

UN Biodiversity Lab
(UNBL) Global Biodiversity
Framework (GBF)
Mapping Project

TECHNICAL REPORT

Enabling Implementation of
NBSAP and KMGBF Targets
in Malawi



Photo credit: Randall Brummett, 2002



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Policy Note for Decision Makers

<https://unbiodiversitylab.org/policy-note-malawi/>



1. Introduction

Malawi's biodiversity, highlighted by its freshwater and terrestrial ecosystems, is the foundation of the national economy and social well-being, directly supporting food security, hydroelectric power, and livelihoods (C. Sayer et al., 2019)¹. Its unique biodiversity assets include the endemic Chambo fish (*Oreochromis karongae*) and hundreds of other endemic cichlids in Lake Malawi, African elephant, wild dog, and black rhinoceros in its protected areas. However, these vital resources are under severe and increasing threats from habitat loss, land degradation, and the impacts of climate change (Daniel Kpienbaareh et al., 2022)².

Given these increasing pressures and the critical national reliance on natural resources, the Kunming-Montreal Global Biodiversity Framework (KMGBF) of the Convention on Biological Diversity (CBD), which aims to achieve a world living in harmony with nature, is critical for Malawi, especially Target 1 on biodiversity-inclusive spatial planning. There is an opportunity for Malawi, as a CBD Party, to use the framework to safeguard biodiversity, strengthen resilience to climate change, and protect the natural assets that support long-term national growth. The UN Biodiversity Lab (UNBL)-GBF Mapping Project was thus launched to provide the essential spatial data and technical capacity to realize this ambition.

Spatial data is essential for the implementation of the KMGBF targets; they will also be essential for monitoring and reporting on progress to achieve these targets: [41% of the headline indicators and 36% of the component indicators have methodology encouraging the use of spatial data](#). In particular, KMGBF Targets 1, 2, and 3 – which aim to spatially plan and manage all areas to reduce biodiversity loss; restore 30% of all degraded ecosystems; and conserve 30% of land, waters and seas – depend on the use of geospatial data for identifying areas for sustainable management, restoration and protection. Implementation of KMGBF Targets 4-12 and 14 can also be bolstered by spatial planning, according to a [report released by the International Union for the Conservation of Nature \(IUCN\)](#) in October 2024.

Malawi is implementing the KMGBF targets through the revision and finalization of the Third National Biodiversity Strategy and Action Plan (NBSAP III), led by the Environmental Affairs Department (EAD) within the Ministry of Natural Resources and Climate Change (MNRCC). While the previous NBSAP II concluded in 2025, the EAD is actively developing NBSAP III to translate the global KMGBF goals, such as Target 1, 2, and 3 into specific, actionable national targets. This process ensures that key conservation priorities, including securing Lake Malawi's endemic species, restoring vital water catchment areas, and integrating biodiversity into the National Land Use Planning Framework, are formally adopted and financed for implementation by 2030.

In this context, the EAD implemented the UNBL-GBF Mapping Project from Q2 2024 to Q4 2025 in partnership with key national stakeholders to support national use of spatial data to achieve KMGBF Targets 1, 2, 3 and provide powerful co-benefits for Targets 4, 8, 10, 11, and 12, as well as equivalent targets at the national level. This work was undertaken with the support of the South African National Biodiversity Institute (SANBI) Technical Support Centre, the United Nations Development Programme (UNDP) and the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC), as well as the broader [UN Biodiversity Lab \(UNBL\)](#) partnership. The project used the UNBL spatial data platform and its [Essential Life Support Area \(ELSA\)](#) methodology, which identifies areas where actions to protect, manage, and restore nature can best contribute to the achievement of national priority policy targets on biodiversity, climate, and sustainable development.

1 Sayer, C., Palmer-Newton, A.F., and Darwall, W.R.T. (eds.) (2019). Conservation priorities for freshwater biodiversity in the Lake Malawi/Nyasa/Niassa catchment. Gland, Switzerland: IUCN. <https://doi.org/10.2305/IUCN.CH.2019.RA.1.en>

2 Kpienbaareh, D., Batung, E.S., and Luginaah, I. (2022). Spatial and temporal change of land cover in protected areas in Malawi: Implications for conservation management. *Geographies* 2, 68–86. <https://doi.org/10.3390/geographies2010006>

The UNBL-GBF Mapping Project, funded by the Gordon and Betty Moore Foundation, mobilized key national stakeholders and experts to undertake a series of activities to develop an ELSA priority action map to support NBSAP and KMGBF targets, to use UNBL to bolster Malawi's efforts around using geospatial data to monitor and report on the indicators of the KMGBF monitoring framework, and to co-develop UNBL to further increase its value to support Malawi in their commitments to the KMGBF.

