities can allow for accessing firewood, agroforestry and other permitted uses. The inner concentric zones could be demarcated as no-go zones to allow the area to be restored.

- Regenerative agricultural practices: An agricultural project in Dodoma, Tanzania, illustrates regenerative restoration techniques and emphasises the importance of clear land tenure. The project used regenerative agriculture to demonstrate how food production and nature can coexist. The project also created opportunities to engage with communities and build their capacity to derive various co-benefits (ICLEI Cities Biodiversity Centre, n.d.). Governance of the site where the project was implemented played a significant role in its success. Land tenure affects how people decide to use natural resources, because it influences who has the right and the incentives to invest in improvements, and who benefits from changes in use and productivity. An agreement between the community and the local municipality was reached that clarified tenure. This gave the community rights to practise regenerative agriculture on the site (and so to learn techniques and benefit from them). The city council maintained ownership, but with the clear intention of using the land as a training opportunity for community members.

- Creating incentives: The benefits of preserving biodiversity need to be distributed among nearby communities that rely on these natural resources. Although the benefits of preserving biodiversity are typically recognised on a global or national scale, it is the local inhabitants, particularly rural people striving to secure their livelihoods, who face costs when their use of natural resources is restricted by conservation measures. Direct incentives for community-based conservation through contracts and payments are therefore considered important to ensure effective conservation. There might already be certain local advantages stemming from conservation efforts, such as ecological services like protecting watersheds, as well as opportunities for employment or revenue sharing through ecotourism (Rakotomanana et al., 2013). Additionally, incentives such as innovative land tenure systems can be developed. In Dar es Salaam, Tanzania, for example, there is considerable interest in enhancing native species stocks in local plant nurseries,

provided there is an economic incentive to source seeds and cultivate native plants (ICLEI, 2023).

- Coastal adaptation strategies: Mauritius provides a good example of success to build on. Since 2012, Japan's International Cooperation Agency (JICA) has been supporting the Republic of Mauritius to design a long-term coastal adaptation strategy. Stages have included a nationwide coastal risk assessment (JICA, 2016), and capacity development through demonstration projects (Duvat, Anisimov & Magnan, 2020). On the south-eastern coast, the community of Grand Sable was chosen for such a project. In this area, the coastal zone is low lying and experiences wave-driven flooding. To reduce community and road exposure, the Grand Sable demonstration project (2013) created a 250 m long, 10 m wide and 2 m high gravel beach as a wave buffer. After this demonstration project, public authorities implemented the Noyale Project (in 2017), creating a further 100 m long, 10 m wide and 1 m high gravel buffer to waves, stabilised by groynes and backed onto a concrete parapet wall.

- Sustainable land management: One sustainable land management practice that has been used with positive results in grasslands of the Miombo–Mopane woodlands, is reseeding with nitrogen-fixing trees or herbaceous fodder legumes, and controlled grazing. This technique has been shown to speed up the build-up of soil organic matter, leading to improved moisture use efficiency and a rise in productivity and yields, and further improving soil structure and carbon content (FAO, 2022).

- Rehabilitation of mangrove ecosystems: In Kilifi County, Kenya, a project named 'Rehabilitation of Mangrove Ecosystem through Nature Based Enterprises' in Rabai Sub-County has used nature-based enterprises to economically strengthen the local community and restore the mangrove ecosystem. The project assists the community, particularly the Mwachi Deko community-based organisation, by improving their capacity to engage in aquaculture, beekeeping, ecotourism and butterfly farming within the mangrove ecosystem. The group also plans to launch ecotourism initiatives in the region. The mangrove ecosystem is a breeding ground and home to many fish and crab species, and the target area covers 10.3 ha. The mangrove ecosystem had previously been damaged by community members (farmers and fishermen) who were removing it for commercial and construction uses. Additional factors for degraded mangrove ecosystems were siltation, which was brought on by the 1997 El Niño rains via the Kombeni River. The project, which began in 2016, assists roughly 150 households. By the end of 2022, the project had rehabilitated 55% of the degraded land. The FAO first funded the project, but the Kilifi County Government has since assisted the group in establishing fishponds and acquiring equipment and fingerling fish. However, gaining sufficient funds to successfully implement the project has been a challenge. Additional coastal ecosystem restoration projects

mentioned by RKI Four, from Kenya, include boardwalks along mangrove ecosystems, beach clean-up activities occurring throughout the county (Kilifi) on a monthly basis and the collection of plastic waste along the coastal areas of Watamu and Mariakani counties by community members and recycled into items that could be sold locally.

- Invasive species management: The experience of Conservation Management Areas (CMA) in Mauritius has demonstrated that original vegetation can be recovered in areas where alien invasive species have been removed (Baret et al., 2013; Iranah et al., 2018). However, private landowners typically lack the financial and technical means to set up CMAs on their lands (Iranah et al., 2018). Nevertheless, it is evident that just removing invasive alien plant species offers significant positive impacts on indigenous fauna and flora (Laurance et al., 2012; Iranah et al., 2018). Manual weeding and fencing off a patch of wet forest from large alien mammals like the Java deer and feral pigs has been tried in Mauritius (Baret et al., 2013; Iranah et al., 2018) and there has been much experimentation to compare manual and chemical control of invasive plants (Baret et al., 2013). In some cases, herbivores (e.g. Aldabra tortoises in Round Island, Mauritius) are used to help disperse seeds of native plant species (Baret et al., 2013). The South Africa experience also demonstrates significant gains from invasive species control, in particular through strong government interest and investment, according to Key Informant Two. Southern and East Africa also suffer the impacts of aquatic invasive species (e.g. water hyacinth, Nile perch and carp), but much scientific information and practice experiences are available to support decision making (Mutethya et al., 2021.)

- Awareness and capacity building: Studies such as du Toit et al. (2018) suggest there is insufficient capacity and expertise to identify, assess and manage green infrastructure in urban areas. This typically stems from financial limitations, technical limitations, limited institutional capacity and inadequate infrastructure. In addition, poor awareness and knowledge of the benefits ('ecosystem services') provided by urban biodiversity and urban green spaces suggests a need to raise awareness among local communities and decision makers. Nevertheless, we found some examples of success.

