Turning the tide on environmental degradation in South Asia: Scoping study of research-to-action priorities for the Reversing Environmental Degradation in Africa and Asia (REDAA) programme

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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.

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About the REDAA programme

REDAA is a programme that catalyses research, innovation and action at local, national and regional levels across Africa and Asia through a series of grant calls. Funded projects are interdisciplinary, often locally led and focus on solutions for ecosystem restoration and wildlife protection, enabling people and nature to thrive together in times of climate, resource and fiscal insecurity.

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Executive summary

Environmental degradation must be tackled – urgently

The global assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) 2019 and, more recently, the Intergovernmental Panel on Climate Change Working Group II report – *Climate Change 2022: Impacts, Adaptation and Vulnerability* – highlight the state of ecosystem degradation resulting from human population dynamics and consumption levels, overexploitation of natural resources, environmental pollution, and climate change. There is growing concern over tipping points in key vulnerable mountain, freshwater, rangeland, mangrove and peatlands ecosystems, among others. The societal and economic costs of such degradation are very high. Moreover, adverse impacts fall disproportionately on the poorest, most marginalised and most disadvantaged communities and countries, who are still largely dependent on natural ecosystems for societal and economic wellbeing. Despite multiple efforts in policy and practice over the past few decades, the situation has not improved. While new approaches and solutions are emerging, there are few truly effective and scalable solutions available globally, largely due to the lack of an enabling environment that fosters and supports the kind of just transformations required to counter these trends and reverse degradation.

Scoping study approach

The objective of this scoping study is to identify between 6 and 12 research-to-action (RTA) priorities that the Reversing Environmental Degradation in Africa and Asia (REDDA) programme could support, where ***evidence*** can be improved and taken up, ***tools*** can be improved and well used, and ***governance systems*** can be improved for environmental restoration and sustainable natural resource management. The scoping also identified emerging ecosystems and degradation hotspots where research-to-action priorities may be located. Information was considered from seven South Asian countries: Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan and Sri Lanka. While we recognise very important nature-people-climate challenges in Afghanistan, it is not included in this study due to the ongoing security situation and the difficulty of undertaking review and analytical work there.

A six-step methodological approach was adopted that used a combination of desk research, consultations, key informant and expert survey, and meta synthesis:

- Step 1 was a preliminary review of key global, regional and national reports to define hotspots in South Asia where environmental degradation matters the most, and to understand broad-scale challenges of environmental degradation in the region.
- Step 2, the literature review, helped to develop a broader list of research-to-action (RTA) themes through knowledge mapping and helped identify five priority areas.

- Step 3, the cluster consultations, brought in the perspectives of researchers, practitioners, and representatives of community organisations and helped contextualise the broad RTA themes and priority sites within the five priority areas in the seven countries.
- Step 4, the regional consultation with key experts, allowed results from the two cluster consultations to be shared and helped shortlist priority sites and important RTA themes.
- Step 5, a quick survey of experts, helped prioritise 12 RTAs by weighing them against the criteria of robustness, inclusiveness and sustainability.
- Step 6 involved further desk research to help consolidate and further narrow down to six priority RTAs based on their compliance against the criteria of impacts (site or cross-cutting), locally led, intersectionality, multi-sectoral, scale-appropriateness, and value-for money.

South Asian regional context

The South Asian region is a densely populated landmass, with unique physiography and a great diversity of climatic zones and socio-economic contexts. It has the world's highest mountain ecosystems – the Himalayas, often known as the Third Pole – coupled with low-lying zones, such as the Bay of Bengal and the fertile delta of Bangladesh. Some of the region's most critical ecosystems are transboundary, such as the Sundarbans mangrove forest, shared by India and Bangladesh, or the great Himalayan rivers basins, upon which almost 3 billion people depend for water and food security. South Asia is home to 7% of the world's mangrove habitat and 3% of the world's forests, as well as other important ecosystems such as rangelands, wetlands and peatlands. These ecosystems are critically important: they host 15% and 12% of the world's flora and fauna, and provide between 70% and 85% of rural communities with a subsistence livelihood. But the South Asian environment is transitioning fast. With some of the fastest urbanisation and economic growth rates, the region is experiencing rapid environmental change and the ecosystems are being adversely degraded. More than 40% of the world's poorest people live in South Asia and some 51% of the population is food-energy deficient despite the region being the 'food bowl of Asia'. This presents ever-greater challenges as environmental degradation impacts the poorest the most – and climate change is making the situation even more difficult.

Drivers and impacts of environmental degradation

Environmental degradation in South Asia is a complex issue that is driven by a variety of factors, including population growth, rapid urbanisation, climate change, industrialisation, widespread poverty and high dependence on natural resources. The region is also experiencing rapid economic growth, with gross domestic product (GDP) increasing by 17% between 2020 and 2021. The growth in both population and economy has affected the natural environment. Unsustainable land-use practices, unplanned urbanisation, over-extraction of resources and rapid industrialisation have increased air and water pollution, annual rates of deforestation, coastal flooding and erosion, ecosystem degradation, soil erosion and desertification, and the spread of invasive and alien species.

These environmental problems have wide-reaching impacts, including biodiversity loss, changes in ecosystem dynamics, increased disaster risk, water contamination, loss of livelihoods and risk to human health. A significant impact on economy is evident through decreased land productivity and increased damage from disasters. There are also severe socio-cultural implications, such as the out-migration of men and the resulting feminisation of agriculture and natural resources management with economic impacts on traditional livelihoods. Importantly, increased gender and social inequality are evident. For example, women, poor urban dwellers, and populations with limited occupational opportunities face greater exposure to the impacts of air and water pollution.

Priority areas and potential sites for REDAA

Priority areas were identified according to the following criteria:

- Biodiversity richness, degree of threats and degradation (part of global biodiversity hotspots, or 200 global ecoregions or Important Bird or Biodiversity Areas)
- Scale and severity of impacts
- Vulnerability to climate exposure and change
- Areas inhabited by marginalised communities, including tribal and Indigenous peoples and local communities (IPLCs) (see Box 1)

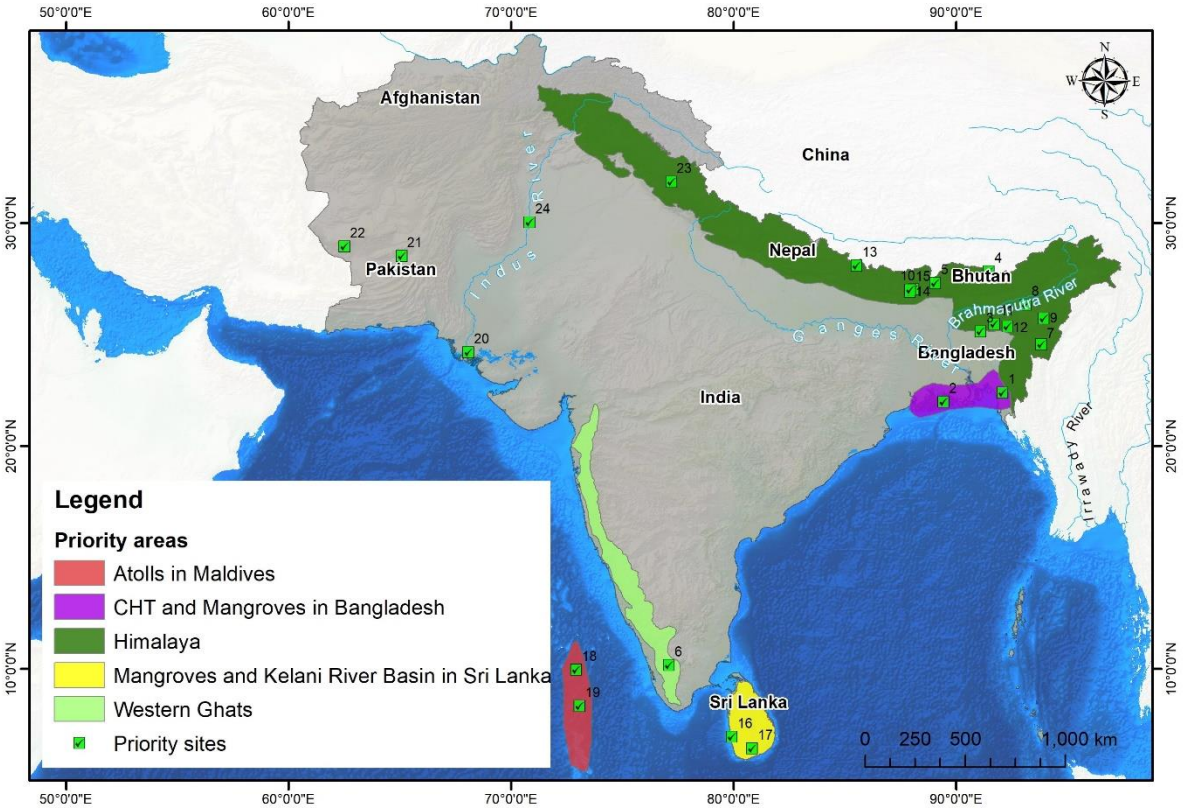
Based on these criteria, five priority areas were identified: Western Ghats (India); Himalayas (Bhutan, Nepal, north-east India, Pakistan); Chittagong Hill Tracts and Sundarbans (Bangladesh); atolls (the Maldives); and the Kelani River Basin and mangroves (Sri Lanka).

Box 1: Indigenous peoples and local communities

IPLC is used as a broad term to refer to the many Indigenous peoples and local communities, including minority groups, as they are variously defined, recognised or accorded protections under the constitutions of South Asian countries. Nepal's constitution recognises 59 Indigenous peoples or nationalities. India does not recognise 'Indigenous' but uses 'Scheduled Castes (SCs) and Scheduled Indian Tribes (SITs)' to officially designate its most disadvantaged socio-economic groups, including a special category for Particularly Vulnerable Tribal Groups (PVTGs). Similarly, the Bangladesh constitution does not recognise Indigenous peoples in this term but does ensure affirmative action for its 'tribes, minor races, ethnic sects, and communities'. It is also the case that in some areas there may be contestations between Indigenous peoples and local communities, or Indigenous peoples and minorities.

Within each priority hotspot, 24 prospective priority sites have been identified for REDAA intervention based on literature review and consultation with 85 experts, using the aforementioned criteria.

Figure 1: Potential priority areas and sites for REDAA-supported initiatives in South Asia



Source: ICIMOD, 2023 (produced for this report).

Emerging research-to-action priorities for REDAA

Evidence

Literature review and stakeholder consultations pointed to opportunities to fill two important evidence gaps in the region: cultural values and climate impacts.

RTA 1: Cultural values evidence

> *Integrating local perceptions and traditional knowledge on the diverse and multiple values of ecosystem services into cost–benefit assessment of environmental degradation.*

There is significant gap in ecosystem services valuation research and a need to increase scientific understanding on the values of cultural and regulating services and the costs of their degradation (Adhikari et al., 2022). There is also limited evidence on assessment of socio-cultural values of

ecosystems at local scale, and limited recognition of such values in policymaking and implementation, often leading to local disenchantment with conservation efforts (Chaudhary et al., 2019). The loss of traditional knowledge and the lack of local engagement can lead to the failure of restoration efforts. For example, in north-east India, implementation of traditional and ecological practices has been replaced with generalised scientific tools, leading not only to failures in restoration but also the gradual loss of traditional knowledge (Das et al., 2021). Preservation of these historical practices and knowledge related to natural resources needs urgent consideration. Expert insights from specific sites supports the findings in the literature and highlights the need to support people's understanding of ecosystem services values to ascertain true and diverse values of natural and managed ecosystems, especially those nurtured by traditional ecological knowledge.

RTA 2: Climate impacts evidence

> *Multidisciplinary action research on climate-induced extremes on ecosystems and biodiversity, and its cascading impacts on various sections of society, integrating local perceptions and lessons from maladaptation practices.*

South Asia is one of the regions that is most vulnerable to the effects of climate change (Sivakumar & Stefanski, 2011) and is still severely data deficient (Wester et al., 2019; Sharma, 2012). The majority of studies are focused on climate models and variables, ignoring people's perceptions and ecosystem-based understandings, local-level climate action and maladaptation practices (Rahman, 2019). There is limited understanding on the impacts of climate change on biodiversity and ecosystem services, and the cascading impacts on different sections of society (Wester et al., 2023). Given that climate change is one of the major drivers of environmental degradation, multidisciplinary knowledge for informed policies and locally led management actions are urgent as they trigger climate mitigation, adaptation and maladaptation practices (Rahman et al., 2019). It is important to view impacts from the local perspective and make adaptation actions more inclusive, fair and equitable, given that climate impacts are disproportionately experienced, and the concern is that the perspectives of marginalised communities are not incorporated into the design and action of nation-level climate programmes (Rahman et al., 2019).Recommendations for future research include: landscape-level understanding of the climate change impacts, such as the impact on glaciers on how this affects ecosystems and biodiversity and in turn, livelihoods and hydropower infrastructure (Parker et al., 2017); (2) understanding the shifting patterns of plant communities as a result of climate change (Kottawa-Arachchi & Wijeratne, 2017); and (3) identifying hydrological impacts of climate change across the entire Kelani River Basin and predicted biological responses (Surasinghe et al., 2020).

Tools

There is a need to support tools that have made a demonstrable positive contribution to more effective natural resources and landscape management. There are two priority areas where tools can be improved and scaled up to facilitate more inclusive participation and enable positive effects for those who are most dependent on these ecosystems.

RTA 3: Tools for implementing nature-based solutions

> *Supporting the design and implementation of integrated and inclusive nature-based solutions (NbS) to adapt to climate change and support IPLC-led actions.*

Nature-based solutions (NbS) are actions to protect, sustainably manage or restore natural ecosystems that address societal challenges, while simultaneously providing human wellbeing and biodiversity benefits (IUCN, 2020). Just as climate change is driving environmental degradation, ecosystem degradation contributes to climate change and makes people more vulnerable to its impacts. NbS provides a useful conceptual framework that emphasises the importance of tackling the interlinked societal challenges of climate change, environmental degradation and inequality together. The challenge remains on how to design and implement truly integrated and inclusive NbS in practice.

Building on existing research, lessons learnt and good practices in South Asia, practical tools can be developed to address the challenge and make NbS truly work for nature, climate and people. Those tools can highlight common success factors and enabling conditions to deliver effective NbS and scale up good practices. For examples, in the Maldives, developing implementation capacity of local stakeholders and developing frameworks to assess environmental and social impacts of infrastructure-based coastal protection measures were highlighted as key enabling conditions (Poti et al., 2022). Experiences from Indigenous tribes in north-east India, who have been working for millennia to adapt to climate change while ensuring food and water security, highlight the importance of learning from local and traditional knowledge when designing and implement NbS (Tynsong et al., 2020). Revitalisation of traditional agroecosystems including agroforestry practices, culturally safeguarded sites, the use of neglected underutilised (NUS) crops and preservation of traditional Indigenous crops can all contribute to food security in a changing climate (Joshi et al., 2020; Tsuchid & Takeda, 2021; Smith et al., 2021; Aryal et al., 2023).