In Malawi, under the leadership of EAD, which serves as the government's CBD Focal Point, the work was undertaken collaboratively with key national stakeholders. These included the Malawi University of Science and Technology (MUST) which serves as the designated Country Implementing Agency; various government departments, including: the Department of Fisheries, the Department of National Parks and Wildlife (DNPW), the Department of Land Resources Conservation, Forestry Research Institute of Malawi (FRIM), under the Department of Forestry; the National Herbarium and Botanical Gardens of Malawi (NHBG), the Wildlife and Environmental Society of Malawi (WESM); and experts from academic institutions, including: Lilongwe University of Agriculture and Natural Resources (LUANAR), Malawi University of Business and Applied Sciences (MUBAS), Mzuzu University (MZUNI), and the University of Malawi (UNIMA). These partners helped to select and design project activities in two ways: (1) guiding development of a spatial prioritization analysis to support NBSAP implementation and contributions to achieve the KMGBF; and (2) selecting activities most helpful to support the development of a national monitoring system and production of the Seventh National Report (7NR) to the CBD.

For the first workstream, national stakeholders provided critical input to an **integrated spatial planning process** designed to support the country to identify and evaluate potential nature-based action areas that would support the achievement of national environmental, climate, and socio-economic priorities, as defined by NBSAP Targets 1, 2, 3, 5, 9, 12, 13 and KMGBF Targets 1-4, 8, and 10-12. This supported the government to leverage existing global and national datasets and world class spatial prioritization approaches to create and validate an ELSA priority action map identifying where protection/conservation measures could contribute to the delivery of NBSAP target 3 and KMGBF Target 3; sustainable management measures could contribute to the delivery of NBSAP Target 11 and KMGBF Target 10; restoration efforts could contribute to the delivery of NBSAP Target 2 and KMGBF Target 2; and enhancing green spaces and urban planning could contribute to the delivery of NBSAP Target 12 and KMGBF Target 12. The spatial prioritization identified locations for these nature-based actions that also maximized co-benefits for achieving NBSAP Targets 5, 9, 11, 12 and KMGBF Targets 4, 8, 10, and 11. The resulting ELSA priority action map can also support the implementation of the Land Degradation Neutrality (LDN) response hierarchy under the UN Convention to Combat Desertification (UNCCD). The LDN response hierarchy is a structured approach to achieve neutrality by prioritizing prevention, minimizing ongoing degradation, and restoring degraded land.

For the second workstream, national stakeholders took part in various ad hoc monitoring activities designed to enhance the use of the UNBL platform for monitoring and reporting on NBSAP and KMGBF Targets in their country. These activities included: (1) **creating a central repository for national data in Malawi's UNBL workspace**; (2) executing **capacity building and training on UNBL** to enable national stakeholders to utilize features most relevant to action around the KMGBF; and (3) as well as the **update of a national indicator on ecosystem protection level**.

This work led to recommendations to achieve NBSAP Targets 1, 2, 3, 5, 9, 12, 13 and KMGBF Targets 1-4, 8, and 10-12, and to support relevant policy development, implementation, monitoring, and reporting, with a specific focus on Malawi's NBSAP update and implementation. The capacity building offerings developed in partnership with EAD and provided to technical experts were designed to support handover of the Malawi workspace on UNBL and the ELSA spatial prioritization data, tool, and outputs to facilitate ownership and use throughout the implementation period of the NBSAP and the KMGBF.

In this technical report, we describe in detail the methodological steps and results for the spatial analysis products and tools created to support the objectives of the UNBL-GBF Mapping Project. The final list of outputs generated in partnership with national stakeholders through the project include:

1. **ELSA priority action map** that identifies where protection, restoration, sustainable management and urban greening efforts should be focused to lead to the best national outcomes for related targets of Malawi's NBSAP, as well as Targets 1-4, 8, and 10-12 of the KMGBF (summarized in section 2 of this report).
2. **Policy note** to support national use and uptake of UNBL and the ELSA priority action map in the context of NBSAP and KMGBF implementation (summarized in the [policy brief](#)).
3. **National secure UNBL workspace** for Malawi (summarized in section 3 of this report).
4. **ELSA Integrated Spatial Planning Tool** configuration available through the national workspace for Malawi on UNBL to support updates and iteration of the spatial prioritization analysis (described in the [ELSA Integrated Spatial Planning Tool User Guide](#)).
5. **Capacity development and training materials on UN Biodiversity Lab** to support national efforts around NBSAP implementation and 7NR development (summarized in section 3 of this report).
6. **Update of the national indicator on ecosystem protection level** (summarized in section 3 of this report).

Please see Annex 2 for a full list of project documents and reports related to these products, and Annex 3 for all relevant user guides, including guidance on accessing Malawi's UNBL workspace and using Malawi's ELSA Integrated Spatial Planning Tool configuration on UNBL.



Photo credit: Godfrey Phiri, 2013

2. ELSA priority action map to support NBSAP and KMGBF targets

The ELSA priority action map to support actions to achieve the spatial NBSAP and KMGBF targets was developed through five distinct project steps (Figure 1). The steps are designed around a holistic, community-centered, context-specific, and adaptive approach to integrated spatial planning.



Figure 1. Five steps for creating an ELSA priority action map to support action towards NBSAP and KMGBF targets (Images adapted from Rice et al.³)

³ Rice, W.S., Sowman, M.R., and Bavinck, M. (2020). Using Theory of Change to improve post-2020 conservation: A proposed framework and recommendations for use. *Conserv Sci Pract* 2, e301. <https://doi.org/10.1111/csp2.301>.