  A case study in Mauritius (Critical Ecosystem Partnership Fund, 2019) titled: ‘Restoring Native Forest at Chamarel: Ecological Restoration, Species Reintroduction, and Reconnecting the Public with Nature’, illustrates the importance of incorporating awareness raising with other tools for restoration. In this case study, the private sector partnered with school children, tertiary education students and volunteers. The study combined information about native species and extinct species, narratives about the restoration process and requirements, and visions of the forest in the past

and planning for the future, and involved partners in the restoration process (e.g. weeding and planting). Actual involvement in the restoration process brought renewed realisation of forest ecosystem services and a better understanding of the scope of the restoration effort required to restore forest ecosystem services.

A biodiversity mainstreaming project in Tanzania, 'Integrated action on Biodiversity' showed that awareness-raising messages around ecosystem services should be carefully tailored for different target audiences (ICLEI, 2020). For local communities, messages embedded in analogies, examples and sensory experiences achieve new insights and understanding. The project also experimented with incorporating ecosystem services training into the formal curriculum for urban design for third year university students. This was highly effective in reinforcing awareness of nature's benefits in cities. For city officials, it was important to make the links between ecosystem services and urban problems such as air pollution and urban heat (and make them spatially explicit). This showed that municipal services and urban issues can be partially addressed through enhanced ecosystem services. It created a lot of support for a planning tool (the 'Thematic Atlas') designed in this manner (ICLEI, 2020).

Projects also need awareness on species choice for restoration, as this will be highly site specific. Inventories can be helpful if they offer species information (with the correct taxonomic treatment) linked to the ecosystem services required at a site. Such tools are, however, not common.

- Innovative agricultural practices: Soil degradation could be addressed through the following management options: crop rotation, cover cropping, strip cropping, proper tillage practices, combined applications of organic and inorganic fertilisers, crop residue management, agroforestry, contour farming, liming and other physical conservation measures. According to Ruuska, increasing agroforestry is necessary in Dakatcha Woodland, southeastern Kenya, in order to make charcoal from planted trees instead of native forest. Fast-growing tree species could be planted as part of afforestation programmes, to ease pressure on the forests and offer a substitute for forest goods (Ruuska, 2013).

- Establishing protected areas: Several countries have established protected area systems, with varying levels of protection and different methods of management (Baret et al., 2013). Protected areas traditionally guard critical habitats for species so that they can thrive in nature, unimpacted by human disturbance. But it is important to provide science-supported evidence into conservation policy formation. In recent years, in efforts to preserve Madagascar's biodiversity, cultural heritage and ecosystem services, the protected areas network has promoted sustainable resource

use to combat poverty and enhance local communities that rely on natural ecosystems for their subsistence (Rakotomanana et al., 2013).

3.2.2 Tools and approaches that could be developed

Bearing in mind the successes described above, we identify the following tools and approaches as opportunities for REDAA investment.

GIS and remote sensing tools

Visualising key ecosystem services through mapping can be an effective vehicle for motivating people to engage in sustainable land management, conservation and restoration. There are many ways to map ecosystem services. These include spatial, GIS-based models to provide detailed estimates of ecosystem services' supply and value, using location-based data. In addition, participatory approaches that use knowledge and expertise from people in the study area are increasingly applied to map ecosystem services, especially in attempts to better match science with societal needs (Willemen et al., 2018). REDAA could invest in GIS and remote sensing tools, to promote better imagery and perhaps invest in better technologies to decrease fragmentation of datasets. Further investment could also be given to building GIS technical skills.

Developing national standards, indicators and monitoring tools

Key Informant Five, from Zambia, highlighted a lack of national standards for assessing, measuring, monitoring and reporting on biodiversity or environmental degradation, and a lack of a national system for ecosystem classification. For example, the informant said there is no national system for classification and management of wetlands although this is a major ecosystem and critical for biodiversity and livelihoods. Without such information, project design and implementation is haphazard. REDAA could undertake research into monitoring tools that properly monitor the extent to which degradation and restoration is happening in these countries.

Developing educational campaigns

Key Informant Eight, from Rwanda, suggested that practitioners should research and identify alternative energy sources for domestic cooking as well as engage the community in tree planting and river bank protection education initiatives. The Key Informantinformant highlighted that projects focusing on alternative energy sources and reforestation within secondary cities, especially Rubavu and Kigali city, are needed. REDAA could invest in awareness campaigns that look at innovative agricultural practices such crop rotation and planting fast-growing tree species that could be used for charcoal production.

Urban biodiversity mainstreaming

Given the rapid rate of urbanisation in Africa and the concomitant loss of biodiversity, biodiversity mainstreaming is one approach used to create awareness of the value of biodiversity and to integrate biodiversity and urban nature considerations into urban planning and governance. Biodiversity mainstreaming at the municipal or sub-national level is supported by the Convention on Biological Diversity and enjoys increasing support from Parties to the Convention. Two long-term projects across Africa, Urban Natural Assets (UNA) and INTERACT-Bio, have implemented a range of biodiversity mainstreaming interventions covering outreach, urban nature investment cases, ecosystem services mapping and training, restoration planning, multi-level and multi-sector dialogues and demonstration projects (physical changes and installations) (ICLEI, 2023).

These projects affirm that biodiversity mainstreaming requires at least a decade and multiple entry points in order to achieve effective and sustainable impact and to create opportunities for scaling best practices. REDAA could consider investing in awareness campaigns and technical support for practices that look into ecosystem-based approaches and nature-based solutions.

3.3 Governance systems

Challenges in institutional setup make it difficult to establish procedures, practices and policies that will reverse environmental degradation. Here we explore gaps and opportunities in institutional setup. The literature review for this study produced rich information on a wide array of governance mechanisms related to addressing environmental degradation in East and Southern Africa.

3.3.1 Key governance challenges

Capacity challenges

In a study on reversing degradation in Ethiopian wetlands, Giweta and Worku (2018) summarise impediments to the adoption of sustainable wetlands management. They cite: weak local institutional setup and capacity for wetland management; limited and/or no coordination of national institutions for the sustainable management of wetlands; poor knowledge and lack of awareness about wetlands in policies and decision making for sustainable wetland management; and lack of wetlands management plans for most wetlands.