RTA 4: Local conservation guidance

> *Co-developing guidelines for implementing Indigenous people and local community led other area-based effective conservation measures (OECMs) to formalise the efforts of local landscape stewards and their traditional landscape management practices.*

Ecosystem degradation is a major issue in South Asia, and its key drivers are overextraction, mismanagement and lack of specific policy and guidelines on locally led conservation initiatives. Limited recognition of rights and access to places are contributing to the degradation of landscapes and are vulnerable to mismanagement. If access and rights are given to local entities, locally led restoration could deliver positive conservation and development outcomes. Restoring and revitalising sacred groves have been successful in the Western Ghats through coordinated efforts to raise awareness and engage grassroots organisations in management (Ranganathan et al., 2022). Nepal also presents a very good example of community forest and landscape-based conservation (Sayer et al., 2017), which consider a mosaic of land uses.

OECM is also an opportunity to identify and acknowledge areas that require restoration, and to advocate for the rights of IPLCs, encourage them to manage their areas and recognise their efforts nationally and globally. Such recognition would contribute to effective and sustainable restoration and management. Guidelines at the regional, national or site level can help in the assessment of potential OECMs, as well as in the process of recognising and advocating areas for inclusion as OECM at the national and global scale.

South Asia countries have committed to contribute to the Kunming-Montreal Global Biodiversity Framework '30x30' target, which aims to protect and manage at least 30% of the Earth's surface by 2030 through protected areas and OECMs. The region holds huge potential to contribute to the target as it is home to areas such as sacred groves or patches of forest and other land use protected and used by local people for cultural and religious purposes. Such areas have high environmental value and can complement formal conservation efforts (Rath & Ormsby, 2020).

Governance

One of the key challenges across all seven countries was the lack of participatory natural resources governance; many studies have recommended a shift to co-management, which includes sharing power, knowledge and responsibility between stakeholders (Poti et al., 2022). There are plenty of examples where participatory natural resource governance works well in the region. For example, adaptive co-management of Myristica freshwater swamps in the Western Ghats of India enabled communities, local stakeholders and the government to work together and improve the protection of forested and natural landscapes (Ranganathan et al., 2022).

RTA 5: IPLC rights and resource management

> *Drawing on good practices to strengthen capability of traditional institutions to advocate for their rights and implement effective and equitable resource management.*

South Asia has a forest-dwelling population of between 120 million and 150 million. Making up a large segment of this population are Indigenous people and local communities, whose culture and traditions are crucial to management of ecosystems (Ramakrishnan et al., 2012). Traditionally, IPLCs manage resources through traditional institutions. Evidence shows that traditional institutions like *Mukhiya, Balyan* and community conserved area (CCA) councils have effective strategies to manage natural resources well and adapt to crises like climate change and biodiversity loss. For example, local communities' traditional approaches to coping with climate change in the north-eastern floodplains of Bangladesh are valuable in informing national adaptation policies to avoid maladaptation and enhance climate change resilience (Rahman, 2019). However, insecure property rights for farmers, inadequate benefit-sharing mechanisms (Wangchuk & Tobgay, 2015) and the disintegration of traditional institutions (Smith et al., 2021) hinder effective resource management and disincentivise IPLC participation and engagement. It is crucial to strengthen the capacity of traditional institutions to incorporate gender equality and social inclusion (GESI) in planning, implementation and

management of natural resources. This entails supporting traditional institutions, such as CCA councils in Nagaland and Indigenous communities in Bangladesh's Chittagong Hill Tracts, to design implementation plans for traditional and culturally safeguarded land resources. This is fundamental, especially to enable equitable access and benefit-sharing processes and mechanisms.

RTA 6: Inclusive restoration

> *Supporting synthesis and exchange of good practices to enhance representation and meaningful participation, decision making and leadership of women, youth and Indigenous peoples and local communities in restoration of traditional land resources and ecosystems.*

In South Asia, it is evident that certain groups – particularly men, the rich and powerful, and those belonging to higher castes – have been able to control and benefit from the available natural resources. Meanwhile women, Indigenous and marginalised communities have been excluded (Ojha et al., 2022; Chaudhary et al., 2018), which further marginalises them – especially Indigenous women.

The promotion of participatory resource governance that integrates the knowledge of various actors and promotes equitable benefit sharing is crucially important in South Asia. But there is still significant gap in inclusive decision-making concerning land and resources tenure, especially for women and marginalised groups. There are also significant opportunities for policy harmonisation and the sharing of best practices across South Asia countries in restoration. For example, community-based government programmes that have engaged local communities in the region have played an important role in nature conservation (Tauli-Corpuz et al., 2020). In Bhutan, under country's Community Forestry programme, 76,360 hectares (ha) of forest is managed by 28,654 households (Wangchuk et al., 2018). In Nepal, 2.2 million ha of forest is managed by 2.9 million households (Ghimire & Lamichhane, 2020) and in India, more than 22 million ha of forests are jointly managed by local communities and the Forest Department under the Joint Forest Management (JFM) system (Patra, 2015). These figures demonstrate the potential scale at which restoration could become truly resilient if it was fully inclusive.

Next steps

Consultations with key experts at local to regional level are now needed to consider, modify, fine-tune and further develop the priorities identified here, such that they can be incorporated in REDAA strategy.

Background

South Asia is the largest landmass of the Asian continent, covering around 12% of the land surface of Asia and 3.5% of the world's land surface area (Hijioka et al., 2014). The region is comprised of eight countries: Afghanistan, Bangladesh, Bhutan, India, Nepal, Pakistan, the Maldives and Sri Lanka. South Asia is the most populated region in the world (World Bank, 2023), supporting around 1.9 billion people (as at February 2023) of diverse cultures, faiths and ethnicities (Finlayson, 2019).

The South Asia region is also topographically diverse. Dominated by the Indian Plate, the region extends from the Indian Ocean in the south to Mount Everest in Nepal, the highest peak in the world (UNEP & DA, 2016). The climate of this vast region varies significantly, from tropical monsoon in the south to temperate in the north (Olive, 2005). It is one of the most biodiverse regions in the world, home to 19 of the world's 235 Ecoregions and three Global Biodiversity Hotspots – Himalaya, Indo-Burma and the Western Ghats. It covers most of the Indomalayan and Palearctic biogeographic realms, which support diverse ecosystems, and includes the world's highest mountain ecosystems – the Himalayas, often known as the Third Pole – as well as low-lying zones, such as the Bay of Bengal and the fertile delta of Bangladesh (NGS, 2022). The region's key ecosystems are forests, freshwater rivers and streams, grassland and shrubland, alpine meadows, wetlands, swamps, mangroves, urban areas, snow and ice, and coral reefs (Reddy et al., 2018). More than 18% of the total land is under forest cover, accounting for almost 3% of the world's forests (Reddy et al., 2018) and 7% of the world's mangrove habitat (Giri et al., 2015). South Asia hosts 16% and 12% of the world's flora and fauna, respectively, and many of these species are endemic to the region (UNEP & DA, 2016). Some of the world's most charismatic species reside within the region, including the Royal Bengal tiger (*Panthera tigris tigris*), the one-horned Rhinoceros (*Rhinoceros unicornis*), the Asian elephant (*Elephas maximus*) and the red panda (*Ailurus fulgens*) (UNEP & DA, 2016).

Biodiversity is a major contributor to South Asia's economy. Within the region, between 70% and 85% of rural communities depend on their surrounding natural ecosystems for subsistence livelihoods (Xu et al., 2019; Ali et al., 2007). In Nepal, 80% of the population is dependent on forests and agriculture for their livelihoods while between 26% and 39% of the country's GDP comes from agriculture, forestry and fisheries (GoN & UNDP Nepal, 2020). Up to 300 million people in India are dependent on natural resources, including marginalised communities who are the direct beneficiaries and managers of biodiversity. The situation is similar in Bhutan and Bangladesh, where there is high dependence on forest and aquatic resources. In Bhutan, agriculture, livestock and forestry together account for 13% of GDP, while hydropower contributes a further 13% (World Bank, 2013).

However, South Asia is facing an existential environmental crisis, marked by resource depletion, air and water pollution, waste generation and improper management, and vulnerability to natural hazard-related disasters. South Asia also has one of the highest rates of habitat destruction in the world; thousands of its native species are threatened with extinction. The crisis is driven by complex and often interrelated direct and indirect drivers of change, including population growth, rapid

urbanisation, economic growth, overexploitation of resources, and land use and land cover change (Sultana et al., 2022). Degradation has often been associated with rising per capita income, population growth and weak governance systems (Tan et al., 2022). In 2014, 34% of the population resided in urban areas (Chandiramani & Airy, 2018). With some of the world's fastest rates of urbanisation and economic growth, South Asia is experiencing rapid environmental change and all ecosystems are being adversely impacted. And by threatening South Asia's ecological security, these factors also increase the region's vulnerability to climate change (UNEP & DA, 2016).

Increased climate variability and resulting extreme weather events and disasters are evident in South Asia (Wester et al., 2019). The region also suffers from weak institutional capacity and limited inter-country cooperation, leading to competition over and unsustainable use of natural resources. The state of degradation in the region is likely to worsen in the future, leading to increased disasters risks, food and water insecurity and severe loss and damage (IPCC, 2022). This is of particular concern given South Asia's high dependence on nature's contributions for subsistence livelihoods and economic development. More than 40% of the world's poorest people live in South Asia and, despite the region being the 'food bowl of Asia', some 51% of the population is food-energy deficient (Rasul, 2014). This presents ever-greater challenges as environmental degradation impacts the poorest people disproportionally – and climate change is making the situation even more difficult.

The UK's Foreign, Commonwealth and Development Office (FCDO), together with the International Institute of Environment and Development (IIED), is working towards developing a frontier research-to-action (RTA) programme – Reversing Environmental Degradation in Africa and Asia (REDAA). REDAA is expected to be a five-year programme that will include a grant-making facility to support initiatives putting research into action. To define a set of priorities for REDAA, FCDO/IIED commissioned scoping studies in sub-Saharan Africa, Southeast Asia and South Asia. The scoping study in South Asia is led by the International Centre for Integrated Mountain Development (ICIMOD), with support from Ashoka Trust for Research in Ecology and the Environment (ATREE) in India.

Objectives

The key objective of the scoping study is to identify between 6 and 12 research-to-action priorities that REDAA could support, where evidence can be improved and taken up, tools can be improved and well used, and governance systems can be improved for environmental restoration and sustainable natural resources management.

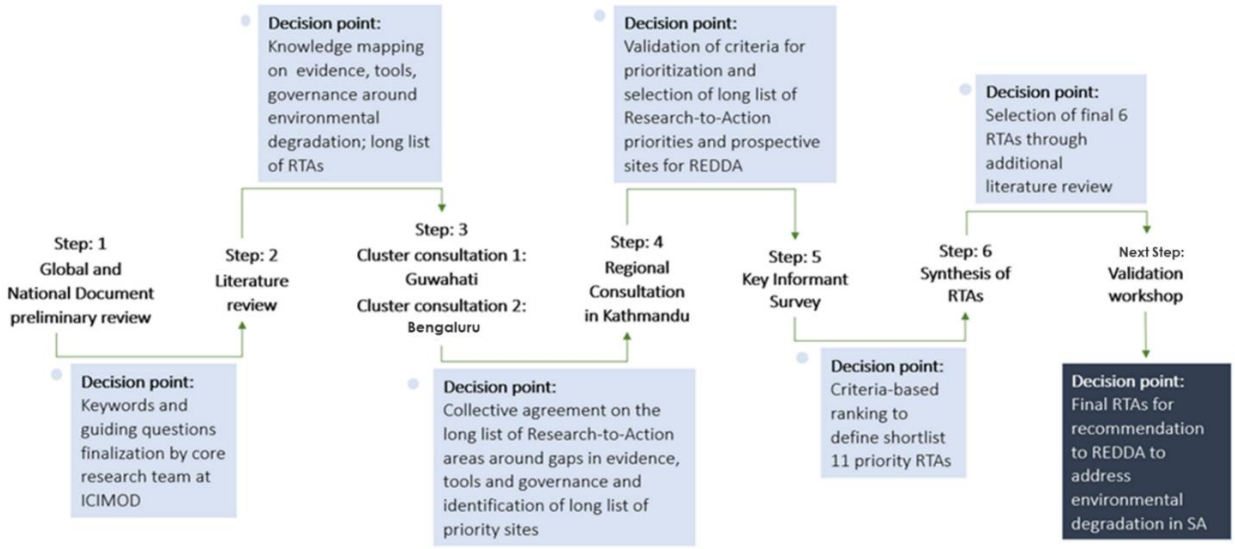
For this scoping study, '**evidence**' refers to evidence base – research quality, research institutes, research gaps and research uptake – which can be improved and taken up for environmental restoration and sustainable natural resource management. '**Tools**' relates to management practices, solution interventions, methods and approaches used to address and mitigate the challenges of environmental degradation. '**Governance**' refers to institutional processes and mechanisms that enable equitable engagement, voice, social inclusion and benefit sharing while addressing issues of environmental degradation, including long-term support mechanisms such as engagement, capacity and finance systems.

The findings are expected to inform the REDAA strategy for South Asia and guide a grant-making facility that supports initiatives putting research into action, for environmental restoration and sustainable natural resources management in the region.

Methodological approach

The study adopted a seven-step, mixed-methods approach that included both quantitative and qualitative analysis, followed by expert review and literature-based synthesis, and validation through regional workshops (Figure 2). Analysis of peer-reviewed articles was quantitative (bibliometric analysis), while qualitative methods included cluster consultations, key informant and expert interviews, and multi-stakeholder workshops.

Figure 2: Summary of methods adopted to derive priority research-to-action areas for South Asia



Step 1: Preliminary review

The preliminary review helped to define keywords and guiding questions for the literature review (Step 2). Key global, regional and national reports were reviewed, including:

- IPBES Global assessment report on Biodiversity and Ecosystem Services (2019)
- National Biodiversity Strategies and Action Plans (NBSAPs)
- Nationally Determined Contributions (NDCs) reports
- Critical Ecosystem Partnership Fund (CEPF) Ecosystem Profiles
- World Rangelands Atlas 2021
- Hindu Kush Himalayan Assessment Report 2019
- South Asia Environmental Outlook (2014)
- IPCC Sixth Assessment Report Cross-Chapter Paper: Mountains (2021)
- World Mangrove Alliance State of the World's Mangroves 2021

We also considered and reviewed the websites of government and non-governmental organisations such as the World Bank, Asian Development Bank and ATREE. This helped us to understand the situation and broad-scale environmental degradation challenges in South Asia.

Step 2: Literature review

The literature review enabled us to map knowledge on environmental degradation. A quick bibliometric analysis of 1,200 publications published between 1970 and 2021 helped us to define the broad themes for RTA priorities. For this, 'environmental degradation' and related keywords were combined with ecosystem restoration keywords to detail the causes of environmental degradation, and potentially provide tools and governance systems to restore them (Table 1). *Scopus* and *Google Scholar* were used for the peer-reviewed literature and grey literature search. For grey literature review, we followed the 'state-of-the-art' method (Grant and Booth, 2009) and conducted a preliminary review of selected literature to analyse status and trends of environmental degradation in South Asia. The 'state-of-the-art' method focuses on specific subject matter(s) to gain an overview of the issues to pave the way for further action (Grant and Booth, 2009).