Step 1

Convene national leadership team

The first step of the integrated spatial planning process involves engaging experts with relevant knowledge and stakeholders with vested interest or influence in the outcome. Engaging these groups to become leaders in the co-design and application of the spatial planning process is essential, because it ensures that the resulting spatial plan is credible, trusted, and applicable in policy making. The engagement of stakeholders was done through a core stakeholder working group, in charge of advancing specific questions in a timely manner, and a broader involvement of stakeholders to disseminate the results and ensure the process is understood and used, moving forward. Broad participation also helps develop a community of practice around the common objective of data-driven environmental decision-making while nurturing champions to help integrate the outputs of this spatial planning process into national and subnational policy and action.

In Malawi, EAD acted as the convening partner to identify members of the core working group undertaking the spatial prioritization mapping exercise, in close coordination with the UNDP Country Office. Together with the UNBL team, the core working group met regularly to ensure the project's implementation.

To successfully implement the spatial planning component of the project, a series of workshops and working groups were organized. After an inception workshop on 3 July 2025 that co-defined project objectives and established two working groups to carry forward the spatial planning (Working Group 1) and monitoring and reporting (Working Group 2), the spatial planning workstream was executed through a series of meetings of Working Group 1. These included: (1) a first meeting to introduce the methodology on 4 September 2025, (2) two sessions to co-create the spatial prioritization map on 25 November and 2 December 2025, and (3) a results sharing session organized on 23 January 2026.

The first meeting of Working Group 1 discussed objectives for the integrated spatial planning process, national priorities to achieve the spatial NBSAP and KMGBF targets, and national data important for inclusion in the spatial prioritization analysis. In the second co-creation session, participants and experts had the opportunity to co-create the spatial prioritization analysis used to develop the ELSA priority action map by reviewing and weighting the data layers used for developing the ELSA priority action map, assessing tradeoffs, and collectively agreeing on a map showing where nature-based actions could best achieve NBSAP Targets 1, 2, 3, 5, 9, 12, 13 as well as KMGBF Targets 1-4, 8, and 10-12.

Working Group 1 brought together a subset of important stakeholders for the integrated spatial planning process, led by EAD. Coordination with EAD, alongside MUST, was strategically managed to ensure the integration of diverse sector approaches and direct alignment with the ongoing NBSAP revision process. The key departments that actively participated in the working group were the Department of Fisheries, the Department of National Parks and Wildlife, FRIM, and the Department of Land Resources Conservation. The group also drew on specialized expertise from NHBG, WESM; and experts from academic institutions, including: LUANAR, MUBAS, MZUNI, and UNIMA.

Step 2

Develop a national vision

The central goal of the UNBL-GBF Mapping Project was to provide the spatial evidence required to implement Malawi's NBSAP III. The national vision focuses on specific priorities identified by Malawi's stakeholders to ensure that global goals are translated into national results.

NBSAP Target 1 serves as the primary driver for this project, aiming to ensure that all of Malawi's terrestrial and freshwater ecosystems are under integrated, biodiversity-inclusive spatial planning. This national target specifically seeks to bring the loss of areas of high biodiversity importance, such as the Shire River Basin and Lake Malawi catchments, close to zero by 2030. The achievement of this spatial planning goal is inseparably linked to NBSAP Target 2 (Restoration) and NBSAP Target 3 (Protection). These parallel national targets require high-quality spatial data to identify which degraded landscapes must be restored to maintain water security and which high-integrity ecosystems require formal protection to safeguard Malawi's unique endemic species.

The national vision for the UNBL-GBF Mapping Project in Malawi was developed through stakeholder engagement sessions focusing specifically on national policy commitments aligned with the NBSAP and KMGBF. These sessions emphasized how nature-based actions could best contribute to achieving not only NBSAP Targets 1-3, 11 and 13 and KMGBF Targets 1-3, 10, and 12, but also contribute to the achievement of NBSAP Targets 5, 9, and 12 and KMGBF Targets 4, 8, and 11. To guide the spatial prioritization process, specific area-based constraints (also called 'area-based targets') were identified for the proportion of Malawi's land area within the priority area map that should be identified for 1) protection, 2) restoration, 3) management, and 4) urban greening. Following consultations, the default area-based constraints were set as follows:

- **Protection:** 30% based on NBSAP Target 3 and KMGBF Target 3;
- **Restoration:** 30% of degraded areas in Malawi (2.5% of land area) based on NBSAP Target 2 and KMGBF Target 2;
- **Sustainable Management:** 5% based on expert opinion from the core project team and review by Working Group 1;
- **Urban Greening:** 30% of urban extent in Malawi (0.1% of land area) based on expert opinion from the core project team and alignment with GBF Targets 2 and 3, as well as final review by Working Group 1

Note: The actions referenced here are the functional equivalent of actions of the LDN response hierarchy supported under UNCCD. 'Protect' is the equivalent of 'avoid' land degradation, 'manage' is the equivalent of 'reduce' land degradation, and 'restore' is the equivalent of 'reverse' land degradation. In summary, this equates 'Protect–Manage–Restore' with 'Avoid–Reduce–Reverse', ensuring alignment across global biodiversity frameworks. For more information on each KMGBF Target, please see the [CBD website](#). For more information on the LDN response hierarchy, see the [UNCCD website](#).