Our stakeholder engagement noted a lack of capacity or willingness to enforce environmental regulations. Key Informant Seven, from Zambia, noted a heightened push by the top political leaders to relax environmental regulations in favour of

accelerated mining and other extractive projects, even though these present major current and future risks.

Specifically when looking at challenges and causes of wetland degradation, it is found that this can be addressed particularly through increasing the awareness on the social, economic and ecological importance of wetlands, involving relevant stakeholders, enriching the traditional knowledge of the local community with scientific knowledge, adapting principles of sustainable wetland management for mitigating climate change and restoring degraded ecosystem functions, investing in wetland restoration programmes/projects, and protecting illegal use, conservation and protection of wetland resources (Giweta and Worku, 2018).

Unsuitable policy environment

Often, policies and laws supporting sustainable management are largely in place, and yet are not implemented. Stakeholder engagements in South Africa and Mauritius reinforced this view, saying that policies are developed and that people understand what needs to be done to achieve effective restoration, but that challenges such as underfunding, poor political will and vested interests inhibit efficient and effective implementation. In particular, there is a lack of enabling policies that could spell out clear institution roles and responsibility to advance work. Environmental conditions are typically not mainstreamed into processes for economic planning, trade and investment, and environmental economics and land-use carrying capacity assessments are not adequately considered in development permitting processes. An enabling policy environment can be highly supportive to restoration efforts but it is critical to clarify land tenure issues and set clear institutional responsibilities (Mulinge et al., 2015).

3.3.2 Opportunities to improve governance

Capacity building and technical support to local government officials

REDAA could create capacity building and training for government officials to enhance expertise on degradation and restoration. This is necessary in order for institutions to see the need for restoration and to ensure that this is added as a priority in future urban planning. Topics could include:

- Participatory forest conservation and management approaches
- Community empowerment through nature-based enterprises
- Having streamlined policies in environmental governance
- Mainstreaming climate change actions into all sectors
- Coordination among key government lead agencies and community in environmental conservation and management
- Adequate budgetary/resource allocation for environmental conservation programmes

- Unbiased enforcement of environmental laws

Participatory planning and management

Participatory planning and management approaches ensure interest groups and stakeholders are represented, and that their views are considered during the decision-making process. Participatory processes also foster good governance, transparency, and accountability. When planning restoration projects it is important to include stakeholders on all levels, especially Indigenous People and local communities (IPLCs), to ensure ownership and continuity of restoration efforts. Including stakeholders is vital to ensuring degradation in the area does not reoccur.

So, it follows that developing capacities is important in order to empower stakeholders to lead and manage restoration projects. Empowering local communities is especially important to the preservation of endangered species in remote areas with weak government control (Rakotomanana et al., 2013). The rights of IPLCs and their traditional use of natural resources are especially pertinent in this context, as shown by the case of the Ogiek tribe in the Mau Forest in Kenya, who used litigation to have their rights acknowledged (Albertazzi et al., 2018). Several IPLCs in Kenya were subsequently able to benefit from an enabling policy environment, through the Forest Act of 2005, which prescribed the development of Participatory Forest Management Plans (PFMPs). These helped integrate ecotourism into people's use of the forest (Nzau et al., 2022; Albertazzi et al., 2018).

In addition, NGOs often play a crucial role in promoting equity. In Mauritius, lobbying by the Wildlife Society resulted in the cancellation of plans to build a highway through the Ferney Valley and forest (Sultan, 2016). Civil societies in partnerships with NGOs can aim to defend good governance and protect resources against corruption and illegal trade.

Enabling an integrated landscape approach

Growing understanding of the drivers of deforestation and degradation in sub-Saharan Africa, and their 'wickedly' complex interactions, highlights the need for integrated management and governance. One approach to addressing interconnected social, environmental, economic and political challenges involves focusing on integrated solutions at landscape scales (Reed et al., 2016). A landscape approach allows cross-sector and cross-scale integration to address conflicting policies, priorities, interests, demands, and management over environmental resources (Djenontin & Zulu, 2021). Cooperation between government agencies and community-based organisations, IPLCs, smallholders and the private sector needs strengthening through processes that develop knowledge and organisational capacity, and by building trust.

This approach has been applied in the Eastern Province of Zambia (The Integrated Forest Landscape Project) and in central Malawi. In Malawi, the focus was restoring two agro-

forest landscapes – Ntchisi Forest Reserve (NFR) in Ntchisi district and Mua-Livulezi Forest Reserve (MLFR) in Dedza district. The governance architecture combined interacting formal and informal structures and actors operating through decentralised institutions at nested village, village-group, Traditional Authority and district scales. Poor cooperation, asymmetrical resources distribution, and low level of social learning were weakening governance. The project aimed to strengthen existing informal collaborative arrangements and establish new formal ones to fill identified gaps. The project proposed that policy institutions providing interfaces for inter-sectoral and cross-scale linkages take on coordination functions.

4 Identification of research-to-action priorities and potential priority landscapes

This section presents a preliminary 'longlist' of research to-action priorities within the three 'pillars' of evidence, tools and governance. This preliminary list is then evaluated against REDAA criteria to produce a shortlist. A list of potential priority landscapes for REDAA is also identified.

4.1 Evaluating research-to-action priorities (RTAPs)

Table 13 presents a preliminary list of RTAPs based on the broad insights and opportunities outlined in Section 3. These were then scored against eight criteria for REDAA support, provided by IIED (see Table 14). The scoring is given in Tables 15–17. Each priority was scored on a scale of one to five for how well it met each criterion. Higher scores indicate a good match.

The preliminary list includes diverse topics across the three 'pillars' of evidence, tools and governance. REDAA supports and prioritises catalysing locally led research, innovation and action to help people and nature thrive together. Therefore, these aspects were considered when refining the list. RTAPs that feature a research and innovation component and include an intersection between people and nature were given more preference. However, although there is a great potential to include local communities and Indigenous Peoples in site-specific interventions, there are barriers that potentially restrict their participation. These could include ensuring adequate platforms for participation and the challenge of getting all stakeholders to adopt transdisciplinary approaches. Additionally, the success of research-linked RTAPs depends on an environment that supports research uptake and translation into practice.

Table 18 ranks the RTAPs by their score, and suggests the top five as priorities for the REDAA programme. From the evaluation and scoring, RTAPs P9, P10, P4, P11 and P8 obtained relatively high scores. Additionally, the RTAPs above also score highly according to the *locally led* component. The final shortlist includes two RTAPs on governance, two RTAPs on tools and one RTAP on evidence.