Table 1: Criteria used for the systematic literature review

Criteria	Details
South Asia*	Bangladesh, Bhutan, India, Nepal, Pakistan, the Maldives, Sri Lanka
Keywords	"environmental degradation" OR "habitat loss" OR pollution OR, fragmentation OR deforestation OR "land use change" OR exploitation OR invasive OR climate OR urbanization OR infrastructure OR "ecosystem degradation"
	Environmental restoration: protection OR conservation OR restoration OR solution
Article type	articles, reviews, and book chapters
Subject area	environmental science, earth and planetary science, agriculture and biological science, social science, multidisciplinary [based on Scopus categories]
Language	English
Timeline	1970–2021

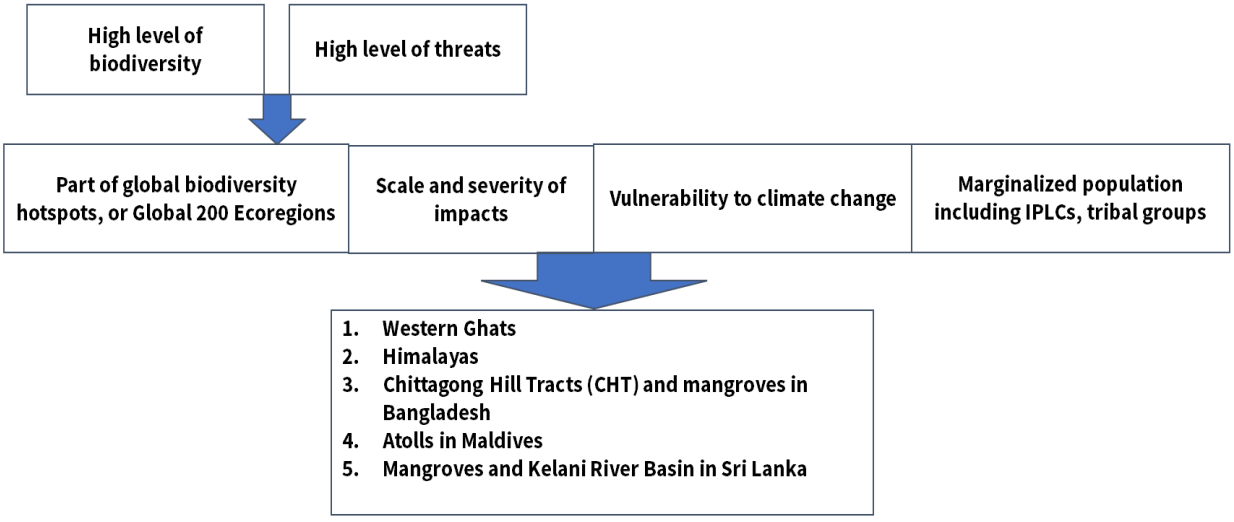
*Afghanistan was not included given the ongoing security situation and the challenges in undertaking analytical work and consultation in the country.

As well as bibliometric analysis, selected literature was subject to in-depth review and content analysis. A thorough review of selected publications (see reference list) helped to understand the status of environmental degradation in South Asia. . It also provided insights into priority areas or hotspots of environmental degradation in South Asia. The priority areas were identified according to five criteria:

- The richness of biodiversity
- The degree of threat and degradation (e.g. overlap with global biodiversity hotspots, Global 200 Ecoregions or Important Bird and Biodiversity Areas)
- The scale and severity of impacts
- Vulnerability to climate exposure and change
- Areas inhabited by marginalised communities including IPLCs and tribal people (**Error! R eference source not found.**)

The broader knowledge mapping around the evidence, tools and governance formed the basis for cluster consultations. The literature review helped to identify the RTA long list.

Figure 3: Criteria for identifying REDAA priority hotspots



Step 3: Cluster consultations

ICIMOD and ATREE co-organised two cluster consultations, in Guwahati (18 November 2022) and Bengaluru (28 November 2022). The consultations brought together researchers, practitioners and decision makers from Bangladesh, Bhutan, north-east India and Nepal to discuss the long list of issues and RTA themes identified through the literature review and to put them into the context of prospective sites. The specific objectives of the consultations were to:

- Identify what evidence is necessary to inform decisions to address environmental degradation in the identified hotspots
- Identify existing tools, innovations and mechanisms being employed to reduce the degradation of critical ecosystems and explore their potential for replicability
- Identify policy, institutional and governance enablers and barriers, and new mechanisms that could be piloted for wider adoption in South Asia.

Findings from the literature review were used to guide discussions during the consultations, and the prospective long list of RTA themes were discussed and prioritised based on specific criteria.

A total of 37 people participated in the Guwahati consultation (27 in person and 10 online), representing government, academia and nongovernmental and civil society organisations from across seven states of north-east India and the hill districts of north Bengal, Nepal and Bangladesh. The Bengaluru consultation, which covered the Western Ghats, Sri Lanka and the Maldives, was attended by 28 people (24 in person and 4 online).

A long list of 40 priority sites from two consultations are given in **ANNEX I**. The long list includes sites in Pakistan, which were added based on literature review and through separate consultation with experts from ICIMOD-Pakistan office and in-country partner networks. Forests, wetlands, grasslands (including the unique grassland-shola matrix in the higher reaches), agroecosystems, riparian forests, sky islands, and mangrove ecosystems were identified as critical sites threatened by degradation and considered a priority for restoration at the subnational level.

Step 4: Regional consultation

A hybrid (in person and virtual) regional consultation was held in Kathmandu on 1 December 2022 to help with short-listing themes for RTA themes and priority sites for REDAA interventions. The criteria for prioritisation or ranking were also discussed. To avoid potential bias, specific criteria were followed for ranking.

A total of 15 participants from Bangladesh, Bhutan, India, Nepal, the Maldives and Sri Lanka attended the regional consultation. The purpose was to share the findings of two cluster consultations and build consensus on key RTA themes and ideas sorting them using the scale appropriateness criteria – that is, whether the interventions is within the scope of REDAA grant (reference used: <100,000 and <1–2 years >100,000 and up to 4 years). Using this scale appropriateness criteria, 25 out of 59 RTA themes and 24 out of 40 prospective sites were shortlisted (**ANNEX II**). Participants then discussed and finalised the criteria that would be used to identify and prioritise 6–12 potential RTA interventions for REDAA (Table 2).

Table 2: Criteria for RTA priority ranking and prioritisation

Criteria	Definition	Sub-criteria
Robustness	The interventions have significant results	Site specific and national Regional and transboundary
Inclusiveness	The intervention engages and benefits local stakeholders	Traditional institutions with inclusive knowledge development processes; evidence generated is relevant to wider sections of society Local communities, women and youth are involved
Interdisciplinarity	The intervention requires inter and multidisciplinary understanding	Multisectoral coordination and engagement – relates to many sectors, and bring in interdisciplinary engagement Multi-stakeholder collaboration
Sustainability	The intervention can be scaled or continued, or evidence meaningfully used after REDAA	Locally designed and owned, priority for communities Supported by government policies and programmes Strong interest from private sector to invest and collaborate

Step 5: Key informant survey

A key informant survey was conducted to prioritise the shortlisted RTA themes. A total of 15 experts from seven countries responded to the survey. Respondents scored each RTA theme according to: (1) their relevance to the prioritised sites that were identified during the cluster consultations (Step 3); and (2) their effectiveness against the criteria identified in Step 4 (Table 2) – robustness, inclusiveness, intersectionality and sustainability. These site-based scores (SBS) and effectiveness-based scores (EBS) were then combined to create a list of 12 potential interventions for REDAA (**ANNEX III**). The site-based ranking also helped identify priority sites specific to RTA themes. Cumulative scores for all sites and all respondents were used.

Table 3: Site-based score, where 3 = high relevance and 1 = low relevance

	RTA a	RTA b	RTA c	RTA d	RTA e	RTA f
Site 1	3	2	1	2	1	1
Site 2	2	3	1	3	1	2

Table 4: Effectiveness-based score, where 3 = high effectiveness and 1 = low effectiveness

	RTA a	RTA b	RTA c	RTA d	RTA e	RTA f
Criteria 1	2	1	2	2	1	3
Criteria 2	2	3	1	2	2	3

Step 6: Synthesising RTA priorities

Drawing on expert inputs and literature, we narrowed down from 12 to 6 RTA priorities, using the following criteria: impact, participatory process, cross-disciplinarity, and scale appropriateness and fit with time frame (Table 5).

Step 7: Multi-stakeholder consultation

The six identified RTA priorities were validated and fine-tuned through multi-stakeholder consultation, which included an in-person workshop with 15 key experts from the South Asia region and an online survey shared with more than 200 regional stakeholders.

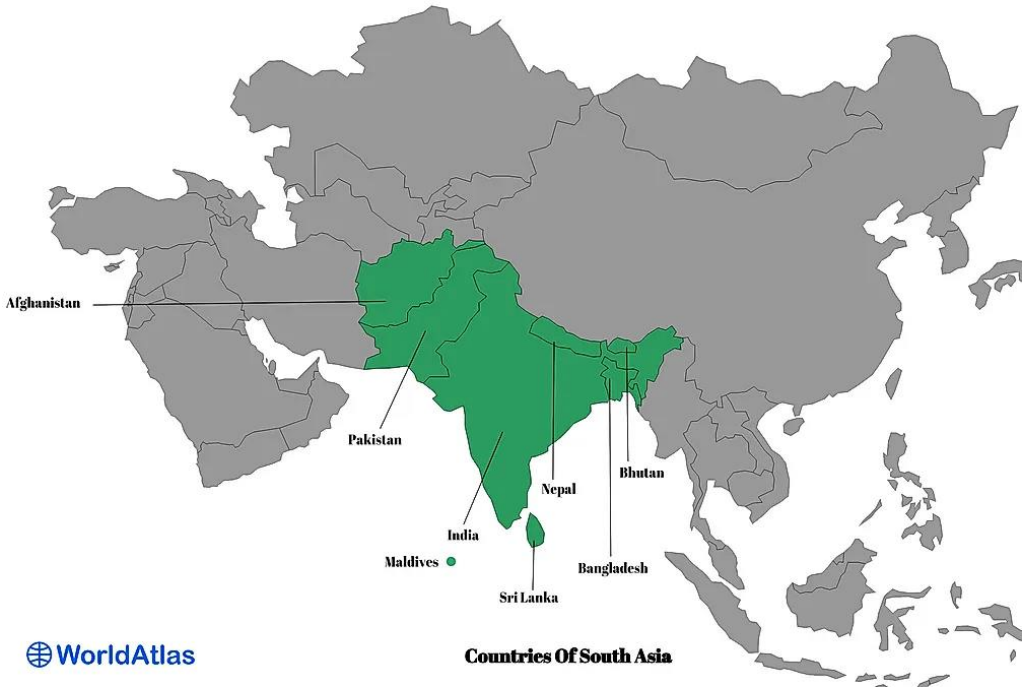
Table 5: Criteria used for ranking RTA priorities

Scale appropriateness (fund resource and time)	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 US$10,000 and US$100,000 over 6 to 24 months, or a grant of between US$200,000 and US$1,000,000 over four years.
Site-specific impact	If the issue(s) were addressed, it would have a major impact in a specific place.
Cross-cutting impact	If the issue(s) were addressed, it would greatly impact systems or processes that affect many places.
Locally led processes and understanding	The issue is best addressed by locally led action, especially action led by IPLCs.
Intersectional processes and understanding	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.
Foster cross sectoral collaborations	The issue is best addressed by fostering multi-stakeholder and cross/trans-disciplinary collaborations.
Value for money	The ways in which the issue is addressed will provide good returns on investment, benefits to costs and value for money.

Geographical focus

This study covers the South Asia region, which encompasses eight countries – Afghanistan, Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan and Sri Lanka (see Figure 3). The study focuses on five priority areas: (1) the Himalaya; (2) the Western Ghats; (3) the Chittagong Hill Tracts and Sundarbans mangroves in Bangladesh; (4) atolls in the Maldives; and (5) Kelani River Basin in Sri Lanka. While we recognise nature-people-climate challenges in Afghanistan, it is not included in this study due to the ongoing security situation and the difficulty of undertaking review and analytical work there.

Figure 4: South Asia region and its eight countries



Source: WorldAtlas

Sitting between East Asia and the Indian subcontinent, the **Himalayan** region is geologically young and characterised by extreme altitudinal variations, which contribute to its rich biological diversity. The Eastern Himalaya Region includes elements of two of the world's 34 biodiversity hotspots: the Indo-Burma Hotspot and the Himalaya Hotspot (CEPF, 2005). The region's ecosystems provide valuable goods and services such as water, soil retention, climate regulation, carbon sequestration and other biological resources (Xu et al., 2019). It is home to diverse ethnic groups and minority communities who depend on the rich natural resources and biodiversity of the landscape for their sustenance and wellbeing. Millions of people downstream also depend on these goods and services (Molden et al., 2014).

The Western Ghats, extending along the west coast of India, cover an area of 180,000 square kilometres. The Western Ghats comprise the major portion of the Western Ghats and Sri Lanka Hotspot. The area is extraordinarily rich in biodiversity. Although it accounts for less than 6% of the land area of India, the Western Ghats is home to more than 30% of all plant, fish, herpetofauna, bird and mammal species in the country, with a high proportion of endemics (Gunawardene et al., 2007). As a largely montane area with high annual rainfall, the Western Ghats performs important hydrological and watershed functions. Approximately 245 million people live in the peninsular Indian states that receive most of their water supply from rivers originating in the Western Ghats. Thus, it sustains the livelihoods of millions of people and, with the possible exception of the Indo-Malayan region, no other hotspot impacts the lives of so many people (CEPF, 2007).

Bangladesh is one of the world's most vulnerable countries to climate change impacts according to the Global Risk Index 2021 (Eckstein et al., 2020). Climate change has significantly impacted **Sundarbans mangrove forests**. Loss of mangrove forests have rippling effects, including reduced land productivity, elevated risks to human health and exposure to disaster risks and loss of income among coastal communities. The forests of the **Chittagong Hill Tracts**, which account for a third of the country's forest cover, have been severely degraded over the last few decades (Rasul, 2007) affecting biodiversity and water security.

The Maldives is home to some of the most diverse and healthy **atolls** and coral reefs in the world, but these reefs are under threat from several factors including overfishing, pollution and climate change. The degradation of coral reefs can have significant impacts on fish populations and the overall health of marine ecosystems. As is also the case in Sri Lanka, sea-level rise and coastal development in the Maldives has led to erosion of the coastal belt and can impact the environment and the lives and livelihoods of local people.

The **Kelani River Basin** emerged in most reviews as a hotspot for freshwater degradation in Sri Lanka. This river basin, although high in biodiversity and endemism, suffers from issues such as illegal water diversion and extraction, pollution from agrochemicals, industrial discharge, domestic waste, as well as impoundment for hydroelectricity generation (Surasinghe et al., 2020). Numerous studies have made urgent calls for increased protected-area coverage for the Kelani River Basin, particularly in regions of high species richness, vulnerable wetlands and aquatic habitats, erosion-prone areas, and sites of cultural and aesthetic value (Surasinghe et al., 2020). This demands further biodiversity and socioecological research across the entire river basin.

Key findings

Environmental degradation in South Asia

Environmental degradation is increasingly becoming a major issue in South Asia. Some of the key issues are air and water pollution, deforestation, degradation of ecosystems, land and soil degradation, biodiversity loss, land use and land cover change (LULCC) and fragmentation, human–wildlife conflict, and invasive species (Table 6).

Table 6: Key environmental issues across the countries of South Asia

Countries	Key issues
Bangladesh	Air pollution, drought and water scarcity, land degradation and soil erosion, land conversion, climate change -sea level rise, temperature, extreme events, wetland degradation
Bhutan	Air pollution, solid waste disposal, water pollution in urban areas, glaciers melt
India	Deforestation, fragmentation, land cover change, water contamination, biodiversity loss
Maldives	Marine and ground water pollution, solid waste, coral reef degradation
Nepal	Air pollution, forest fires, human-wildlife conflicts, soil erosion, solid waste, climate change, loss of traditional knowledge and practices
Pakistan	Deforestation, desertification, wetland degradation, air and water pollution
Sri Lanka	Land degradation, water and air pollution, biodiversity loss, human-wildlife conflicts, climate change

Source: NBSAPs, SA Environment Outlook, Scopus.