While the prioritization analysis was explicitly designed to address the targets of the NBSAP, the resulting spatial outputs provide a strategic foundation for the implementation of other key national frameworks. By taking action on the biodiversity priorities identified, Malawi simultaneously advances the goals of the [Malawi 2063 \(MW2063\)](#) vision, specifically Enabler 7 (Environmental Sustainability), by protecting the natural capital essential for agricultural productivity. Furthermore, these results provide spatial evidence for the [National Forest Landscape Restoration Strategy \(2017\)](#), supporting Malawi's AFR100 commitment, and the [National Charcoal Strategy \(2017-2027\)](#), by identifying sustainable management zones that reduce pressure on protected forest reserves.

Step 3

Gather spatial data

Datasets were identified to support the qualitative elements of NBSAP Targets 1, 2, 3, 5, 9, 12, and 13 as well as KMGBF Targets 1, 2, 3, 4, 8, 10, 11, and 12 which were the targets that could be spatially mapped with available national and global data. When identifying datasets, national data took precedence over global data as they tend to better reflect national conditions, be viewed as more accurate by national users, and are more likely to be formally recognized for official use by governments.

Spatial data was compiled to meet two basic needs: 1) delineation of where nature-based actions – termed ‘zones’ – for protection, restoration, sustainable management and urban greening can occur, and 2) spatial proxies for NBSAP and KMGBF targets, termed ‘planning features’. This process was aided by a foundational global data stack available through the ELSA Integrated Spatial Planning Tool on UNBL, which includes a default set of planning features based on global data. These initial planning features were selected either because they were directly referenced in the metadata of the KMGBF monitoring framework for the target, or because they were identified as an important layer to support spatial planning for the target by an independent UNBL Expert Advisory Committee. Working from these foundational global datasets significantly reduces the time needed in the data collection phase of the integrated spatial planning process by providing an initial set of data that can be screened for relevancy at the national level and used as a guide to identify national datasets for inclusion.

The identification of relevant national data was undertaken through a data hackathon where national stakeholders and data experts identified existing national datasets related to each of the NBSAP and KMGBF targets (Meeting 2 of Working Group 1). Once the national datasets were identified, the core team engaged national data owners and relevant national institutions to secure permission to use these data.

All national datasets were screened by the core team to ensure they were spatially explicit with area-based information, contained sufficient metadata, and were consistently mapped at the national level. Datasets were then further filtered to retain only datasets that could serve at least one of the two data needs, which were either: a) mapping possible locations for zones, or b) serving as planning features. National data used for planning features replaced global data from the foundational data stack where it better mapped NBSAP and KMGBF targets at the national level.

A total of 21 national datasets were identified to support the qualitative elements of NBSAP Targets 1, 2, 3, 5, 9, 12, 13 and KMGBF Targets 1, 2, 3, 4, 8, 10, 11, 12 in Malawi (Figure 2). No global datasets were used. The primary dataset used to restrict the potential location of each nature-based action zone was Malawi Ecological Condition layer from the [Regional Project ‘Southern Africa: Spatial Biodiversity Assessment, Prioritisation and Planning \(SBAPP\) in South Africa, Namibia, Mozambique and Malawi’](#). Datasets to map planning features spanned coarse filter proxies for biodiversity, such as nationally identified important ecosystems (e.g., intact ecosystems, ecological condition and threatened ecosystems for protection limited to natural and degraded areas, and fine filter maps (e.g., key biodiversity areas and fish diversity) important to map NBSAP Targets 3 and 5 and KMGBF Targets 1, 3, and 4. Other datasets represented important spatial proxies for opportunities to either mitigate or adapt to climate change (e.g., high carbon stock, flood abatement opportunities, and priority aquatic systems for improved management) important for the achievement of NBSAP Targets 9 and 11 and KMGBF Targets 8 and 10, while others represented ecosystem services important for sustainable development and human well-being (e.g., potential clean water provision and urban greening potential) important for NBSAP Targets 12 and 13 and KMGBF Targets 11 and 12. To evaluate trade-offs among broad conservation goals, each dataset was identified as supporting particular NBSAP and KMGBF targets, as well as one of biodiversity, climate change, or human well-being (Figure 2). A full list of input data used in the spatial prioritization analysis is included in Annex 1.