Table 13: Research-to-action priorities

Pillar	No.	Research to action priorities
Evidence	P1	Support multi-sectoral input from NGOs, IPLCs, government and academics to bridge the knowledge gap between various sectors on degradation and restoration and build datasets and other forms of research
	P2	Invest in knowledge-based relationships between local stakeholders including research organisations generating evidence and decision makers at different levels of governance and implementation.
	P3	Support peer-to-peer exchanges between different stakeholders to build capacity for environmental restoration initiatives.
	P4	Support youth- and women-centred initiatives to translate research into practical approaches to reverse environmental degradation.
Tools	P5	Strengthen technical support on the use of GIS and remote sensing tools, to promote better imagery and perhaps invest in better technologies to decrease fragmentation of datasets.
	P6	Undertake research into tools that adequately monitor degradation and restoration.
	P7	Prioritise partnerships with mapping institutes that allow for IPLCs and other organisations to be a part of the mapping process.
	P8	Support education and awareness campaigns that increase knowledge of harmful practices and capacity for alternatives, such as efficient agricultural and energy use.
	P9	Develop technical support for stakeholder practices that take ecosystem-based approaches, and seek climate change adaptation, nature-based solutions and sustainable and innovative land management practices.
	P10	Develop educational campaigns and training for government officials and other stakeholders to enhance expertise on degradation and restoration.
	P11	Strengthen participatory planning and management approaches that aid in developing knowledge and

Governance		organisational capacity while building trust between diverse interest groups and stakeholders including IPLCs, CSOs, NGOs to have their views considered during the decision-making process.
	P12	Support integrated landscape approaches that holistically tackle degradation and attempt to build and strengthen cooperation.

Table 14: Evaluation criteria of research-to-action priorities

Extent, period and cost	**Scale-appropriate.** The issue can be usefully addressed with the scale of support that may be possible from the REDAA programme, e.g. a grant of between about GBP50,000 and GBP100,000 over 6–24 months, or a grant of between about GBP200,000 and GBP1,500,000 over 4 years.
	Time-frame fitting. The issue can be completely addressed within 6 months to 4 years, or a significant contribution to addressing the issue can be made and verified within 6 months to 4 years.
	Value for money. The way in which the issue is addressed will provide good return on investment, benefits to costs and value for money.
Type of influence	**Site-specific impact.** If the issue was addressed it would have a major impact in a specific place.
	Cross-cutting impact. If the issue was addressed it would have a major impact on systems or processes that affect many places.
Active participation	**Locally led.** The issue is best addressed by locally led action, especially action led by local communities and Indigenous Peoples.
	Intersectional. The issue is best addressed through intersectional understanding and empowerment of vulnerable groups including Indigenous Peoples, women, youth, migrant workers, landless labourers, and displaced peoples.
Collaboration	**Cross-disciplinary and multi-stakeholder.** The issue is best addressed by fostering multi-stakeholder and cross-/trans-disciplinary collaborations.

Table 15: Evaluation scores for evidence-focused research-to-action priorities

Criteria		**Research-to-action priorities based on evidence**			
Score: 1–5 ***1 being least relevant*** ***5 being most relevant***		**P1: Support multi-sectoral input from NGOs, IPLCs, government etc.**	**P2: Invest in knowledge-based relationships**	**P3: Invest in organisations that convene peer-to-peer exchanges**	**P4: Invest in training youth and women**
Extent, period and cost	**Scale-appropriate**	**5:** It is possible for REDAA to invest in a 6–24-month project depending on the scale of project, which can aim to include a multi-sectoral approach that includes NGOs and IPLCs.	**4:** There is potential to develop partnerships in developing research between local stakeholders.	**5:** There is potential to carry out peer-to-peer exchanges to support favourable outputs within the budget.	**5:** The training would be feasible within the budget allocations.
	Time-frame fitting	**4:** A project aimed at adopting a multi-sectoral approach is achievable within the time frame delineated on the criteria period, as the various sectors undertaking degradation and restoration can easily be identified at local levels through existing government coordination mechanisms.	**4:** Complexities involved in integrating ecological issues with social issues and local development needs may affect the implementation period, and potentially extend it in some cases. However, 2–4-years implementation can be achieved with proper planning and participation of target beneficiaries.	**5:** The peer-to-peer exchange could result in capacity building and knowledge exchange within the allocated time frame.	**5:** The training would be feasible within the time frame to upskill women and youth groups on ecosystem restoration practices. Given a longer time frame, training schedules could be deepened to address more intricate aspects relating to the gaps and needs identified by women and youth groups.

	Value for money	**4:** The monetary benefits or returns on investment are very likely to be positive due to the use of synergised planning and data collection to inform decision making among various stakeholders and sectors.	**3:** It would be difficult to evaluate return on investment in the short term however there is potential to develop evidence-based policies that can guide implementation practices that have the potential to synergise funding streams and increase returns.	**4:** Having governments make decisions on best practices learnt from peer-to-peer exchanges would have value for money during restoration.	**5:** The training would provide skills relating to environmental restoration. This would ensure better uptake and less delays in implementation and would save on costs.
Type of influence	**Site-specific impact**	**3:** This multi-sectoral approach may be applied at a site-specific scale and include a range of local stakeholders.	**5:** Depending on the scope of the project. There is potential to have site-specific impact.	**3:** This is dependent on how quickly institutions involved in restoration can adopt best practices learnt. The time frame can be longer for government institutions, but can be achieved in the medium term.	**5:** The training would be intended to support communities at a specific site to undertake better practices relating to environmental restoration.
	Cross-cutting impact	**5:** The approach allows for mandates from multiple stakeholders to be addressed and can influence sectoral processes.	**4:** Restoration efforts would bring together multiple stakeholders, which would break down silos and enable transdisciplinary learning and impact.	**5:** The peer-to-peer exchange allows for cross-learning within sectors, which can improve processes and practices to guide implementation.	**4:** The training has the potential to train women and youth groups from various areas, enabling impact in various areas. Impact depends on uptake and broader systems including an enabling environment.