Ecosystems

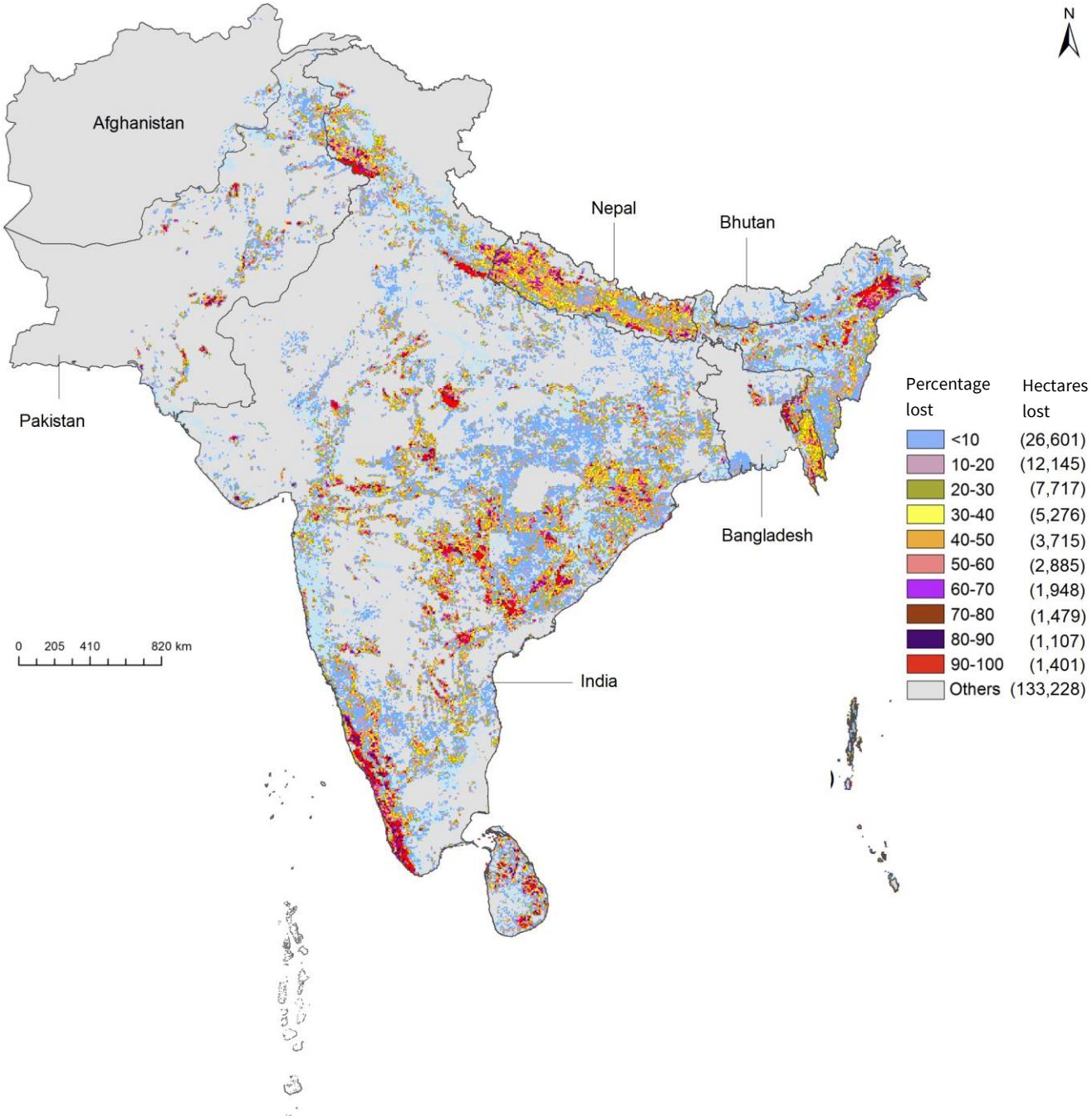
The diverse ecosystems are degrading faster than ever in the region. Some of the most threatened and degraded ecosystems in the region are forests, mangrove, coastal, grassland and wetlands.

Forests

Deforestation and forest fragmentation in South Asia is one of the major issues. The long-term change analysis over a period of 85 years (1930 to 2014) indicated a loss of 30% of the forest cover (Figure 4).

Higher annual net deforestation rates were observed in the period from 1930–1975 (0.68%) followed by 1975–1985 (0.23%), 1985–1995 (0.12%), 1995–2005 (0.06%) and 2005–2014 (0.04%) for the region (Reddy et al., 2018). But despite this gradual decline in net annual rates of deforestation, forest cover continues to decrease due to logging, agriculture and urbanisation, leading to biodiversity loss and the degradation of important ecosystems (Haughan et al., 2022). During the period 2005 to 2014, Bangladesh had the highest annual net rate of deforestation (0.75%), followed by India (0.03%), Nepal (0.01%) and Sri Lanka (0.01%). From 2000 to 2020, Pakistan experienced a net change of 948 km^2 in tree cover from 2000 to 2020 (Pakistan Forest Atlas, 2023). Forests in Pakistan are diminishing at a rate of 270 km^2 per year (FAO, 2005; 2010). Importantly, forest fragmentation is a major problem for the region and is expected to be a major issue in the coming decade. Among the seven study countries, forest fragmentation is most serious in Bangladesh and Nepal. Boundaries of forests remain intact, but the condition of forests (productivity, measured based on growing stock) is declining in all study countries except Bhutan and India (FAO, 2020). Forest encroachment and fragmentation have resulted in the loss of tiger habitat in Namdapha–Royal Manas Transboundary Landscape (Bhutan, India and Nepal) and the Terai Arc Landscape, the biological corridor linking Nepal and India (Joshi et al., 2016).

Figure 5: Percentage and hectares of forest cover loss in South Asia between 1930–2014



Note: 5x5 km grid cells. Figures in brackets represent total number of hectares lost. Source: Reddy et al. (2018)

Mangroves

The major marine and coastal areas in South Asia are mangroves, coral reefs and coastal wetlands. The world's largest mangrove is situated between India and Bangladesh, while the Maldives has the seventh largest coral reef area (SACEP, 2019). Mangroves in South Asia have sharply declined over the

past decades, with an estimated decline of 85% in India, 78% in Pakistan and 73% in Bangladesh (SACEP, 2019; Macintosh & Ashton, 2002). The degradation of mangroves is due to rapid expansion and unsustainable shrimp aquaculture industry, deforestation for aquaculture and agriculture, high deposition of sediments from uplands, discharge of industrial pollutants and other climatic factors that have led to land subsidence, saline water intrusion and susceptibility to tropical cyclones (Bhowmik et al., 2022). For instance, the Chakaria Sundarbans – the oldest mangrove in the subcontinent – has been completely cleared (Hossain & Lin, 2001). Sea-level rise and extreme events such as cyclones and storms are also contributing to mangrove degradation. Loss of mangrove forests has rippling effects, including reduced land productivity, elevated health risks and exposure to disasters, and loss of income for coastal communities living in and dependent on Sundarbans forests in Bangladesh and India (Dasgupta et al., 2020). Overall, coastal flooding and degradation is an increasing problem in South Asia due to a combination of factors such as overfishing, pollution and coastal development (Rajasuriya et al., 2002).

Coral reefs

Around 6% of the world's coral reef area is found in South Asia, with the Northern Indian Ocean being one of the 10 coral biodiversity hotspots with high endemism (Roberts et al., 2002). the atoll system of the Maldives ridge (Maldives, Lakshadweep and Chagos) is the largest atoll system in the world and, together with Sri Lanka, has been identified as 1 of the 10 global priority areas for coral reef conservation. Coral reefs are threatened by climate change, disease, overharvesting of resources, pollution, dynamiting and high sedimentation deposition (SACEP, 2019).

Wetlands

South Asia's wetlands are degrading due to rapid population growth, urbanisation, pollution, industrialised agriculture and overexploitation (Szabo & Mundkur, 2017). For example, India has lost nearly one-third of its natural wetlands over the past four decades (Chatterjee, 2020). In the Western Ghats, the swamps that once occupied large swathes are now restricted to less than 2 km^2 and vast patches have been converted into paddy fields and settlements (Molur et al., 2011).

Similarly, there is evidence that wetlands in Bangladesh are under increasing stress as a result of climate change, which is causing more frequent and intense disasters, more algal blooms, shifting breeding grounds and soil salinization (Kibria & Haroon, 2017). Wetlands in Pakistan and Nepal face similar problems with overextraction of resources and conversion to other land uses. A major hindrance to wetland conservation in the region is that most countries still do not have a nationwide atlas of wetlands, which often makes it difficult to monitor the extent of degradation and effectiveness of restoration actions.

Importantly, high-altitude wetlands often defined as areas of temporary or permanent saturation located 3,000 metres above sea level, between the tree line and permanent snowline, are degrading (O'Neil et al., 2022). Limited information on high-altitude wetlands, climate change, asymmetrical

development, and demographic transitions pose the immediate challenges to high-altitude wetlands during this century (O'Neil et al., 2022).

Grasslands

Grasslands cover 60% of the Hindu Kush Himalaya region (Ning et al., 2013, Miller, 1997), and 24% and 12% of the geographic areas of India and Nepal, respectively (Ning et al., 2013; Rawat & Adhikari, 2016). More than 100 million people living in this area are dependent on grasslands for their livestock husbandry-based livelihoods. Collection of non-timber forest products, particularly medicinal and aromatic plants, in the high-altitude grasslands support rural livelihoods in Bhutan, India and Nepal (Shrestha & Bawa, 2013; Negi et al., 2017). Grasslands in South Asia are also important habitats for many threatened species. For instance, the Terai grasslands of Nepal is home to rare and endangered species such as the one-horned rhino, Asian elephant, and wild water buffalo, and shaped by floods, fires, and erosion. But despite being one of the world's most productive ecosystems, only 4% of the unique Terai grasslands are protected (ILRI, IUCN, FAO, WWF, UNEP and ILC, 2021). Grasslands are under immense human and climate-induced pressures (Rawat & Adhikari, 2016. India's environmental history suggests that a forest- and timber-centric view of the landscape has had enormous implications for grasslands, their biota, and the people and livestock that have depended on them (Vanak et al., 2017).

Land and soil degradation

Soil erosion, desertification, and loss of fertile land are major environmental problems in South Asia (Lal, 2007), driven by a combination of factors such as overgrazing, deforestation, and poor agricultural practices (Ma & Ju, 2007). The overuse of fertilisers and pesticides (Reynolds et al., 2015), as well as industrial pollution, contribute to soil degradation in South Asia affecting both agriculture, natural ecosystems, and human health (Abdul et al., 2022).

Drivers

Environmental degradation in South Asia is complex and driven by a variety of factors including population growth, rapid urbanisation, climate change, industrialisation, widespread poverty and high dependence on natural resources. South Asia is home to 1.9 billion people, making it the most populated region in the world (Worldometers, 2023), and is predicted to experience high population growth in the coming decade. The region is also on a path of rapid economic growth, with GDP increasing by 17% between 2021 and 2020 (World Bank, 2021). This growth in both population and economy have affected the environment as a result of unsustainable land use practices, unplanned urbanisation, overextraction of resources, and rapid industrialisation (Sultana et al., 2022). Pollution is one example of the consequences of unplanned growth and becoming a major problem in many South Asian cities (Kapinga & Chung, 2020). Increasing industrial and vehicular emissions pollute the air, and water is polluted as waste management systems and sewage treatment fail to keep up with demand. India is one of the major global emitters of carbon dioxide (Li & Jiang, 2020). Air pollution has been linked to a wide range of health problems, including respiratory illnesses and heart disease, and

water pollution has a major negative impact on human health and the environment (Krishna et al., 2017). South Asia is a home to many major rivers and other water bodies, but these freshwater bodies are often polluted by industrial waste and agricultural runoff, which can harm aquatic plants and animals and make the water unsafe for human use (Hasan et al., 2019). Environmental degradation, along with climate change and other factors are likely to worsen disaster risks and food and water security for the rapidly growing population of the region (IPCC, 2022; Rasul & Neupane, 2021).

South Asia is particularly vulnerable to the impacts of climate change (Sivakumar & Stefanski, 2011), such as sea-level rise, extreme weather events and changes in precipitation patterns, while also being severely data deficient (Sharma, 2012). Moreover, rapid and unplanned urbanisation and infrastructure development have intensified hazards in South Asia (Bhatt et al., 2019). For example, in Nepal, unregulated clearing of forests for rural road construction, particularly in the mid-hills, have resulted in landslides (Chalise et al., 2019), causing loss and damage to lives and property. The coping capacity of the rural poor – especially in marginal areas – is considered low; we urgently need to mainstream good practices for climate change adaptation into sustainable development planning in the region (Ahmed & Suphachalasai, 2014)).

Invasive species are another major driver of biodiversity loss and ecosystem degradation in the South Asia. Over the years, the number of invasive species has increased across the region. In the Eastern Himalayas, invasives species are spreading in the forests of Siwaliks and mid-hills of Nepal. For instance, plants such as *Lantana camara, Eupatorium adenophorum* and *Mikania micrantha* are widespread in Chitwan National Park. Water hyacinth is now common across India, Nepal and Bangladesh. Invasive species threaten native vegetation and biodiversity, and contribute to the acceleration of environmental degradation.

Impacts

Loss of biodiversity: Deforestation, habitat destruction and pollution all contribute to the loss of biodiversity in South Asia. This can have a ripple effect throughout the food web, as the disappearance of one species can disrupt the balance of the entire ecosystem. It has been observed that rising temperatures in the region have had a significant impacts on river flow patterns (Lutz et al., 2016) and on ecosystems and its species (Singh et al., 2021). Even with a predicted temperature rise of 1.5 °C in the Hindu Kush Himalayan region, most ecosystems – including forest, rangeland, wetlands and others – could be seriously impacted due to changes in species abundance, composition and productivity (Negi et al., 2012). At the species level, some of the major effects are population decline, decline in species richness, and habitat shifts and degradation. For instance, the upward shift of the snowline has negatively impacted snow leopard (*Panthera uncia*) habitats (Li et al., 2016), which are likely to be reduced in Bhutan, Nepal and India by 2080 (Farrington & Li, 2016). Golden snub-nosed monkey (*Rhinopithecus roxellana*), Himalayan Musk deer (*Moschus chrysogaster*) and Himalayan langur (*Semnopithecus entellus*) have also been experiencing range shifts in the region (Luo et al., 2012).

Loss of livelihoods: Environmental degradation has led to the loss of livelihoods for many people, particularly those who rely on natural resources (Ohlsson, 2000). For example, the degradation of coral reefs leads to a loss of fish stocks, which can negatively impact the livelihoods of fishing communities (Techera et al., 2019). Similarly, soil erosion and desertification lead to the loss of fertile land, negatively impacting the livelihoods of farmers (Lal, 2007).