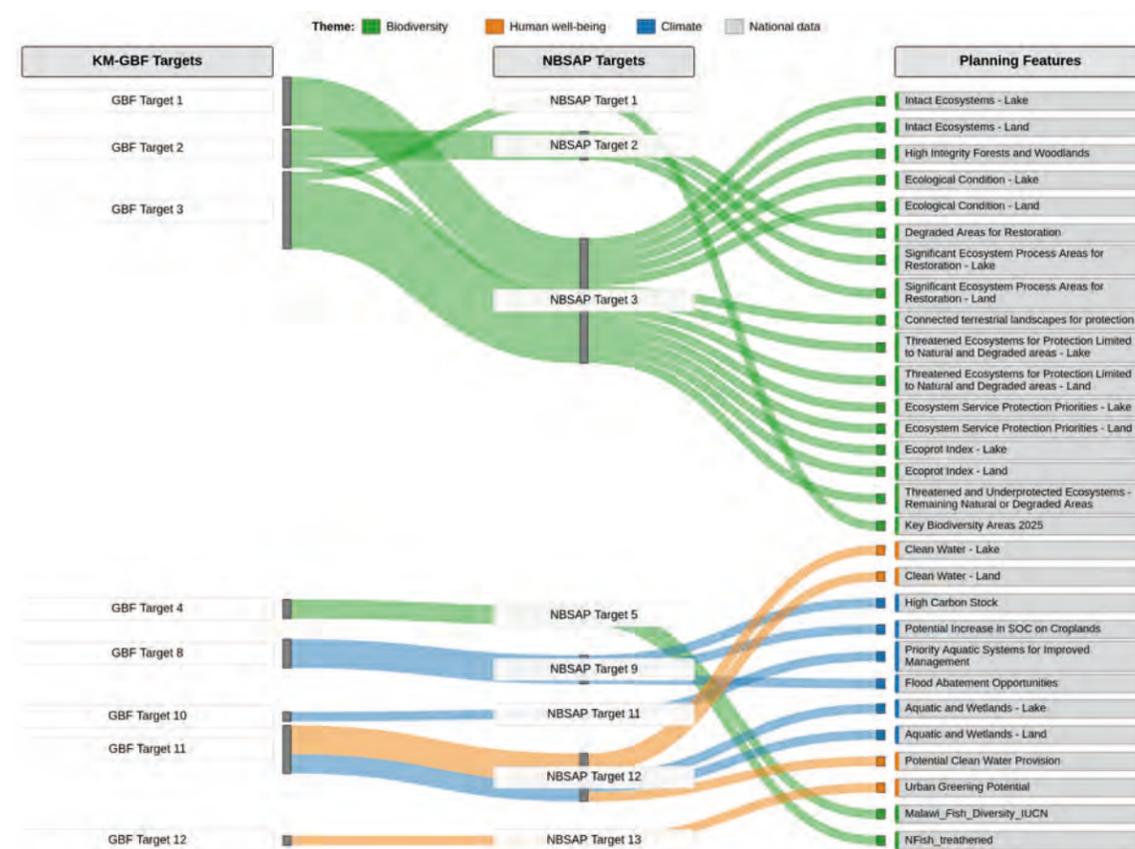


Figure 2. NBSAP and KMGBF targets and planning features selected for inclusion in the analysis to map priority action areas in Malawi

All spatial data was summarized into planning units, which are the individual spatial units that are evaluated for protection, restoration, management or urban greening action within the ELSA priority action map. Planning units are akin to individual pixels in a raster image. For Malawi, the planning unit size was 375m*375m. Therefore, a 375m primary resolution was used as it balances computational time against mapping precision. With this planning unit size, there are 848,968 planning units at the national scale, which is a number that results in the ELSA Integrated Spatial Planning Tool taking roughly 2 minutes to run an optimization to create an ELSA priority action map, which allows for near-real time scenario analyses. 375m*375m is also a likely sufficient resolution for national level planning of protected areas and other land management actions. Moreover, for any input datasets that were received at a higher resolution in the native form, these data are summarized into the planning units at that native resolution. By doing so, this ensures that no finer resolution spatial information is overlooked when downsampling to a 375m resolution. For ad-hoc subnational planning and implementation, it might be necessary to identify a finer planning unit resolution.

Step 4

Analyze multiple actions and outcomes

The fourth step is to use systematic conservation planning (SCP) to analyze spatial priorities for protection, restoration, sustainable management and urban greening, as well as the outcomes of these actions for all planning features. SCP is used to optimize spatially explicit conservation actions to promote the persistence of biodiversity and other natural features in situ. SCP involves a transparent and objective process of setting clear goals and objectives, and subsequent planning for conservation actions that meet them. SCP was originally developed to identify alternative proposed networks of protected areas. More recently it has evolved to consider multiple nature-based actions and objectives beyond biodiversity, making it suited for engaging with the complexity of integrated spatial planning across landscapes and nations. SCP was used to run a spatial prioritization analysis to analyze all nature-based action zones and planning features at once, thus capitalizing on spatial synergies across all NBSAP and KMGBF targets when identifying priority areas for NBSAP and KMGBF implementation. In addition to integrating multiple commitments, SCP enables diverse stakeholder groups to weigh the relative importance of the various planning features, view trade-offs that result from conflicting priorities, and foster dialogue around cross-sectoral collaboration and implementation.

The ELSA Integrated Spatial Planning Tool uses the *prioritizr* software library to run the SCP spatial prioritization analysis. The *prioritizr* package is conceptually similar to the widely used planning software Marxan but differs in its implementation of integer linear programming techniques instead of simulated annealing as the solving algorithm. The linear programming approach can solve large problems (>1 million planning units) faster than other approaches, allowing for real-time analysis with stakeholders. Moreover, it supports a broad range of objectives, constraints, and penalties that can be used to customize conservation planning problems to the specific needs of a conservation planning exercise.