Active participation	**Locally led**	**3:** There is potential to have a locally led approach, which would provide contextually relevant data.	**3:** There is potential to generate evidence by incorporating other ways of knowing through locally led stakeholders who can provide local and indigenous knowledge.	**3:** There is potential to engage community-based organisations in leading peer-to-peer exchanges to undertake knowledge sharing.	**4:** The training could take on a peer-to-peer exchange and knowledge-sharing approach, which would ensure that it is locally led.
	Intersectional	**4:** Multi-sectoral research requires a high level of understanding and participation of a cross-sector of stakeholders, particularly vulnerable groups and IPLCs who are normally under-represented but most affected by environmental degradation.	**4:** The intersection of ecological, social and local development needs require intersectional involvement of a wide range of stakeholders, especially the locally affected groups.	**4:** There is potential to include various stakeholders including marginalised groups in shared learning.	**5:** The training aimed at women and youth enables capacity building and empowers these groups to have a better understanding of best practices relating to environmental restoration.
Collaboration	**Cross-disciplinary and multi-stakeholder**	**5:** Multi-sectoral research requires a high level of collaboration across all sectors in order to be impactful and yield workable solutions.	**4:** Addressing ecological, social and local development needs requires high collaboration across different sectors.	**4:** In order for the peer-to-peer learning to work, it needs a considerable level of participation.	**4:** Involving other stakeholders to offer lessons, share experiences and learn from the training would ensure a cross-disciplinary and cross-sectoral approach.
	Total score:	**33**	**31**	**33**	**37**

Table 16: Evaluation scores for tool-focused research-to-action priorities

Criteria		**Research-to-action priorities based on tools**				
Score: 1–5 ***1 being least relevant*** ***5 being most relevant***		**P5: Strengthen technical support for GIS and remote sensing**	**P6: Research monitoring tools**	**P7: Partnerships with mapping institutes**	**P8: Education and awareness campaigns**	**P9: Provide technical support to stakeholders**
Extent, period and cost	**Scale-appropriate**	**4:** For building capacity on new tools and allowing for better and more regular mapping, a longer time frame would be needed to allow participants to adopt the new technologies.	**4**: Undertaking research on monitoring tools can be achieved mostly in the long term.	**4:** Involving communities and training them on easy mapping techniques is feasible.	**5:** Carrying out educational and awareness campaigns is feasible within the budget allocation.	**5:** Technical support and training on innovative practices is feasible within the budget.
	Time-frame fitting	**4:** The longer time option allows for continuous training over the course of the project, which is better for uptake and up-to-date training.	**4:** Longer time frames would allow for adequate research into testing new monitoring tools to evaluate their effectiveness.	**5:** Partnering with stakeholders to establish processes for improved mapping can be undertaken within the time frame allocated.	**4:** Public awareness campaigns are feasible within the time frame. Carrying out the campaigns over a longer period of time allows for continuous messaging.	**5:** Offering technical support within the allocated time frame is feasible whereas the longer time frame can allow for follow-up training.

	Value for money	**4:** It is hoped that rigorous and continuous training can have knock-on effects that can lead to easier implementation and uptake, thus saving costs.	**5:** Undertaking research into monitoring tools can assist in mapping the extent of degradation and restoration, which would support more accurate interventions, thus saving costs.	**4:** Fostering partnerships with stakeholders including IPLCs will ensure accurate data is captured from the local level and that it informs decision making, reducing the costs of implementing poor policies. An enabling environment is useful in ensuring that implementation is undertaken with ease.	**3:** Public awareness and education campaigns can in the long term realise value for money through improved implementation due to better understanding. However, it is a bit difficult to measure uptake in the short term since behaviour change takes a longer period.	**5:** Technical support and capacity building increases knowledge and improves practices, thus enabling processes to be undertaken efficiently, reducing costs relating to errors and risks.
Type of influence	**Site-specific impact**	**5:** Training can be targeted at local stakeholders to address challenges and develop solutions for a particular site.	**5:** Monitoring tools can be used to gather data on extent of degradation as well as map restoration efforts over time on a specific site.	**5:** Mapping and data collection is a site-specific activity, hence gathering data to support decision making at a site scale is very feasible.	**5:** Public awareness and educational campaigns can be targeted at specific areas hence ensuring that they are site specific.	**5:** Technical support and capacity building can be targeted at addressing and solving certain challenges at a site scale.
	Cross-cutting impact	**3:** The impact of training stakeholders in using GIS tools would be multi-sectoral but would have more impact in the long term and be dependent on	**4:** Monitoring tools can generate useful information for various stakeholders in multiple sectors thus providing evidence for decision makers to create accurate and specific	**3:** The impact of partnerships would be felt across sectors but would likely be in the long term and dependent on the level of collaboration and efficiency of	**4:** There is great potential for cross-cutting impact although improvement of socio-economic and ecological conditions from increased awareness levels may	**5:** The technical support and training can be developed along different themes and aimed at multiple stakeholders who are involved in various sectors hence ensuring

		decision-making systems.	interventions. However, uptake would depend on an enabling environment.	coordination mechanisms.	only be realised in the long term.	that the lessons learnt can be applied across various sectors.
Active participation	**Locally led**	**3:** The learning curve can create barriers to locally led initiatives. However, training can support using alternative mapping approaches and including communities in data collection and mapping especially when it relates to ecosystem services.	**3:** Approaches that use local monitoring techniques can be mainstreamed and upscaled.	**3:** There is potential to upskill communities to take ownership of mapping and undertake data collection using tools that are readily available to them.	**5:** There is a potential to include IPLCs in crafting messaging that is context-specific and relates to their lived experiences.	**4:** The training can take on a transdisciplinary charette approach where participants learn from each other ensuring that different ways of knowing, including from IPLCs, is held with value, enabling local solutions to emerge from an understanding of the local context.
	Intersectional	**3:** Mostly people with GIS skills would be involved but there is a potential to upskill IPLCs and vulnerable groups in contributing to data collection through various methodologies, which can be fed into a GIS database.	**4:** Monitoring approaches can include IPLCs and other marginalised groups in the data collection process to ensure that granular data is collected.	**3:** Mostly people with mapping skills would be involved but there is a potential to upskill IPLCs and vulnerable groups in contributing to data collection through mobile apps, which can be fed into a GIS database.	**4:** Educational awareness can be useful in highlighting aspects that affect IPLCs and other vulnerable and marginalised groups to show the link between socio-economic needs and environmental degradation.	**4:** There is a potential to mainstream lessons learnt from vulnerable and marginalised groups as it relates to indigenous and local practices, which can be scaled up, thus recognising and acknowledging the contribution of these groups.