Human–wildlife conflict: Habitat fragmentation, rapid urbanisation, intensification of agriculture land use, linear infrastructure and population growth have increased human dominance in natural landscapes. This has intensified the competition for space and resources between humans and wildlife – especially larger species like the Royal Bengal tiger, the Asian elephant, common leopard, bears and monkeys (Sharma et al., 2021). As a result, the incidence of conflict between humans and wildlife has also increased, leading to loss of life (people, wildlife and livestock) and significant crop damage. In Nepal, an average of 115 persons were attacked by large mammals each year between 2010 and 2014 (Acharya, 2016). In West Bengal, India, 62 elephants were hit by trains between 2004 and 2015 (Roy & Sukumar, 2017).

Impact on human health: Environmental degradation has negatively affected on human health in South Asia (Eswaran et al., 2019), particularly people living in poverty or in marginalised communities (Uddin & Jeong, 2021). For example, air and water pollution have caused respiratory illnesses and other health problems, and exposure to chemicals and toxins has led to chronic health issues (Hasan et al., 2019). Contamination of water sources has increased incidences of water- and food-borne diseases in the region (Sarker et al., 2021). A study reported that food-borne diseases in Bhutan almost doubled between 2015 and 2019, increasing from 8 events to 15 (Chhetri et al., 2021). In Bangladesh, 8.5% of all deaths are as a result of water, sanitation and hygiene related issues (UN-Water, 2013).

Economic impacts: A significant impact on the economy is evident through reduction of productivity, increasing costs, and damaging infrastructure (Smith et al., 2021). For example, the degradation of water resources has caused decreased crop yields, while damage to coastal infrastructure can result in lost tourism revenues (Karthikheyan, 2010).

Out-migration: Environmental degradation has forced people to leave their homes in search of better opportunities and resources; in Bangladesh, for example, migration became permanent as disasters worsened environmental degradation (Poncelet et al., 2010). One study estimates that by 2050, over 13 million people living around Sundarbans in Bangladesh will out-migrate due to different environmental crises (Rigaud et al., 2018). This can lead to increased urbanisation and urban poverty, as well as greater pressure on the environment in new areas. The economic pressures on traditional livelihoods have led to out-migration of men, resulting in the feminisation of agriculture and natural resources management in South Asia (Goodrich et al., 2022). In India and Nepal, agricultural work done by women is 4.6 to 6.6 times higher than men (Goodrich, Mehta & Bisht, 2017). Declines in agricultural yields and discrimination in food allocation have severe impacts on food security and

malnutrition among women and children in Bangladesh, India, and Nepal (WHO, 2014; Kabir et al., 2016).

Food insecurity: Environmental degradation has caused poor crop yields, soil erosion, water scarcity and loss of biodiversity, which has negatively impact food security in South Asia (Bandara & Cai, 2014). Climate change also exacerbates food insecurity, as it brings uncertainty and variability to precipitation and temperature, making agriculture more difficult (Douglas, 2009).

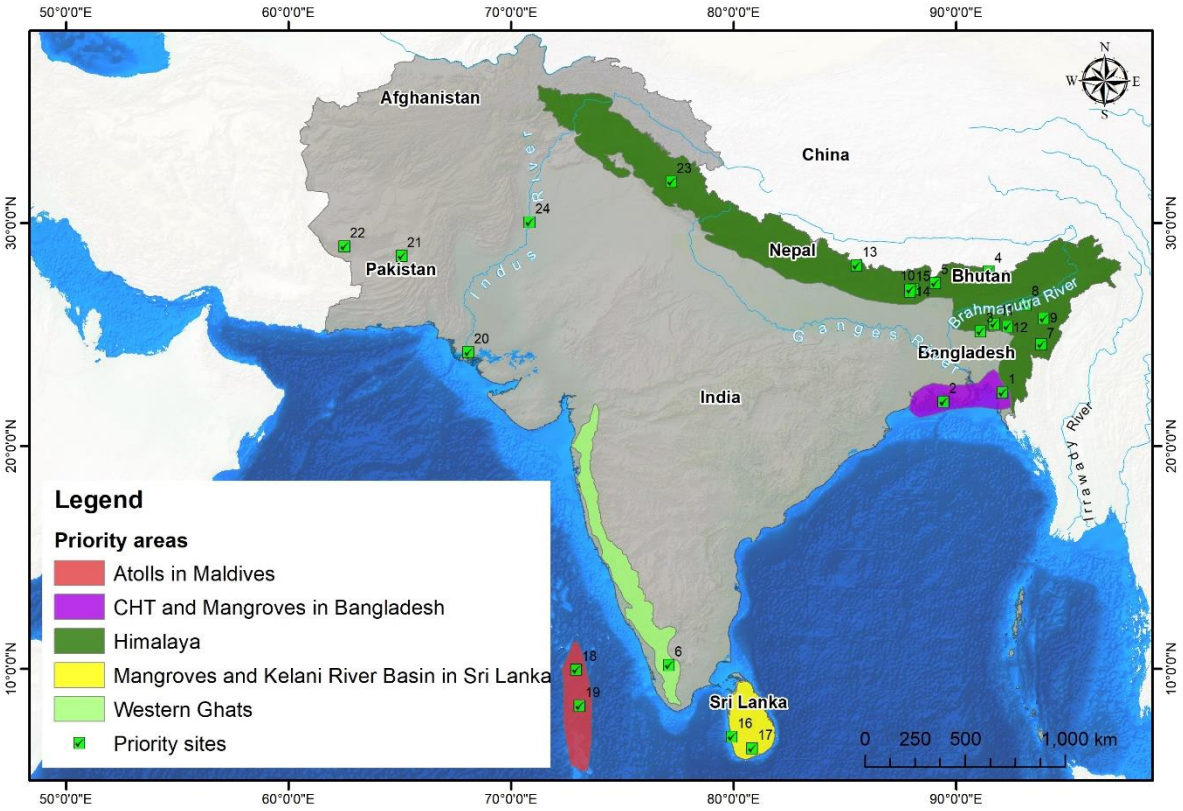
Social inequity and gender inequality: Environmental degradation disproportionately affects marginalised groups, such as those living in poverty or in remote areas, and social inequity is very evident. Marginalised groups lack the resources and capacity to adapt to the negative impacts of environmental degradation. For example, women, poor urban dwellers and populations with limited occupational opportunities are more exposed to air and water pollution (Pouramin et al., 2020; Maharjan et al., 2022). According to one estimate, 7% of total annual pregnancy loss in South Asia is attributable to ambient air pollution (Xue et al., 2021). More women than men in Bangladesh, India and Nepal suffer from arsenicosis, because of their high exposure to contaminated water during cooking and washing activities (Sultana, 2012).

Women often bear primary responsibility for collecting firewood, fodder and water. Loss of nearby forests and the drying up of water sources have therefore disproportionately affected women and girls (Gurung et al., 2019). Travelling further to collect these resources is both labour and time intensive, which limits the educational and income-generating opportunities of women and girls (Resurreccion et al., 2019; Goodrich et al., 2022). Women and girls also face higher health risks due to water stress and subsequent poor sanitation and hygiene (Pouramin et al., 2020). In South Asia, it is evident that men generally – often those who are locally rich, powerful and belong to higher castes – have been able to control and benefit from limited available natural resources, while excluding women, Indigenous people and marginalised groups (Ojha et al., 2022; Resurreccion et al., 2019; Chaudhary et al., 2018).

Priority areas for intervention

Using the criteria outlined in Step 2 of the methodology (Figure 3), we identified five priority areas for REDAA intervention: (1) the Himalaya (including sites in Bhutan, India, Nepal and Pakistan); (2) the Western Ghats; (3) the Chittagong Hill Tracts and Sundarbans mangroves in Bangladesh; (4) atolls in the Maldives; and (5) mangroves and the Kelani River Basin in Sri Lanka. We then held two cluster consultations – one in Guwahati and one in Bengaluru – to help identify a range of priority sites in each of the five areas using the criteria outlined in Table 2. These sites are either landscapes composed of a mosaic of varied ecosystems or stand-alone ecosystems. We identified 24 priority sites across the South Asia region during the regional consultation (see Figure **6** and Table **7**).

Figure 6: Potential priority areas and sites for REDAA-supported initiatives in South Asia



Source: ICIMOD 2023 (produced for REDAA study).

Table 7: Priority sites in South AsiaCountry	Ecosystem	Site	Major issue, drivers and impacts
1. Bangladesh	Forest	Chittagong Hill Tracts	Unregulated tourism, extraction of resources, unplanned urbanisation, shifting cultivation, deforestation, landcover change
2. Bangladesh	Mangrove	Sundarbans mangroves	Over-extraction of mangrove forests, sea-level rise, climate-induced disasters, and changes in forests, rangeland, peatlands

Table 7: Priority sites in South AsiaCountry	**Ecosystem**	**Site**	**Major issue, drivers and impacts**
3. Bangladesh	Marsh wetlands	Hakaluki Haor, Tanguar Haor and Marjat Baor	Over-extraction, biodiversity loss
4. Bhutan	Forests, grassland	Bumdelling Wildlife Sanctuary and Sakteng Wildlife Sanctuary	Over-extraction, unplanned infrastructure, solid waste
5. Bhutan	Forests, grassland	Proposed corridor (PWS-JKSNR)	Forests degradation and fragmentation
6. India	Agriculture, Rain Forest	Western Ghat, India	Degradation of rainforests, biodiversity loss
7. India	Wetlands, marshes	Loktak Lake, Manipur	Over-extraction, land cover change, biodiversity loss
8. India	Wetlands, marshes	Wetland Complexes of Assam	Over-extraction, solid waste, sedimentation, over-extraction, degradation
9. India	Forests, grassland, and wetlands	Community Conservation Areas in Nagaland	Habitat fragmentation, over-extraction, Land cover changes
10. India	Forests, wetlands, grassland	Singalila–Barsey–Chewa Bhanjyang landscape	Vulnerable to climatic hazards, faulty agricultural practices, human wildlife conflict, unregulated tourism, and unplanned urbanization.
11. India	Forest, grassland	Sohra-Mawphlang Corridor, north-east India	Massive deforestation leading to the slow extermination of highly endangered species such as the clouded leopard.
12. India	Forests, rivers	Jaintia Hills mining areas, Meghalaya	Massive mining of coal, limestone and setting up of cement factories.

Table 7: Priority sites in South AsiaCountry	**Ecosystem**	**Site**	**Major issue, drivers and impacts**
			Rivers are being poisoned with limestone residue thereby making the PH level too high for any aquatic life to survive
13. Nepal	Rangeland, forests, cryosphere, wetlands, peatlands	Langtang valley	Climate-induced disasters, and changes in forests, rangeland, peatlands
14. Nepal	Forests, grassland, wetlands	Panchthar-Ilam-Taplejung (PIT) corridor	Encroachment, forests degradation, urbanisation, warming
15. Nepal	Wetland, forest, grassland	Mai Pokhari Ramsar	Loss of traditional culture and practices, unsustainable harvesting of resources, limited recognition of IPLCs
16. Sri Lanka	Freshwater, riverine	Kelani River Basin	Sedimentation, overextraction, biodiversity loss
17. Sri Lanka	Forests, grassland, wetlands	Udawalawe National Park	Over-extraction, land cover change, biodiversity loss, agriculture lands, urbanisation
18. Maldives	Coral reef	Atolls of the Maldives ridge	Coral degradation, overextraction, unsustainable coastal development
19. Maldives	Coral reef	Atolls of the Maldives ridge	Coral degradation, overextraction, unsustainable coastal development

Table 7: Priority sites in South AsiaCountry	Ecosystem	Site	Major issue, drivers and impacts
20. Pakistan	Coastal wetlands	Indus River Delta and coastal wetlands	Sedimentation from upstream, waste, seawater intrusion, erosion, excessive fishing and bycatch
21. Pakistan	Juniper forests	Juniper forests of Balochistan	Largest juniper forest in the world: illicit cutting of junipers for fuelwood, overgrazing and trampling, encroachment, and habitat fragmentation.
22. Pakistan	Desert	Chagai desert	Mining, oil and gas exploration, illegal hunting, and shooting
23. Pakistan	Forests	Moist and dry temperate Himalayan forests	A global hotspot for avian diversity. Threats: commercial logging, fuelwood cutting and overgrazing, bird shooting for feathers
24. Pakistan	River and wetlands	Indus river system and wetlands	Water diversion and drainage, agricultural intensification, toxic wastes, and pollutants

Good practices and current challenges

This section presents the good practices and challenges in evidence, tools and governance identified through literature review and consultations.

Evidence

Ecosystem services

Understanding of ecosystem services and their linkages to human wellbeing and resilience in South Asia is limited. Local communities are extremely dependent on the services provided by ecosystems in the region (Xu et al., 2019). Broadly, reviews on ecosystem services in most countries commonly employ biophysical methods to assess provisioning and regulate services, highlighting the need to

improve scientific understanding of *cultural* ecosystem services (Chaudhary et al., 2019). These recommendations more often emerged from studies focused on India, Nepal, Pakistan and Bhutan. For example, cultural ecosystem services – especially spirituality and connections to landscape – were not well understood in Nepal (Adhikari et al., 2022) or Pakistan (Ali et al., 2022). More specifically, in terms of economic valuation, there are limited economic valuation studies of non-marketed, non-timber forest products (Uprety et al., 2016). Literature review and consultations also highlighted several other gaps in scientific knowledge, namely: the impacts of land use and land cover change (LULCC) on ecosystem services in Pakistan (Saeed et al., 2022); current medicinal plant extraction practices in Bhutan (Wangchuk & Tobgay, 2015); systematic assessments of the utility and cultural value of underutilised and future smart crops of Nepal (Joshi et al., 2020); utility assessments of the endemic *Myristica* plant species found in the swamps of Western Ghats (Ranganathan et al., 2022); and documentation and non-monetary valuation of cultural services provided by sacred groves across the Western Ghats (Pandey, 2022).

Climate change impacts and adaptation

While many climate change studies have been conducted in South Asia, gaps in evidence remain. Despite being one of the regions most vulnerable to the effects of climate change (Sivakumar & Stefanski, 2011), South Asia is still severely data deficient (Wester et al., 2019; Sharma, 2012). There are several recommendations to improve the understanding of impacts related to climate change at species, ecosystems and societal levels. Most data deficits relate to the impacts of climate change on biodiversity and agriculture, warranting research in this field for South Asia. Particular gaps include: landscape-level understanding of the impacts of climate change – for example, the impacts on glaciers and ice snow, and the resulting downstream effects on livelihoods and hydropower infrastructure (Parker et al., 2017); understanding of the shifting patterns of plant communities as a result of climate change (Kottawa-Arachchi & Wijeratne, 2017); identification of hydrological impacts of climate change across the entire Kelani River Basin and predicted biological responses (Surasinghe et al., 2020); and recognition of the landscape-level ecosystems that are most vulnerable to climatic impacts, based on natural and cultural capital (Lamsal et al., 2017). Research indicates the usefulness of financial mechanisms as a part of nature-based solutions to tackling climate risk (Al-Maruf et al., 2021).

Improving the knowledge base on climate change adaptation requires a multiscale and multidisciplinary approach. Firstly, scale has been identified important in improving the understanding of climate change adaptation. For example, Karki et al. (2022) find that although Nepal has vast literature documenting climate change adaptation at local levels, it was mostly concentrated in a few regions; there was no such research in several districts of Western and Eastern Nepal. Secondly, climate change is highly dominated by physical science, and there is a great divide between the physical science and social science research in climate change adaptation. For example, Rahman et al. (2018) explains that, in Bangladesh, this is because climate change research is too authoritative,

relying only on climatic models and variables without incorporating perception-based understanding and social science perspective.