The [maximum utility optimization function](#) within *prioritizr* is used for its ability to find locations for the nature-based actions that maximize the total representation of planning features, accounting for zone contributions, with the relative importance of each planning feature controlled through a weighting parameter. To promote equity in representation across planning features, the core team conducted a pre-calibration process in which a script: 1) weights all planning features equally, evaluating how well each feature is represented in the solution (e.g., its maximum utility); 2) weights each feature as 1 while setting all other features to 0, and again solving the problem to see the impact of that feature's weight on the overall solution (e.g., its maximum representation); and 3) finally, enters a calibration loop where it iteratively adjusts the weights based on the difference between the maximum utility and maximum representation for each feature, aiming to minimize the difference (delta) between these values and leading to a more equitable representation across all features. These pre-calibration weights then serve as our starting weights in the ELSA Integrated Spatial Planning Tool's server backend for the priority area map co-creation sessions (two hybrid sessions organized with Working Group 1).

Step 5

Co-create the ELSA priority action map to support NBSAP and KMGBF targets

The final step is to use the ELSA Integrated Spatial Planning Tool to co-create the ELSA priority action map through real-time iterative scenario analyses with stakeholders. As the spatial prioritization process integrates multiple, often competing, priorities in a given country, leadership from national experts and stakeholders is key for evaluating trade-offs across scenarios and iterating maps to identify a final product that best meets the diverse objectives of the national vision.

To allow full involvement of the core team and broader stakeholder group within the integrated spatial planning process, the ELSA Integrated Spatial Planning Tool configuration for Malawi was preloaded with all relevant spatial data and used to run spatial prioritization analyses during live co-creation sessions with Working Group 1. The tool allows data visualization, setting targets and weights, real-time (~2 minutes) optimization runs, display of the resulting ELSA priority action maps, and tabular analysis of the results. The co-creation of the ELSA priority action map was done using this tool through two sessions of Working Group 1. See Annex 3 for detailed guidance on accessing the tool and creating iterative ELSA priority action maps.

In the first co-creation session, weights for each planning feature were assigned by national experts in Working Group 1. During this weighting session, each planning feature – represented by a spatial dataset – was shown to stakeholders, and its source, characteristics, and meaning were discussed. Stakeholders were then asked to give each dataset two different weights: the first one consisting of a value between 0 and 10, quantifying their perspective of how important the planning feature should be in guiding the identification of priority action areas in the resulting maps and supporting national environmental commitments; the second one consisting of a discrete value of 0, 0.5 or 1, where stakeholders evaluated whether they a) did not trust the reliability of the dataset's source at all, b) were uncertain in its reliability, or c) were confident in the reliability of the dataset's source, respectively. The overall weight for each dataset, per stakeholder, was obtained by multiplying each importance score by each confidence score. These overall weights were then averaged across all stakeholders for each dataset. The final average weights were then configured as default weights for each planning feature in the ELSA Integrated Spatial Planning Tool. The tool, now preloaded with default weights set by stakeholders, was then used to create and iterate the final ELSA priority action map, as well as associated ELSA heatmaps, in the second live co-creation session.

The ELSA priority action map (Figure 3) serves to identify areas for each action (protection, restoration, sustainable management, urban greening) to achieve area-based constraints in a way that maximizes the representation of all planning features, given their weights. To evaluate the trade-offs of integrated spatial planning for this first map, the representation of each planning feature in the initial ELSA priority action map was measured. All planning features with a representation lower than 30% or lower in the final ELSA priority action map were then flagged and this 'trade-off' of integrated planning was discussed as a group. A voting exercise was undertaken to determine if the weights should be further adjusted to increase the representation of each or certain planning features that experienced this drop in representation. The final average weight across all stakeholders following this exercise has been included as the default weight for each planning feature in the ELSA Integrated Spatial Planning Tool configuration.

In Annex 4, we additionally provide the final ELSA priority action map segmented by region. These maps at the regional level identify the extent of current protected areas in each region, but also the extent of priority areas identified for new protection, restoration, sustainable management and urban greening actions. The results reveal that not only are regions different in the extent to which they have already established protected areas, but also the extent to which they are identified as national priorities for further conservation action. These results can be used to support collaboration between national and regional authorities around implementation of the results of the spatial prioritization analysis.

The ELSA priority action map identified through this process reflects the parameters set in the ELSA Integrated Spatial Planning Tool by Working Group 1, as well as the national configuration of the ELSA Tool based on current national targets and current national and global data. The integrated spatial planning process supported through this project is not a ‘one and done’ process, but rather a foundation that should be built upon as new policy commitments emerge and new and improved data are developed. The capacity building conducted through the project enables for continued re-evaluation of ELSAs to ensure their relevance for guiding landscape planning and resource allocation. National stakeholders may wish to use the ELSA Integrated Spatial Planning Tool with stakeholders across sectors, including changing input parameters and creating different scenarios that could be collectively assessed to broaden ownership of the final product.