Collaboration	**Cross-disciplinary and multi-stakeholder**	**3:** GIS techniques and skills are quite specific and, in many cases, have a learning curve that may discourage everyone from participating.	**4:** Monitoring can rely on multiple inputs from various stakeholders depending on institutional arrangements. It also lets various actors contribute evidence to decision making.	**3:** There is potential to include IPLCs and other groups in a multi-stakeholder approach for undertaking mapping.	**4:** Involving multiple stakeholders in developing education and awareness campaigns can enable messaging to be specifically crafted to various target groups.	**5:** There is potential to run the training in a transdisciplinary manner where all participants are able to learn from each other, thus fostering cross learning.
	Total score:	**29**	**33**	**30**	**34**	**38**

Table 17: Evaluation scores for governance-focused research-to-action priorities

Criteria		**Research-to-action priorities based on governance**		
Score: 1–5 ***1 being least relevant*** ***5 being most relevant***		**P10: Create training for government officials and other stakeholders to enhance expertise on degradation and restoration**	**P11: Participatory planning and management approaches to ensure the representation of interest groups and stakeholders**	**P12: An integrated landscape approach to holistically tackle degradation**
Extent, period and cost	**Scale-appropriate**	**5:** Creating educational campaigns and training for government officials and other stakeholders within the budget allocations is feasible.	**5:** Participatory planning approaches can be undertaken within the budget allocation provided. However the scale, distribution and number of participants will depend on the budget provision.	**4:** Integrated landscape approaches are scalable to desired areas of impact and thus can be designed within available grant funds.

	Time frame fitting	**5:** Creating educational campaign strategies and developing training materials that would be used to train stakeholders is feasible within the time allocation.	**5:** A participatory approach works better after a process has been set up and stakeholders have shared and met over a period of time. Therefore, a longer time frame enables better participation between stakeholders.	**3:** Integrated landscape approaches are scalable and thus with the right scale of implementation can be designed to be undertaken in the short to medium term.
	Value for money	**5:** Creating educational campaigns and undertaking training can help to increase understanding around various aspects relating to degradation and restoration. Thus, it could save costs during planning and implementation due to adoption of better practices to ensure efficiency.	**5:** A participatory approach allows for various stakeholders to establish opportunities for collaboration including participatory budgeting, which can save costs during planning and implementation.	**3:** There is good potential for obtaining value for money as increased cooperation across sectors, institutions and communities implementing integrated landscape approaches would reduce the cost of restoration efforts. This is dependent on an enabling environment.
Type of influence	**Site-specific impact**	**5:** The educational campaigns and training could be targeted at addressing issues in specific sites.	**5:** A participatory approach can be undertaken to address a challenge and develop innovative ideas for a specific site.	**4:** An integrated landscape approach would be aimed at restoration initiatives at a particular site. However, it is dependent on collaboration from various stakeholders and sectors.
	Cross-cutting impact	**4:** The lessons learnt from the educational campaigns and the training can be upscaled to other areas for broader impact.	**4:** Lessons learnt from participatory approaches can be applied across various sectors and in different areas hence leading to widespread impact. However it is dependent on institutional arrangements.	**4:** Integrated landscape approaches involve multiple sectors and could stretch across geographical areas, and thus would have cross-cutting impact.
Active participation	**Locally led**	**4:** The process of creation, adoption and scaling of the campaign would have a better impact if IPLCs are involved in these various processes.	**4:** A participatory approach can be locally led when IPLCs are empowered with skills and tools to facilitate the sessions on	**3:** Integrated landscape approaches are best achieved at the local and site-specific level as they affect communities, and thus should be locally led.

			experience sharing and generating solutions, enabling cross learning.	
	Intersectional	**4:** Creation of campaign materials should be done in collaboration with IPLCs to ensure that the messaging is contextual and addresses the needs of these marginalised groups.	**4:** A participatory approach that highlights the representation of IPLCs can enable a more inclusive and intersectional collaboration between stakeholders, including the more marginalised and vulnerable groups.	**4:** Implementation of integrated landscape approaches are intersectional by nature and are meant to impact on the livelihoods of Indigenous Peoples and various community groups.
Collaboration	**Cross-disciplinary and multi-stakeholder**	**5:** Developing campaign materials should involve a broad group of stakeholders and the training offered should target a diverse group of stakeholders to enable cross learning between participants.	**5:** Participatory processes in their nature ensure that there are diverse stakeholders from various disciplines and backgrounds who can contribute towards dialogue and finding solutions to address challenges.	**4:** Integrated landscape approaches require high levels of collaboration across multiple sectors.
	Total score:	**37**	**37**	**29**

Table 18: Ranking of research-to-action priorities, with the five top-scoring topics highlighted.

Points	Research-to-action priority	Thematic area	Coding
38	Provide technical support to stakeholders for practices that look into ecosystem-based approaches, climate change adaptation strategies, nature-based solutions and sustainable and innovative land management practices.	Tools	P9
37	Create training for government officials and other stakeholders to enhance expertise around the topic of degradation and restoration.	Governance	P10
37	Invest in training for youth- and women-centred initiatives on translating research into practical approaches to reverse environmental degradation.	Evidence	P4
37	Strengthen participatory planning and management approaches to ensure interest groups and stakeholders, including IPLCs, CSOs and NGOs are represented and have their views considered during decision making.	Governance	P11
34	Support education and awareness campaigns that increase knowledge of harmful practices and capacity for alternatives, such as efficient agricultural and energy use.	Tools	P8
33	Invest in organisations that convene peer-to-peer exchanges	Evidence	P3
33	Multi-sectoral input from NGOs, IPLCs, government etc.	Evidence	P1
33	Undertake research into monitoring tools	Tools	P6
31	Invest in knowledge-based relationships	Evidence	P2
30	Partnerships with mapping institutes	Tools	P7
29	Strengthen technical support on the use of GIS and remote sensing tools	Tools	P5
29	An integrated landscape approach to holistically tackle degradation	Governance	P12

4.2 Potential priority landscapes

The likely effectiveness in tackling environmental degradation of the shortlisted research-to-action priorities (see Table 18) in each of the priority landscapes in Southern and Eastern Africa initially identified in the assessment was then considered. It was concluded that one or more of the five RTAPs, if pursued through concerted practical initiatives, could make a useful positive contribution in all the landscapes identified. These potential priority landscapes identified are presented in Table 19.