There are gaps in our understanding of robust adaptation actions at appropriate scales through transdisciplinary research. Documentation and community involvement at local level are limited (Rahman, 2019). In Pakistan, there is not a sound understanding of how local farmers perceive and interpret climate changes (Abbas et al., 2022).

Gaps also exist in our understanding of maladaptation and what this can tell us about climate change risk (Magnan et al., 2016). Maladaptation refers to "action taken ostensibly to avoid or reduce vulnerability to climate change that impacts adversely on, or increases the vulnerability of other systems, sectors or social groups" (Barnett & O'Neill, 2013, p. 88). Maladaptation was highlighted as a particular concern in the Maldives, as well as coastal areas of Bangladesh and Sri Lanka, because of top-down approaches to devising adaptation policies relating to coastal flooding. To ensure that adaptation practices do not have negative unintended consequences in the future, we need to develop a holistic understanding of community-level resource-use dynamics, socioecological vulnerability, and power asymmetries and disparities in order to identify possible maladaptation practices (Rahman, 2019). There is also a need to generate evidence on migration, national relocation possibilities and socio-demographics, which can be used for effective internal migration of climate-affected populations in the Maldives (Magnan & Duvat, 2020). Evidence is also needed to strengthen Sri Lanka's action plan for disaster management, by identifying the barriers and challenges in policies and frameworks related to disaster risk reduction (DRR) in Sri Lanka (Tsuchida & Takeda, 2021). While in Nepal, evidence is needed to improve the understanding of forest–water relationships, so as to avoid the consequences of unscientific measures for reforestation of pine species as a climate change mitigation option (Badu et al., 2019).

Land cover dynamics and biodiversity

LULCC and land degradation risk is the most pervasive and visible form of environmental degradation observed in South Asia. Although there are general assessments around change in cover types (e.g., forest to pasture, cropland to woodland), there is limited understanding of the characteristics of change – such as extent of degradation or effect on productivity or biodiversity). This makes it difficult to identify vulnerability and change hotspots. Likewise, there is a key gap in understanding the land use changes in relation to change in management practices, intensification and abandonment, which would enable the exploration of how sustainable practices can be best supported.

LULCC implies to significant changes in biodiversity. A review on land cover analysis in the Maldives revealed that there has been less attention given to wetlands, partly because most of the conservation efforts are focused on coastal ecosystems and partly because no research has been done to determine the significance of wetlands and its extent of change over the years (Techera & Cannell-Lunn, 2019). Similarly, there is no official assessment of how different drivers are changing biodiversity hotspots such as the Sundarbans forests in Bangladesh (Mahmood et al., 2021). Several

studies have also reported that there is an issue of fast-growing invasive alien plants in Sri Lanka and its impacts on ecosystems and peoples' livelihoods. For instance, invasive species reduce productive land areas of farmland and pastureland, and can affect animal husbandry and agricultural activities. In wetlands, invasive species reduce water quality and flow, trigger water loss in reservoirs and affect fish and other aquatic organisms (GSL, 2020). However, there is no empirical data that characterises and quantifies the effects of invasive species in native vegetation and its cascading impacts people's livelihoods (Ekanayake et al., 2020).

The lack of long-term monitoring and baseline surveys were also key research gaps in several priority sites. For example, the Kelani River Basin lacks the long-term biodiversity assessments that are required for restoration, including baseline population studies and reporting on changes in distribution ranges, water quality and habitat structure (Surasinghe, 2020). A review on conservation challenges in the Western Ghats found that, to mitigate human–elephant conflicts, there was a similar, urgent need for baseline information on elephant behaviour, number, dispersal, functional corridors and habitat use of the Wayanad plateau (Anoop & Ganesh, 2020).

Tools

The approaches discussed in this section are not necessarily 'tools' in and of themselves, but rather broad arenas of action that each require better tools in order to have demonstrable positive effects in addressing environmental issues and enable more effective natural resources and landscape management.

Nature-based solutions

Nature-based solutions (NbS), as called for in international climate agreements, are gaining increased attention in South Asia. However, the limited studies on NbS show gaps in definition, application and impacts across different sectors. For instance, one study of NbS in Bangladesh found that the approach adopted focused on socio-cultural benefits, without reporting evidence on the net benefits for biodiversity (which is a criterion for NbS) (Smith et al., 2021). The study concluded that the effects of NbS on biodiversity across currently practiced NbS interventions in Bangladesh need to be assessed (Smith et al., 2021). The same can be said of NbS in other South Asian countries. For the Maldives, conservation of biodiversity requires extensive research on the effectiveness of existing laws, because of the ambiguities and overlaps in different conservation regulations (Techera, 2019).

A review of NbS measures in Bangladesh pointed out several opportunities for NbS for tackling environmental degradation and related issues. These include: native tree planting for carbon sequestration in the mixed evergreen forests of the Chittagong Hill Tracts and the deciduous Sal forests in central Bangladesh; protection of planted mangroves and re-vegetated sand dunes in coastal flood-prone zones; and restoration of freshwater swamp forests, tree planting on embankments and contour planting for protection of inland flooding and erosion (Smith, 2021).

Coastal zone management is sorely needed to help reduce the impacts of development and natural hazard related disasters on coastal ecosystems and communities.

In the Maldives, the need to develop human resource capacity is strongly recognised, as is the need for a framework to assess infrastructure-based coastal protection measures (Poti et al., 2022). Similarly, enhancing the resilience of ecosystems – particularly of marine coastal areas including vegetated beach systems, mangroves, seagrass beds and coral reefs – were reported as important action areas for climate change resilience in the Maldives (Magnan & Duvat, 2020).

Better tools are needed to make NbS effective, including better monitoring and evaluation of impacts and reporting of net benefits for people and nature.

Pollution and waste management

Land and water pollution and management of solid waste are significant and escalating environmental issues in many South Asian countries due in part to rapid population growth and urbanisation. These issues impact all kinds of terrestrial, riverine, coastal and marine ecosystems. Solid waste management is a particular challenge in South Asia; many cities lack proper waste collection systems or the infrastructure and financial resources needed to manage solid waste and water pollution effectively. Of major concern are industrial effluents, untreated sewage and agricultural run-off, which lead to water and river pollution. Microplastic pollution is also frequently mentioned as significant environmental degradation concern. River water and urban lake pollution is a major issue in Bangladesh. The primary causes of river pollution include silt deposition, reduction in flows, erosion, improper disposal of industrial waste and the excessive use of chemical fertilisers on agricultural land (Uddin & Jeong, 2021). Heavy metals such as zinc (Zn), copper (Cu), iron (Fe) and lead (Pb) are the main contaminants in major river systems in the country (Uddin & Jeong, 2021), while tube wells, ponds and lakes have also been found to have high levels of microbial contamination (Hasan et al., 2019), posing serious risks to ecological and human health. This is of particular concern for freshwater ecosystems such as wetlands, rivers and lakes (Wetlands International, 2018) as well as the coastal areas of South Asian countries (Kaur et al., 2019).

Researchers have suggested a range of small- and large-scale solutions, including effluent treatment plants for industrial wastes, replacement of traditional sewage systems with advanced systems, and capacity building of farmers towards integrated pest management for biological pest control (Heeb, Jenner & Cock, 2019). Constructed wetlands have also proven to help reduce groundwater pollution from heavy metals and can be a viable NbS for treatment of groundwater pollution (Smith et al., 2021). The serious gap lies in regulation and enforcement, which leads to illegal dumping and pollution. There is also limited awareness among local stakeholders of the environmental law enforcement and impact assessment systems.

Traditional and climate-resilient agriculture

Research indicates that climate-smart agriculture can help to increase crop yields, reduce greenhouse gas emissions and improve the resilience of agricultural systems to the impacts of climate change. Several crops associated with traditional agricultural practices – such as nutritious and underutilised crops (NUCs) and future-smart crops (FSCs) – are effective measure to enhance farmland biodiversity as well as to improve food security (Adhikari et al., 2019). However, Indigenous crop species associated with traditional agriculture that are nutritionally dense, energy-efficient and climate resistant are increasingly being replaced by monoculture plantations (Joshi et al., 2020). Many of the traditional agroecosystem has been transformed by the dominant rice-wheat cropping system or cash crop cultivation to either increase productivity or make viable income. But in north-east India and Chittagong Hill Tract in Bangladesh, traditional institution- and practice-led multifunctional agroecosystems still prevail and are now being promoted as regenerative and energy efficient production systems. Although considered primitive and low in economic potential, they are thought to be sustainable, biodiversity rich and efficient in supporting local food and nutrition security. However, these traditional and diverse systems are gradually eroding due to a lack of positive policy and programmatic attention to community efforts in maintaining them. Younger generations in particular are least motivated to take forward these inclusive and nature-positive traditional practices. In the context of climate change, there is a need to strengthen production systems that are environmentally diverse and sustainable in South Asia.

Other area-based conservation measures

South Asia is a rich repository of biodiversity, and protected areas are a major tool for conservation of biodiversity at ecosystem, specie and genetic levels. However, there is limited understanding of the effectiveness of protected areas in the region (Chowdhury et al., 2022; Chaudhary et al., 2022). In Bhutan, 51% of land protected area status, yet information exists on the efficacy, efficiency and potential of biological corridors as a tool for biodiversity conservation remains limited (ICIMOD, 2020). Importantly, the countries of South Asia – all of whom are parties to the Convention on Biological Diversity – have committed to contribute to the '30x30' target of the Kunming-Montreal Global Biodiversity Framework. This target aims to ensure that, by 2030, at least 30% of Earth's surface – especially areas of particular importance for biodiversity and ecosystem services – are effectively conserved and managed through protected areas and other effective area-based conservation measure (OECM). OECM is a geographically defined areas other than a protected area, which is governed and managed in ways that achieve positive and sustained long-term outcomes for in-situ conservation of biodiversity, with associated ecosystem functions and services and where applicable, cultural, spiritual, socio-economic and other locally relevant values (CBD Decision 14/8, 2018). OECMs complement protected areas and can be governed by diverse authorities and arrangements including national and subnational governments, private sector, IPLCs, women's groups or through shared governance. Such areas include sacred sites, village common lands, community forests and agroforestry landscapes. Considering the diverse areas under different management regimes, South

Asia holds huge potential for OECMs. However, there is limited data on potential OECMs at country and regional scales (ICIMOD, 2020). Importantly, guidelines for OECMs in the region are also lacking.

For example, in the Western Ghats, there has been some success in restoring sacred groves through coordinated efforts between the government, grassroots and community-based organisations and schools to build awareness of cultural sites. Initiatives aimed to revitalise sacred groves should be continued and, if possible, scaled up (Ranganathan et al., 2022). Another example is from the Wayanad plateau in the district of Kerala in India, where extensive deforestation, fragmentation of habitats and degradation of wetlands and agricultural landscapes have been reported in the last century (Anoop & Ganesh, 2020). The Wayanad plateau requires a detailed eco-restoration strategy that includes a management plan to mitigate human–elephant conflict and is integrated with restoration plans for surrounding swamps and guidelines for the sustainable extraction of non-timber forest products and livestock grazing so that livelihoods are protected (Anoop, 2020), which can all fit within the OECM framework.

Invasive species management

The pervasive threats of invasive alien species (IAS) to environmental sustainability are well-acknowledged. It is estimated that over the past 400 years, a large proportion of Sri Lanka's tropical forests have become extinct because of IAS (Marambe et al., 2011). They pose serious environmental problems and are considered as one of the major drivers to affecting ecosystem health. The impacts of IAS include the displacement of native vegetation, modification and degradation of ecosystems, and economic loss. Education and awareness raising on invasive species have been a key strategy; however, their management – for example, clearing them from wetlands – is costly. On the other hand, the cost of eradicating IAS may be offset by acquiring benefits from bioenergy (Stafford et al., 2017) and finding other uses for the biomass, such as biochar or resource substitution.

Governance

Strengthening capability of traditional institutions

Traditional institutions are established practices of society (Giddens, 1984), and have continually adapted and evolved with the local specificities over many centuries (Farooquee et al., 2004). These institutions are based on cultural practices and beliefs, and tend to be deeply rooted in history and tradition (Acharya et al., 2016; Farooquee et al., 2004). Examples include *Mukhiya* in Nepal, a high-functioning information organisation that manages the social, economic and judicial affairs of the local community (MoSTE, 2015) and *Bulyan* in India, a traditional council for protecting sacred groves. Traditional and local institutions have limited capacity to lobby their needs, rights and requirements for resource governance. There often is mismatch between the state policy, state-run conservation and environmental restoration programmes and investment, and how traditional institutions govern their land and natural resources governance. Such mismatch can lead to ineffective policies and restoration efforts. For example, in north-east India, the implementation of traditional and ecological practices has been replaced with generalised scientific tools, leading not only to failures in restoration

but also to the gradual loss of traditional knowledge (Das et al., 2021). Meanwhile, locally led restoration efforts can have sustainable outcomes. For example, in Niitii – a village in India's Arunachal Pradesh State – the Apatani tribe have been protecting a sacred grove, known locally as *lyago,* according to the traditional governance system, which is headed by a traditional council (*Bulyan*). The Bulyan has been protecting the site for centuries, resulting in ecological and cultural benefits (ICIMOD & UNDP, 2021).

Research suggests that there is limited coordination and cooperation between the state and traditional institutions. For restoration governance to be inclusive, it is important to understand the institutional arrangements and complex social dynamics at play(Poti et al., 2022). Strengthening capabilities of traditional institutions needs urgent consideration.

Multi-stakeholder engagement

The governance structures in South Asia are complex, with multiple levels of government and different levels of authority and stakeholders. Lack of coordination between different levels of government across scales is a major barrier to effective conservation and restoration efforts – particularly as less attention is paid to enhancing stakeholder participation and engagement (Reed et al., 2019). This calls for the creation of multi-stakeholder partnerships. It also highlights the critical issue of equity in access to information and technology, especially the elite capture of community-based approaches (Chaudhary et al., 2018). Collaboration and partnerships between government agencies, academia, NGOs, the private sector, and local communities are crucial for leveraging resources and expertise, and ensuring long-term sustainability of environmental restoration efforts. This challenge was noted around the lack of coordination between state agencies and local stakeholders for REDD+ governance in the Chittagong Hill Tracts (Smith et al., 2021).

Land-use policies in Nepal are also still focused on technical aspects without the integration of knowledge, experiences, roles, and adaptive capacity of land users. This therefore requires the integration of various actors, and their knowledge for equitable benefit sharing of ecosystem services, as well as for a truly adaptable and sustainable land use planning (Aryal et al., 2021b). Similarly, climate change response governance in the Maldives has been criticised as being ad hoc, reactive, favouring short-term goals, and lacking coordination between stakeholders (Poti et al., 2022). Another example of poor governance is related to Small Tank Cascade Systems (STCS) in Sri Lanka (Kekulandala et al., 2021) – a connected series of tanks that store, convey and utilise water from an ephemeral rivulet (Madduma, 1985) and act as water harvesters for storage of water during dry seasons. Sri Lanka's North Central Dry Zones are dominated by these systems. However, changes in governance and the transfer of responsibility for STCS to the government have reportedly hindered their multifunctionality, which is resulting in negative consequences for local communities. Here too, researchers have recommended adaptive co-management for the revitalisation of STCS. Instead of focusing solely on engineering and irrigation efficiency, STCS management should consider its multifunctionality and cultural value (Kekulandala et al., 2021). A co-management approach is also recommended for the protection of the Myristica freshwater swamps and other less well-represented

ecosystems in the Western Ghats, where communities, local stakeholders and the government work together to improve the protection of forested and natural landscapes (Ranganathan et al., 2022). Along similar lines, a co-management approach is also recommended for the protection of intellectual property rights of farmers and collectors, and for the equitable sharing of benefits from medicinal plants in Bhutan (Wangchuk & Tobgay, 2015). Gender concerns also remain a major challenge in South Asia, which is likely to worsen in the future given the impacts of climate change (Bhattarai et al., 2015). Past efforts have also shown that excluding women and limiting the recognition of their rights may undermine the success of restoration efforts (Maraseni et al., 2019).