The UNBL team is available past the close of the project to support limited annual updates to the data included in the ELSA integrated spatial planning tool for Malawi. This includes: (1) updating national data layers used as planning features when a new version is released; (2) adding a new data layer that maps an important biodiversity, climate, or human well-being value for Malawi as a planning feature to the tool. To request an update, please reach out to support@unbiodiversitylab.org.

In addition, the configuration of the ELSA tool could be updated to reflect additional national targets, more extensive new/updated national data, and/or customized to a subnational area in the country. These services are available at cost from the UNBL team following the closing of the project. In addition, the UNBL team can support or lead the production of derivative maps based on the ELSA priority action map that can directly support policy implementation (e.g., efforts to focus on a particular goal like climate adaptation, water security or land degradation neutrality). To explore further, please reach out to support@unbiodiversitylab.org.



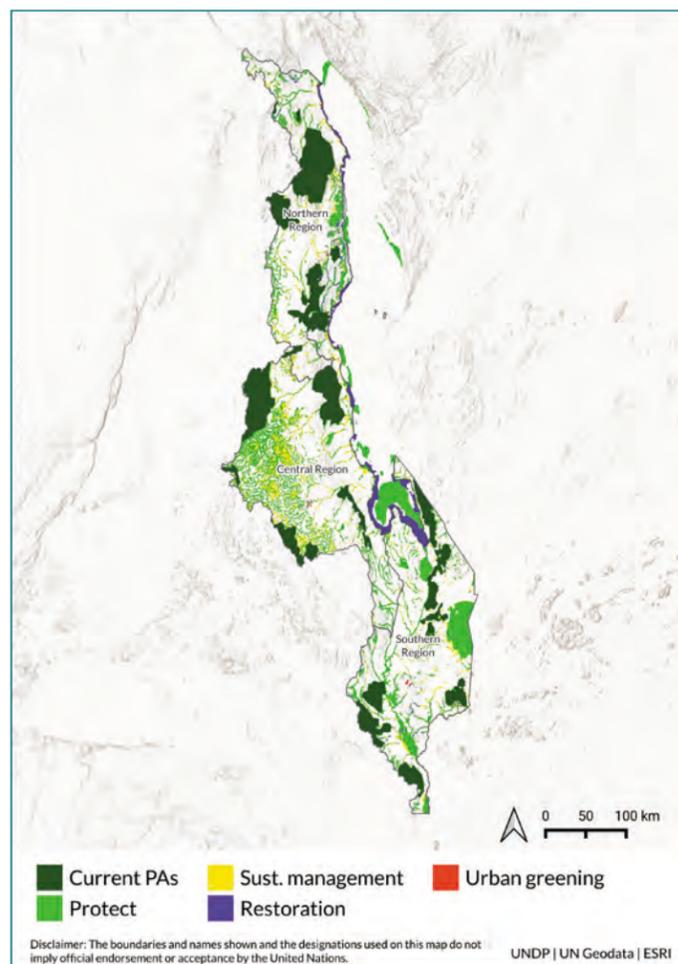


Figure 3. ELSA priority action map identifying where achieving 30% protection, 2.5% restoration (30% of degraded areas), 5% management and 0.1% urban greening (30% of urban extent) in Malawi will maximize the combined representation across all planning features. Planning features are mapped using 21 national spatial datasets for biodiversity, climate change and human well-being, which were selected using guidance from the qualitative elements of the NBSAP and KMGBF. This map has been produced at a 375m resolution.

MAP APPLICATION: This nationally endorsed ELSA priority action map to support NBSAP Targets 1, 2, 3, 5, 9, 12, and 13 as well as KMGBF Targets 1, 2, 3, 4, 8, 10, 11, and 12 shows where actions can most effectively achieve the greatest impact across all planning features while minimizing unacceptable tradeoffs of integrated spatial planning. It can also support the implementation of the Land Degradation Neutrality (LDN) response hierarchy under the UN Convention to Combat Desertification (UNCCD). The LDN response hierarchy is a structured approach to achieve neutrality by prioritizing prevention, minimizing ongoing degradation, and restoring degraded land. This spatial prioritization map outlines an ambitious expansion of protected areas, from 14.47% of the land area covered by existing protected areas, to 30%. This enhancement in protection could come from new protected areas or recognition of other effective area-based conservation measures (OECMs). It also outlines critical areas to pursue sustainable management practices (5% of land area), ecosystem restoration (2.5% of land area), and urban greening (0.1% of land area) to achieve multiple environmental, climate, and sustainable development outcomes. This map shows a strategic, national-level perspective on important places to take action to protect, manage, restore or urban green. Before implementing actions, however, further ground truthing and engagement with local rights holders and relevant stakeholders is needed.

MAP ACCESS: The image files for the heatmaps can be accessed [here](#). The underlying GIS files for all heatmaps created using the ELSA Integrated Spatial Planning Tool can be accessed [here](#). These maps should be cited as:

Environmental Affairs Department & UN Biodiversity Lab, 2025. Technical Report for the UNBL-GBF Mapping Project in Malawi. ELSA priority action map created using spatial data and the UNBL Essential Life Support Area Integrated Spatial Planning Tool on 12 December 2025.