Table 19: Potential priority landscapes for REDAA across Southern and Eastern Africa

Region	Country	Landscapes	Causes of degradation
Drylands and deserts			
Southern Africa	South Africa	Large parts of the Northern Cape, North West and Eastern Cape Provinces	• Population growth, which increases demand for land • Climate change • Unsustainable land use • Competition for productive land due to the growing demand for food, fodder and mineral resources
Southern Africa	Mozambique	Mozambique is largely covered by the Miombo–Mopane ecoregion	• Growing population • Unsustainable land-use practices
Eastern Africa	Kenya	Lake Turkana and Eastern Province	• Extension of cropland onto marginal lands
Grasslands and savannahs			
Eastern Africa	Rwanda	The eastern and south-eastern regions of Eastern Savannah and Eastern Plateau ecological zones (land degradation hotspot in Rwanda)	• Overgrazing • Deforestation • Expansion of 'artificial' areas, which leads to the conversion of savannah to grassland, cropland and artificial surfaces • The area is also exposed to the removal and exploitation of natural vegetation

			• Improper land management, which further leads to a decline in the productivity of the land
Southern Africa	South Africa	Limpopo and Mpumalanga province	• Clearing for croplands in the grasslands • Encroachment of human settlements in the savannahs
Southern Africa	Mozambique	Miombo woodland	• Land cover change: significant reduction of forests, grasslands, savannah through the development of croplands; human settlement has increased along the coastal area
Southern Africa	Malawi	Southern Rift Montane Grassland Mosaic which has montane grassland and forests covering the Nyika National Park and the Vipya areas; the Zambezian Flooded Grassland – perennially wet swamp grasslands covering Lake Chilwa and its surroundings and some surroundings of Lake Malawi; and the South Malawi Montane Forest Grassland Mosaic which has Montane evergreen forests and grasslands, and covers Zomba, Blantyre, Mulanje and Thyolo area	• Improper management of the soil • Poor agricultural practices, • Over-exploitation of vegetation for domestic use particularly for fuel (wood and charcoal) • Overgrazing in areas with high cattle density • Waste deposition and mining of quarry and sand
Forests			
Eastern Africa	Kenya	West Pokot, Marakwet and Turkana, Mt Elgon	• The uncontrolled and illegal logging and clearing of trees to meet the

		and Dakatcha Woodland	domestic and commercial demand for charcoal and wood for fuel and forest fires
Eastern Africa	Kenya	Dryland coastal Arabuko Sokoke forest, Taita Hills, and Gallery forests along Nzeeu River in Kitui County	• Population pressure, land-use pressure and deforestation with associated loss of species, habitats, and ecosystem services • A major driver is a demand for charcoal and firewood, leading to clearing and uncontrolled logging specifically within the Cynometra, Brachylaena, and Brachystegia forests • Arabuko Sokoke forest experienced rapid urbanisation, lack of land-use planning and immigration • Due to the planting of exotic eucalyptus trees in Taita Hills, several springs have dried up • The gallery forests are fragmented, invaded by alien plant species, and significantly modified through human activities
Eastern Africa	Kenya	Mau Forests within the Rift Valley	• Political factors • Wood extraction • Agriculture • Infrastructure development • Infringement of water towers on the forest
Eastern Africa	Kenya	Dakatcha woodlands, Gede Forest, and Mwangea Hills	• Large-scale degradation. The key drivers are an increase in the demand for forest resources, harvest of trees to acquire charcoal for household and commercial purposes, high levels of poverty, agricultural activities that are unsustainable and the inadequate implementation of legislation.
Eastern Africa	Madagascar	Makira Natural Park and Masoala forests	• Deforestation caused by shifting cultivation (slash and burn) practices
Eastern Africa	Madagascar	Coastal areas	• Removal of mangrove forests • Shrimp farm development

Eastern Africa	Madagascar	Eastern and northern portions of Madagascar	• Deforestation. Key drivers include the production of charcoal, logging of trees, and mining activities (Ambatovy mine, which degraded a large portion of primate habitats in the East). The massive movement of people from the southern region to the northern region in Madagascar places increasing pressure on forest resources.
Eastern Africa	Mauritius	Charmeral	• The harvesting of mangroves for timber and fuel • Additional pressure from tourism developers, coastal construction, farmers
Eastern Africa	Mauritius	Ebony Forests	• There is a lack of understanding and research of where degradation is taking place and the extent thereof; therefore this is not widely taken into consideration for restoration projects and government policies
Southern Africa	Mozambique	Nampula, Zambeze and Manika Provinces, which have valuable forests, high population, and are facing high degradation	• Commercial agriculture • Slash and burn cultivation by Indigenous Peoples • Logging to meet the demand for timber • Population pressures
Eastern Africa	Rwanda	'South-western Lowlands of Imbo and Impara ecological zone' (land degradation hotspot in Rwanda)	• Over-exploitation • Soil erosion • Inadequate farming practices, and fragmented and clustered settlement on 'high slide' (sloped land) • Conversion to grassland and cropland
Eastern Africa	Rwanda	'Western lowlands of Lake Kivu border ecological zone' (land degradation hotspot in Rwanda)	• Deforestation and a decline in land productivity due to population growth and the removal of natural vegetation to accommodate cropland and human settlement
Eastern Africa	Rwanda	'Central and Southern Rwanda of Plateau	• Conversion of forest, grassland and cropland to human settlements; in