Priority research-to-action themes for REDAA

Building on the challenges and good practices outlined in the previous section and using the criteria set out in Table 5 (see Methodology), stakeholder consultation and literature review helped identified six RTA priorities for REDAA

Evidence

Literature review and stakeholder consultations pointed to opportunities to fill two important evidence gaps in South Asia:

RTA 1: Cultural values evidence

> *Integrating local perception and traditional knowledge on the diverse and multiple values of ecosystem services into cost benefits assessment of environmental degradation*

Assessments and valuation of environmental functions and services are essential to trigger appropriate development and economic decisions, which too often treat nature and services from nature as free and infinite, resulting in misuse and degradation (TEEB, 2010). Defining diverse and multiple values of critical landscape assets, unique cultural heritage areas and their ecosystem services is urgent and is a high priority for all sites identified in this scoping study. The process of valuation of diverse values and its meaningful integration in policies and plans serves as an important tool for policy makers to take a long-term action against environmental degradation (Bherwani et al., 2020).

Major efforts in South Asia include studies by The Economics of Ecosystems and Biodiversity (TEEB) in Bhutan and India, and by the Biodiversity Finance Initiative (BIOFIN) in Nepal, India and Bhutan. TEEB and BIOFIN have certainly increased the awareness of the values of and the need for financing mechanisms to biodiversity. However, the values of biodiversity and ecosystem services are largely ignored in decision making, policy and planning (Sukhdev et al., 2014).

Local communities are extremely dependent on the services provided by ecosystems in the region (Xu et al., 2019). Proper understanding of the range of ecosystem services, and their monetary and non-monetary value, could aid in the prioritisation and management of conservation and restoration interventions, as well as defining incentive measures for communities who serve as local stewards. There is also limited evidence on assessment of socio-cultural values of ecosystems at local scale and limited recognition of such values in policymaking and implementation, often leading to local disenchantment with conservation efforts (Chaudhary et al., 2018). The loss of traditional knowledge and lack of local engagement can lead to the failure of restoration efforts. Preservation of these historical practices and knowledge related to natural resources needs urgent consideration.

REDAA can help to fill this evidence gap by supporting the participatory mapping of the diverse values of critical ecosystems, capturing in particular the value perceptions of Indigenous people and local

communities. This mapping would include gathering IPLC's insights into what the meaningful integration of values into policy would bring in terms of tangible livelihood benefits and motivation for both communities and the state to better manage ecosystems. Assessing the cost of damage and degradation of the ecosystems and benefit assessment of ecosystem services will allow governments to set the right priorities for incentives or regulatory mechanisms to benefit local communities. This intervention will also allow opportunities to co-develop knowledge with both societal and disciplinary experts (Wangchuk & Tobgay, 2015).

RTA 2: Climate impacts evidence

> *Multidisciplinary action research on climate-induced extremes on ecosystems and its cascading impacts on various sections of society, integrating local perceptions and lessons from maladaptation practices*

South Asia is one of the regions that is most vulnerable to the effects of climate change, but it is also still severely data deficient (Wester et al., 2019; Sharma, 2012). There is limited understanding about the impacts of climate change on biodiversity, agriculture water and other sectors, and the cascading impacts on society. Most climate change studies relating to environmental degradation have focused solely on either ecology – e.g. species distribution and habitat loss and shifts (Deka et al.,2022; Kumar et al., 2022) – or water, with an emphasis on disasters, loss and damage; impacts on multiple sectors are missing.

There are also gaps in our understanding of community-based perceptions of change, adaptation action (Rahman, 2019), ecosystem perspective and maladaptation (Magnan et al., 2016). Several studies indicate that climate change research has relied primarily on climate models and variables, ignoring people's and ecosystem-based understandings and climate action at local scale, as well as maladaptation practices (Rahman, 2019). Given that climate change is one of the major drivers of environmental degradation, multidisciplinary knowledge for informed policies and locally led management actions are urgent as they trigger climate mitigation, adaptation and maladaptation practices (Rahman et al., 2019). It is important to view impacts from the local perspective and make adaptation actions more inclusive, fair and equitable, given that climate impacts are disproportionately experienced, and the concern is that the perspectives of marginalised communities are not incorporated into the design and action of nation-level climate programmes (Rahman et al., 2018).

There is a need to develop an integrated knowledge base on impacts and adaptation options across scales from local to regional and vice versa. To do so, a multidisciplinary approach is required for a deeper, more holistic understanding of the complex dimensions of climate change impacts and response options (Fares et al., 2021). This would ensure understanding and integration of fairness and equity in decisions related to climate change adaptation (Rahman & Hickey, 2019).

REDAA can support multidisciplinary and multiscale action research by capturing the multidimensional aspects of climate change – looking at cascading consequences on nature, economy and people. This action research needs to consider the complex interactions between climate change, ecosystems and society, and analyse the locally driven adaptation and mitigation measures, as well as maladaptation practices. REDAA can also support to improve understanding on adaptation practices in diverse localities involving local stakeholders.

Tools

On uptake and improving the tools, there is a need to support tools that have had demonstrable positive effects towards more effective natural resources and landscape management. There are two priority areas where tools can be improved and scaled up to facilitate more inclusive participation and enable positive effects for those who are most dependent on these ecosystems.

RTA 3: Tools for implementing nature-based solutions

> *Supporting the design and implementation of integrated and inclusive nature-based solutions specially to adapt to climate change and support IPLCs led actions*

Nature-based solutions (NbS) are actions to protect, sustainably manage, or restore natural ecosystems that address societal challenges, while simultaneously providing human wellbeing and biodiversity benefits (IUCN, 2020). Just as climate change is driving environmental degradation, ecosystem degradation contributes to climate change and makes people more vulnerable to its impacts. NbS provides a useful conceptual framework that emphasise the importance to tackle the interlinked societal challenges of climate change, environmental degradation, and inequality together. The challenge remains on how to design and implement truly integrated and inclusive NbS in practice.

Building on existing research, lessons learnt and good practices in South Asia, practical tools can be developed to address the challenge and make NbS truly work for nature, climate and people – particularly women and marginalised groups. Those tools can highlight common success factors and enabling conditions to deliver effective NbS and scale up good practices. For example, in the Maldives, developing implementation capacity of local stakeholders and developing a framework to assess environmental and social impacts of infrastructure-based coastal protection measures were highlighted as key enabling conditions (Poti et al., 2022). Experiences from Indigenous tribes in north-east India, who have been working for millennia to adapt to climate change while ensuring food and water security, highlight the importance of learning from local and traditional knowledge when designing and implement NbS (Tynsong et al., 2020). Revitalisation of traditional agroecosystems including agroforestry practices, culturally safeguarded sites, the use of neglected underutilised (NUS) crops and preservation of traditional Indigenous crops can all contribute to food security in a changing climate (Joshi et al., 2020; Tsuchid & Takeda, 2021; Smith et al., 2021; Aryal et al., 2023).

REDAA can support the design and implementation of integrated and inclusive nature-based solutions to address disaster risks and enhance socio-ecological resilience. Drawing on existing lessons learnt and good practices in the region, REDAA work towards a more holistic, integrated and inclusive approach rather than focusing only on relief-based measures. The inclusive approach in NbS can focus on meaningful participation, equal distribution of and access to benefits, equitable stake and representation of women, youth, IPLCs and marginalised groups. Local ownership can be built by incorporating their knowledge – including local and traditional ecological knowledge of Indigenous people and communities who are vulnerable to and/or directly affected by disasters. This would also help the state authority to embed incentive mechanisms for communities to support the adoption of NbS. NbS can be applied across sectors including agriculture where multi-functional agroforestry practices, and management of traditional food resources and underutilised agrobiodiversity could be promoted to inform national food security and land policies Borelli et al., 2020.

RTA 4: Local conservation guidance

> *Co-developing guidelines for implementing Indigenous people and local community-led other area-based effective conservation measures (OECMs) to formalise the efforts of local landscape stewards and their traditional landscape management practices.*

REDAA can address the need to complement the conservation objective of protected areas with extension of functional areas such as ecological corridors and other area-based effective conservation measures (Ormsby & Bhagwat, 2010). This is also an opportunity to identify, recognise and advocate for the rights of IPLCs to manage their areas – and toprovide global recognition for their efforts. Guidelines at the regional, national or site level will guide the assessment of potential OECMs, as well as in the process of recognising and advocating areas for inclusion as OECM at the national and global scale. This would encourage a rights-based approach to conservation and ensure equitable and inclusive governance of areas contributing to conservation and development outcomes (Jonas et al., 2021).

South Asia countries have committed to contributing to the '30x30' target of the Kunming-Montreal Global Biodiversity Framework, which aims to protect and manage at least 30% of Earth's surface by 2030, through protected areas and OECMs. The region holds huge potential to contribute to this target as it is home to areas such as sacred groves or patches of forest and other land use protected and used by local people for cultural and religious purposes. Such areas have high environmental value and can complement formal conservation efforts (Rath & Ormsby, 2020). However, guidance for and data on potential OECMs in the region are lacking. Clear g – that is, on what land use qualifies for OECMs, how they complement the effort of local communities and their traditional land use practices, how the local stewards benefit from this area-based management tool and how OECM can be used as a restoration tool – require further proof-of-concept.

Governance

One of the key challenges across all countries was the lack of participatory natural resources governance. Many studies have recommended a shift to co-management, which includes sharing of power, knowledge and responsibility between stakeholders (Poti et al., 2022). There are plenty of examples of where participatory natural resource governance works well in the region. For example, adaptive co-management of Myristica freshwater swamps enabled communities, local stakeholders, and the government to work together in the Western Ghats to improve the protection of forested and natural landscapes (Ranganathan et al., 2022). To scale up good co-management practices, two priority areas have been identified.

RTA 5: IPLC rights and resource management

> *Drawing on good practices to strengthen capability of traditional institutions to advocate for their rights and implement effective and equitable resource management*

According to the World Bank (2005), between 120 million and 150 million people are forest dwellers in South Asia – and an additional 350 million–400 million are directly dependent on forests (Chao, 2012; Poffenberger, 1999). A large proportion of these people are Indigenous and local communities. Cultural and spiritual values of Indigenous and local communities in the South Asia are closely associated with different ecosystems (Chaudhary et al., 2019). Traditionally, Indigenous and local communities had managed forests and grasslands through traditional institutions, such as the Kipat and Shingo Nua systems in Nepal, and *Soksing* in Bhutan (Ramakrishnan et al., 2012).

Evidence shows that traditional institutions like Mukhiya, Balyan, and community conserved areas (CCA) councils have effective strategies to manage natural resources well and adapt to crises such as climate change and biodiversity loss. For example, local communities' traditional approaches to coping with climate change in north-eastern floodplains in Bangladesh are valuable in informing national adaptation policies to avoid maladaptation and enhance climate change resilience (Rahman, 2019). Mining activities in homeland areas of IPLCs have exposed them to trace element contamination through air, water and food consumption (Blanco et al., 2023). But those traditional institutions often lack organisational capacity to raise their issues, advocate for their own rights, engage with technical experts and negotiate with governments for their stake in decision making and implementation of restoration initiatives and management of natural resource management.

There is also a need to strengthen the capacity of traditional institutions to incorporate gender equality and social inclusion (GESI) in planning, implementation and management of natural resources. This entails supporting traditional institutions, such as CCA councils in Nagaland and Indigenous communities in Bangladesh's Chittagong Hill Tracts, to design implementation plans for traditional and culturally safeguarded land resources. This is fundamental, especially to enable equitable access and benefit-sharing processes and mechanisms.

REDAA can support research to capture best practices of effective and equitable resource management under traditional institutions, co-develop research with those traditional institutions and identify capacity needs. Based on those needs, REDAA can support capacity-building activities for traditional institutions and strengthen their ability to share their knowledge with researchers and draw support from the government. This will involve enhancing their knowledge and capacity to understand wider political settings and develop their own strategy to engage with often more powerful stakeholders like governments and businesses. In turn, this will help the state to acknowledge the role and leadership of traditional institutions in effective and equitable resource governance.

RTA 6: Inclusive restoration

> *Supporting synthesis and exchange of good practices to enhance representation and meaningful participation, decision making and leadership of women, youth and Indigenous people and local communities in restoration of traditional land resources and ecosystems*

In South Asia, it is evident that men, the local rich and powerful, and those belonging to higher castes have been able to control and benefit from limited available natural resources, while excluding women, Indigenous and marginalised communities (Ojha et al., 2019; Resurreccion et al., 2019; Chaudhary et al., 2018), which further marginalises women, particularly those belonging to Indigenous and marginalised groups. The promotion of participatory resource governance that integrates the knowledge of various actors and promotes equitable benefit sharing is therefore crucially important in the region. In Bhutan, for example, although biological corridors have been officially recognised for protection since 1999, they still lack effective land-use regulations (Brodie et al., 2016).

There is still significant gap in inclusive decision making concerning land and resources tenure, especially for women and marginalised groups. There are also significant opportunities for policy harmonisation and sharing of best practices across South Asia countries in restoration. For example, community-based government programmes that have engaged local communities in the region have played an important role in nature conservation (Tauli-Corpuz et al., 2020). In Bhutan, under country's Community Forestry programme, 76,360 hectares (ha) of forest is managed by 28,654 households (Parker et al., 2017). In Nepal, 2.2 million ha of forest is managed by 2.9 million households (Ghimire & Lamichhane, 2020) and in India, more than 22 million ha of forests are jointly managed by local communities and the Forest Department under the Joint Forest Management (JFM) system (Patra, 2015).

Indigenous and local communities are the first observers of environmental degradation, mainly due to their proximity to and high dependence on natural resources (Yadav & Lal, 2018). Adoption of stringent conservation measures, including eviction of Indigenous and local people, following a top-down approach, has had serious consequences on livelihoods of Indigenous people (Shyamsundar & Ghate, 2014; Chaudhary et al., 2018). Conservation measures without providing alternatives lead to

resource scarcity, which has caused conflicts among local actors as well as with the governmental agencies (ILO, 2017).

Efforts through REDAA can help strengthen multi-level governance with strong institutional set up for and meaningful engagement of women, youth and marginalised communities. Examples of best practice in social forestry from countries such as Nepal, Bangladesh and India can shed light on co-management (Manzoor et al., 2013; Anup et al., 2018). Nepal's participatory approach to natural resource governance has been hailed as a success worldwide, and national alliances such as the Federation of Community Forestry Users Nepal and the Nepal Federation of Indigenous Nationalities have been critical in bringing local communities into the conservation (Aryal et al., 2021a). Nepal's gradual shift from site-based species-specific conservation to landscape conservation that incorporates developmental needs of local communities (Sayer et al., 2017) could be replicated in other regions of South Asia to effectively reverse environmental degradation. This would enhance equitable representation by building the capacities of vulnerable groups to meaningfully engage.