		Central and Mayaga and Peripheral Bugesera ecological zones' (land degradation hotspot in Rwanda)	the process natural vegetation is removed exposing the soil to erosion ● Exploitation of soil and deforestation occurs in this area due to a lack of off-farm activities, poverty and population pressure
Eastern Africa	Rwanda	'City of Kigali of Central Plateau ecological zone' (land degradation hotspot in Rwanda)	● Deforestation caused by urbanisation and development of unplanned and planned urban areas as well as informal and formal settlements ● Increased precipitation run-off, soil erosion occurs, resulting in pollution and the loss of soil
Southern Africa	Zambia	North-Western, Copperbelt and Luapula Provinces	● Wood extraction ● Agricultural expansion ● Charcoal production ● Infrastructure development ● Forest fires ● Land clearance for agriculture, mining and other extractives
Southern Africa	Malawi	Miombo-Mopane woodlands	● Unsustainable use of dryland resources ● Conversion to agriculture and widespread maladaptive practices ● Domestic and commercial extraction of timber ● Land clearing for biofuels driven by population growth, poverty and inequality, and exacerbated by climate change
Inland waters and wetlands			
Eastern Africa	Kenya	Water bodies in Kenya such as Lake Baringo, Lake Olbollosat and Winam Gulf	● The erection of infrastructure on steep slopes ● Buildings with improper drainage systems ● The reduction of infiltration rates due to deforestation ● Increase in sedimentation due to soil erosion, which results in the

			reduction in the surface area of these water bodies ● Water pollution ● Reduction in water quality ● Reduction of catchment areas to support river flows
Eastern Africa	Kenya	A freshwater lake, Lake Naivasha located within the Rift Valley of Kenya	● Invasive fish species – some species were introduced intentionally and others accidentally managed to make their way into the lake ● Increased turbidity of the lake ● Decreased light penetration ● Macrophyte growth and the ability of piscivorous and planktivorous to forge
Eastern Africa	Rwanda	The shores of Lake Kivu in the 'Western lowlands of Lake Kivu border ecological zone' (land degradation hotspot in Rwanda)	● Expansion of urban settlements – this includes the removal of vegetation, which leads to soil erosion
Eastern Africa	Rwanda	Sebeya, Pfunda, Gitsimbi and Mutura Rivers in Rubavu district	● Water erosion, which results in water runoff, landslides and flooding
Eastern Africa	Ethiopia	Choke Mountain catchment, Rift Valley Lakes (Lake Ziway Watershed), Lake Alemaya (Eastern Part of Ethiopia), Awash River Basin, Lake Tana, Koga catchment, Lake Hawassa and Lake Basaka	● Population growth and demand for additional arable land has led to encroachment into the wetlands ● Industrialisation and environmental pollution ● Over-exploitation of resources ● Unsustainable land-use practices and inadequate intersectional planning among relevant institutions ● Agricultural intensification and extension of illegal agriculture ● Climate change effects
Eastern Africa	Madagascar	Wetlands in Madagascar	● Invasive alien species are a driver for reducing the variety of freshwater fish species

			• The removal of trees and vegetation increases soil erosion, which could compromise the water quality of wetlands and its ability to accommodate fisheries activities • Madagascar's wetland ecosystems have become a 'waste land' due to 'trash leaks', which are one of the drivers of environmental degradation in urban and peri-urban areas
Southern Africa	South Africa	Northern Cape	• Invasion of alien plants reduces national streamflow by 2.9%, with far higher hydrological impacts in some of the country's critical catchments
Southern Africa	Zambia	Kankoyo Township in Mufulira District and Kafue's watershed	• Mining
Coastal and marine ecosystems			
Eastern Africa	Mauritius	Lowland coastal forests surrounding harbours in Mahebourg (GrandPort District) and Port Louis	• Deforestation • Eutrophication and the loss of biodiversity • The initial removal of trees
Eastern Africa	Tanzania	Urban catchments in the Coastal Forest hotspot, east-flowing river systems linking mountains, floodplains, estuaries and marine environments within an urban context	• Pollution from factories, litter and effluent
Eastern Africa	Kenya	Mtwapa and Rabai, Kilifi South	• Air pollution due to cement manufacturing factories and industries
Eastern Africa	Kenya	Ganze and Kilfi North areas	• Lack of rehabilitation of quarry sites occurs on multiple scales and arises

			from quarrying and mining activities
Eastern Africa	Seychelles	East coast of Mahe – Au Cap district, North of Mahe – Beau Vallon Beach, South of Mahe – Anse Royale	• Climate change • Invasive alien plants • Human threats such as agricultural activity and pollution along the coasts, and increase in development related to the increase in use of the beaches, which has led to significant vegetation loss
Eastern Africa	Kenya	Mtwapa creek, Malindi and Kilifi	• Marine pollution, littering marine ecosystems, encroachment of riparian areas, unsustainable fishing practices and pollution from plastic and municipal waste
Eastern Africa	Kenya	Kilifi, Lamu and Mombasa Counties	• Over-reliance on forest products, high poverty levels • Inadequate implementation of legislation Unsustainable agricultural practices
Eastern Africa	Madagascar	Coastal areas along Madagascar, Mahajanga area, located in the North-West part of Madagascar	• Mangrove deforestation • Field expansion by immigrants (encroachment)

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Annex 1: Key Informants and interview questions

Table 20: Key Informants interviewed

Key Informant number	Country	Type of organisation	Area of expertise
Key Informant One	Zanzibar	Government official	Environment and solid waste
Key Informant Two	South Africa	State-owned biodiversity research and policy organisation	Ecosystem based adaptation
Key Informant Three	Seychelles	Government official	Urban Planning
Key Informant Four	Kenya	Government official	Environment and solid waste
Key Informant Five	Mozambique	Government official	Forest engineering
Key Informant Six	Madagascar	Academic/private sector	Ecosystem science and socio-economics
Key Informant Seven	Zambia	NGO	Ecologist
Key Informant Eight	Rwanda	Government official	Forests and natural resources
Key Informant Nine	Mauritius	Government official	Public administration
Key Informant Ten	Malawi	Academic	Agriculture and natural resources

Interview questions

- What are the most important environmental degradation issues [to address] in your area [specify geographic location/scale, or multiple scales]?
- What are examples of key [restoration] projects that you know of that have helped to address environmental degradation?
- In your experience and for the area that you are familiar with, what kinds of tools or methodologies, or engagement and governance approaches do work or would work best? [this includes beyond just physical and technical approaches to restoration, but

also social processes and other enabling conditions]

- What are the gaps/shortcomings in existing projects aiming to reverse environmental degradation in your area?

- Could you identify and describe a medium-scale implementation project/s aimed at reversing environmental degradation in your area?