Assessing the effectiveness of 6 RTAs

Table 8: Qualitative narrative assessment of RTA themes against criteria

CRITERIA	EVIDENCE		TOOLS		GOVERNANCE	
	1: Cultural values evidence	2: Climate impacts evidence	3: NbS implementation tools	4: Local conservation guidance	5: IPLC rights and resource mgmt	6: Inclusive restoration
Scale appropriateness	Of high relevance and can be addressed over 4 years with a grant of US$200,000–US$1M. Action research can be completed within 6 months to 2 years; and integration into local policies and plan will take up to 4 years	Requires a deeper understanding of the complex interactions (changes and impacts) and society; and solutions to address the issue will take up to 4 years and grant of US$500,000–US$1M	Requires up to 4 years and resource of US$500,000–US$1M to generate shared understanding and proof-of-concept	Up to 4 years and high-end resource support to bring together wider stakeholders to dialogue, discuss, pilot and develop guidelines for uptake	Requires focused and continual attention for up to 4 years with investment US$500,000– US$1M in learning-by-doing interventions. Also provides seed money for innovations	Requires longer term support for up to 4 years with investment US$500,000– US$1M, mainly for supporting innovation and strengthening leadership through exposure and collaborative interventions
Site-specific impact	If the diverse values are integrated and evidence-based actions are implemented, the evidence can bring multiple benefits to local biodiversity and local people	The evidence will trigger site-specific adaptation and mitigation interventions	Directly affects local environment and most vulnerable and marginalised communities who feel the most impact, but also benefits will be more direct to them	Relates to area-based interventions in a particular site; high site-specific relevance	Traditional institutions have important decision-making roles, so their capacities are directly relevant to reinforcing site-specific impact	Addresses issues specific to local people at and around the site

CRITERIA	EVIDENCE		TOOLS		GOVERNANCE	
	1: Cultural values evidence	2: Climate impacts evidence	3: NbS implementation tools	4: Local conservation guidance	5: IPLC rights and resource mgmt	6: Inclusive restoration
Cross-cutting impact	Allows integration of socio-cultural, ecological, and economic value perception hence understanding of interdisciplinary interventions. Touches upon wider knowledge of IPLCs, women and other marginalised communities	Cuts across biophysical, ecological, climatic, economic, and socio-cultural interrelationships especially touches on knowledge of IPLCs, women and other marginalised communities and policies and plans at the regional and national scales with similar context	Nature-based solutions have the potential to deliver climate, biodiversity livelihoods, and climate co-benefits	While OECMs complement conservation objectives, the tool effectively addresses socio-economic concerns of IPLCs	Widens societal learning and awareness to implement diversified interventions around environment, livelihoods, climate. Enables local institutions to see and connect to larger picture of resource governance	Provides opportunities for leadership and address multiple societal issues relating to resource access, benefit sharing, economy and livelihoods and green business development
Locally led processes and actions	Participatory approaches and inclusion of people's perceptions allows the process of evidence generation to be inclusive and locally led	Knowledge co-production is key here where social learning builds on empirical knowledge of communities, especially IPLCs, women and other marginalised communities, and local authorities across different sectors of the site.	Engages communities into planning of locally acceptable interventions that addresses the local societal challenge	Engages communities and concerned local institutions to design plan and implement OECM optimising benefits for both people and nature	This priority focuses on local formal and informal institutions to address wide range of subjects relating to restoration, conservation, and livelihood development.	Allows opportunity to highlight local innovation or value add them through widening technical knowledge base ad capabilities to lead or voice opinions

CRITERIA	EVIDENCE		TOOLS		GOVERNANCE	
	1: Cultural values evidence	2: Climate impacts evidence	3: NbS implementation tools	4: Local conservation guidance	5: IPLC rights and resource mgmt	6: Inclusive restoration
Intersectional processes and understanding	Provides opportunities to co-develop knowledge with the local people and local communities, women, and other marginalised communities The priority is particularly focused on IPLCs, women, youth, and other marginalised and vulnerable communities who are highly dependent on ecosystem services of the wetland complexes	Embeds understanding of cascading impacts of climate change-build understanding between climate, water, environment, biodiversity, land, agriculture, energy	NbS is an integrated long-term approach where while implementing solutions to mitigate disaster, interventions to support biodiversity and livelihoods must be incorporated, and wider services of ecosystems are sustained	Allows holistic land and natural resources management perspective and integration of both biodiversity conservation and development interventions	Capabilities need to be built in a way local institutions understand national and global policy mechanisms and prepare their future road map innovatively integrating and balancing intersectoral agenda and objectives	Environment governance and associated local knowledge are well transferred to generation next, who add academic and technological innovations and take on sustainable pathway for development and effectively contribute to addressing environmental degradation

CRITERIA	EVIDENCE		TOOLS		GOVERNANCE	
	1: Cultural values evidence	2: Climate impacts evidence	3: NbS implementation tools	4: Local conservation guidance	5: IPLC rights and resource mgmt	6: Inclusive restoration
Foster cross sectoral collaborations	Allows multidisciplinary and multi-stakeholder engagement to understand wider range of value perception- both at local and state levels	Allows multidisciplinary and multi-stakeholder engagement to understand wider range of value perception- both at local and state levels	Triggers engagement of both state and non-state actors, corporate and academia; guidelines provide enablers and barriers to science-practice and policy collaborations	Triggers engagement of different state department and ministries as to support and complement OECM management by IPLCs institutions	Local institutions can negotiate for stronger and meaningful partnership with state and other development partners -reinforcing the local best practices and innovating some	Enable marginalised and deprived sector of society, women, youth and IPLCs to discuss, dialogue and engage with stakeholders with different skills and strengths and interest and strengthen social learning
Value for money	Allows understanding of diverse values and gradual integration into policies/plans and especially design of solutions that brings incentives to local communities, allowing other investors to participate, and leveraging additional resources to support local stewardship	Co-benefits around biodiversity, livelihoods, and disaster risk mitigation and wellbeing of IPLCs, and public awareness adds to the cost-effectiveness	NbS are being promoted globally and countries have different understanding of this idea. This intervention would help clarify the purpose, objective, and effectiveness of nature-based solutions, especially to sustain longer term services from wetlands and make communities integral part of sustaining the services	Co-benefits of conservation and livelihoods; promotion of local heritage and culture. Local capacities for management built minimising conflict over resources and access; supports global cause of enhancing areas under biodiversity conservation	Strong institutions are foundation of equitable resource governance. Traditional institutions are very strong in promoting equitable access and benefits therefore able to judiciously use resources and mitigate conflicts and meaningfully garner support from state and others	This is about investing in youth and women and building their capacity to thoroughly understand the issue environmental degradation through building both empirical and technical knowledge

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Annex I: Long list of 40 identified priority sites

#	Country	Ecosystem	Site	Major issue (s)
1.	Bangladesh	Forest	Cox's Bazar Teknaf Peninsula	Deforestation, land cover change
2.	Bangladesh	Island	St Martins islands	Solid waste pollution, overextraction, unregulated tourism
3.	Bangladesh	Forest	Chittagong Hill Tracts	Unregulated tourism, extraction of resources, unplanned urbanisation, shifting cultivation, deforestation, landcover change
4.	Bangladesh	Mangrove	Sundarbans mangroves	Over-extraction of mangrove forests, sea-level rise, climate-induced disasters, and changes in forests, rangeland, peatlands
5.	Bangladesh	Marsh wetlands	Gulshan-Baridhara Lake	Over-extraction, biodiversity loss
6.	Bangladesh	Marsh wetlands	Hakaluki Haor, Tanguar Haor and Marjat Baor	Over-extraction, biodiversity loss
7.	Bhutan	Forests, grassland	Bumdelling Wildlife Sanctuary and Sakteng Wildlife Sanctuary	Over-extraction, unplanned infrastructure, solid waste
8.	Bhutan	Forests, grassland	Proposed corridor (PWS-JKSNR)	Forests degradation and fragmentation
9.	India	Lateritic plateau (rocks, plateau, peatlands, wetlands, bushes)	Lateritic plateaus of the mid-elevation areas in Southern Maharashtra	Over grazing, and invasion by Prosopis, Lantana, Opuntia species

#	Country	Ecosystem	Site	Major issue (s)
10.	India	Forests, grassland, and wetlands	Community Conservation Areas in Nagaland	Habitat fragmentation, overextraction, land cover changes
11.	India	Agriculture, rainforest	Paddy field complexes managed by communities and villages in Western Ghats	Degradation of rainforests, biodiversity loss
12.	India	Forests, grassland	Forests and savannas of the village commons – Eastern slopes of the Western Ghats	Over-extraction, low-water level, land use change
13.	India	Wetlands, marshes	Loktak lake, Manipur	Over-extraction, land cover change, biodiversity loss
14.	India	Wetlands, marshes	Wetland Complexes of Assam	Over-extraction, solid waste, sedimentation, overextraction, degradation
15.	India	Forests, rivers	Jaintia Hills mining areas, Meghalaya	Massive mining of coal, limestone and setting up of cement factories. Rivers are being poisoned with limestone residue thereby making the PH level too high for any aquatic life to survive.
16.	India	Forests	Tillari–Dodamarg area in the Western Ghats	Land parcels transformed from forest to large-scale plantations of rubber and pineapple
17.	India	Forests, wetlands, grassland	Community Conserved Area complex in Nagaland	Land cover change, deforestation

#	Country	Ecosystem	Site	Major issue (s)
18.	India	Forests, wetlands, grassland	Singalila–Barsey–Chewa Bhanjyang landscape	Climatic hazards, faulty agricultural practices, human wildlife conflict, unregulated tourism, unplanned urbanization.
19.	India	Rivers, riverine forests	Teesta Rangit river basin	High resource extraction from rivers-sand mining quarrying; pollution
20.	India	Forest, grassland	Sohra-Mawphlang Corridor, north-east India	Massive deforestation leading to the slow extermination of highly endangered species such as the clouded leopard.
21.	Nepal	Rangeland, forests, cryosphere, wetlands, peatlands	Langtang valley	Climate-induced disasters, and changes in forests, rangeland, peatlands
22.	Nepal	Forests, grassland, wetlands	Panchthar-Ilam-Taplejung (PIT) corridor	Encroachment, forests degradation, urbanisation, warming
23.	Nepal	Rangeland, peatlands	Limi Valley	Degradation, overextraction
24.	Nepal	Wetland, forest, grassland	Mai Pokhari Ramsar Site	Loss of traditional culture and practices, unsustainable harvesting of resources, limited recognition of IPLCs
25.	Sri Lanka	Freshwater, riverine	Kelani River Basin	Sedimentation, overextraction, biodiversity loss
26.	Sri Lanka	Rivers, riverine forests	Southwestern Sri Lanka rivers and streams	Land cover change, overextraction

#	Country	Ecosystem	Site	Major issue (s)
27.	Sri Lanka	Forests, grassland, wetlands	Udawalawe National Park	Overextraction, land cover change, biodiversity loss, agriculture lands, urbanisation
28.	Maldives	Coral reef	Atolls of the Maldives Ridge	Coral degradation, overextraction, unsustainable coastal development
29.	Maldives	Coral reef	Atolls of the Maldives Ridge	Coral degradation, overextraction, unsustainable coastal development
30.	Pakistan	Coastal wetlands	Indus delta and coastal wetlands	Sedimentation from upstream, waste, seawater intrusion, erosion, excessive fishing and bycatch
31.	Pakistan	Juniper forests	Juniper forest of Balochistan	Largest juniper forest in the world: Illicit cutting of junipers for fuelwood, overgrazing & trampling, encroachment, and habitat fragmentation.
32.	Pakistan	Plateaus, peatlands	Trans-Himalayan alps and plateaus	Fuelwood cutting, overgrazing, illegal hunting, unregulated tourism, and habitat fragmentation
33.	Pakistan	Temperate deciduous forests	Himalayan foothills	Deforestation for firewood and timber, *Taxus willichiana* (Himalayan yew) cutting for graveyards, and overgrazing
34.	Pakistan	Desert	Chagai desert	Mining, oil and gas exploration, illegal hunting, and shooting

#	Country	Ecosystem	Site	Major issue (s)
35.	Pakistan	River and wetland	Indus river system and wetlands	Water diversion and drainage, agricultural intensification, toxic wastes, and pollutants
36.	Pakistan	Forests	Moist and dry temperate Himalayan forests	A global hotspot for avian diversity: commercial logging, fuelwood cutting and overgrazing, bird shooting for feathers
37.	Pakistan	Forests	Balochistan subtropical forests	Heavy collection of fuelwood cutting and overgrazing
38.	Pakistan	River	Balochistan river	Water diversion, solid waste, and excessive fishing
39.	Pakistan	River and wetlands	Indus river system and wetlands	Water diversion and drainage, agricultural intensification, toxic wastes, and pollutants
40.	Pakistan	Chilgoza forest	Chilgoza forest (Suleiman Range)	Chilgoza cutting for fuelwood, drought, wildfires, overgrazing and illegal hunting

Annex II: Long list of 25 RTA themes

These include list of RTAs prioritised by experts during the regional consultation. Longer list of RTAs identified during the two cluster consultations and literature review were narrowed down based on scale appropriateness criteria, considering the impact time frame and resources required for intervention:

1. Climate change, cascading impacts
2. Invasive species assessments
3. Forest cover dynamics – deforestation rates
4. Ecosystem services values assessment for incentives to custodians
5. Understanding of governance enablers and barriers
6. Land use and land cover change – habitat loss and fragmentation
7. Supply chain of major species traded – the cause of deforestation.
8. Impact of urbanisation
9. Pollution and ecological risk
10. Special coastal area management
11. Other effective area-based conservation measures
12. Urban green space management
13. Biomass energy production – invasive species management
14. Phyto-remediation
15. Traditional food systems
16. Promotion of nature-based solutions – incentive mechanisms (e.g., human–wildlife conflict compensation)
17. Protected areas and corridors
18. Waste and pollution management
19. Building participatory and inclusive processes of decision making

20. Engagement of IPLCs and marginalised communities and youths
21. Unfair and inequitable distribution of resources and access and benefit sharing (ABS)
22. Lack of cross-scale and cross-level interactions (i.e., coordination, collaboration) among stakeholders
23. Weak institutional (i.e., formal, or informal) capacities
24. Lack of legal frameworks
25. Mismatch between the scale of the environmental problem and the level of the policy interventions

Annex III: List of 12 RTAs after initial screening

RTA 1: Participatory mapping of diverse and multiple values of ecosystem services from critical wetlands and flood plains.

RTA 2: Review to understand ambiguities and overlaps among conservation and resource management regulations, policies, and laws.

RTA 3: Multidisciplinary action research on reviewing maladaptation practices and cascading impacts on critical ecosystems.

RTA 4: Generating evidence on the impact of LULCC and fragmentation on biodiversity, and their consequent impacts on ecosystem services.

RTA 5: Supporting the design and implementation of nature-based solutions specially to mitigate disasters risk building ownership of IPLCs.

RTA 6: Revisiting guidelines and procedures for Environmental Impact Assessment to incorporate concerns of IPLCs on pollution/waste mitigation.

RTA 7: Building critical mass of stakeholders practicing regenerative agriculture to influence policies.

RTA 8: Co-developing guidelines for implementing Indigenous people and local community led OECMs.

RTA 9: Supporting technology development for bioenergy and biochar production from Invasive Alien Species (IAS) as raw material.

RTA 10: Strengthening capability of traditional institutions to strengthen their arguments and roadmap to effective resource management.

RTA 11: Strengthening or creating a multi-stakeholder platform to develop harmonised plan of action for restoration and natural resources management.

RTA 12: Enhancing representation and meaningful participation, decision making and leadership of women, youth and Indigenous people and local communities.