MAP UPDATES: This map can be further updated, and complemented with additional optimization runs for different scenarios, through use of the ELSA Integrated Spatial Planning Tool configuration for Malawi. Please see Annex 3 for detailed guidance on accessing and using the tool.

An important supplementary component of the ELSA priority action map is the contribution across zones to representation of planning features (Figure 4). Some planning features are only represented within a single zone -- for instance, urban greening potential is only represented within the urban greening zone. However, most planning features are represented across all zones, highlighting the importance of considering a range of zones for achieving the diversity of national commitments to the NBSAP and KMGBF targets around biodiversity, climate change, and human well-being. Put simply, often one action — whether protecting, managing, restoring or urban greening nature — can contribute to achieving multiple NBSAP and KMGBF targets. It is also important to note that the new protect, manage, restore, and urban greening zones would lead to a major increase in the representation of all planning features beyond their current representation in existing protected areas.

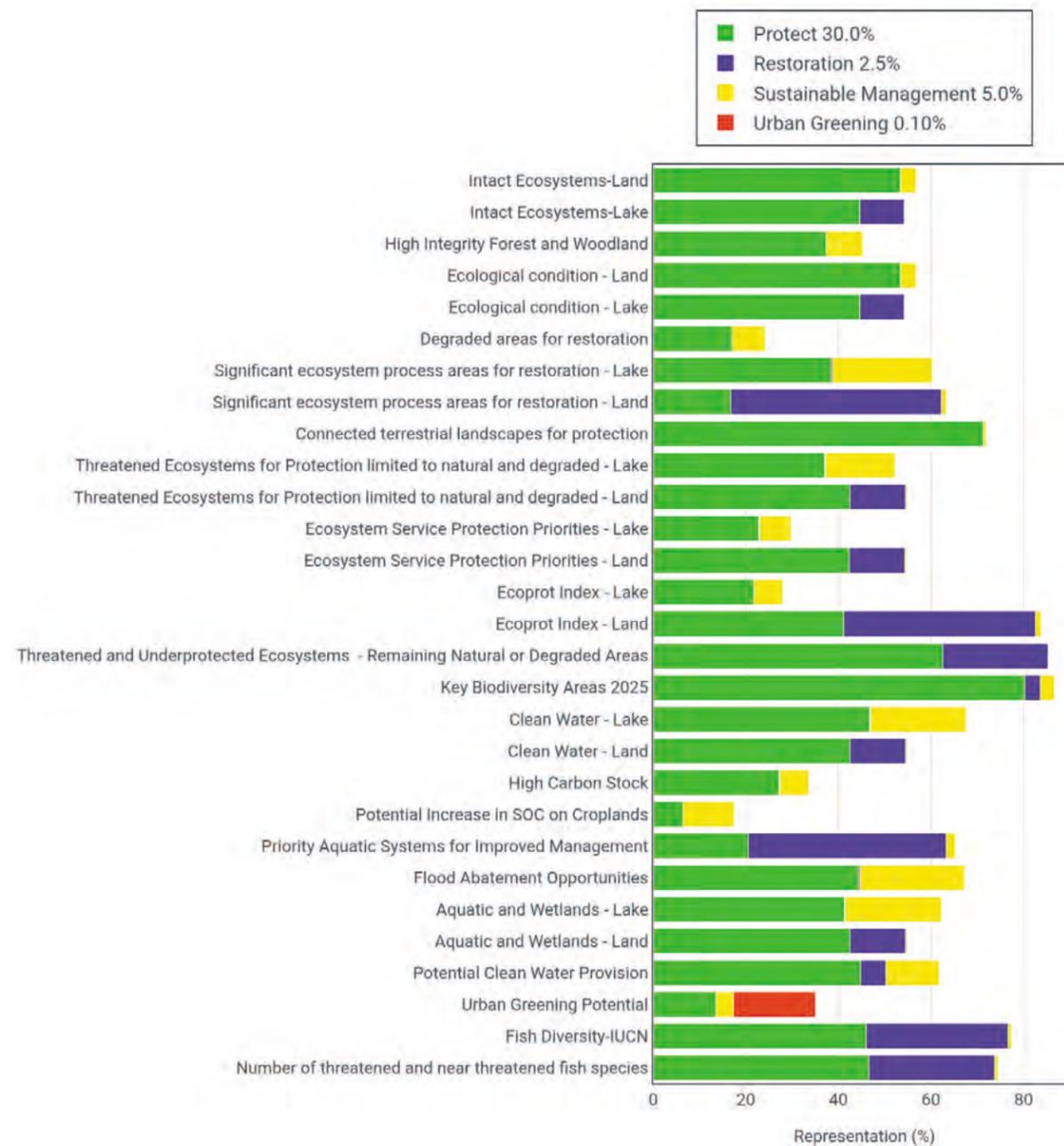


Figure 4. The contribution of existing protected areas, as well as of each priority action zone to the representation of planning features in the ELSA priority action map.

Representation measures how well each planning feature is captured across the priority action zones in an ELSA solution. The representation across zones R_f (%) is calculated as:

$$R_f = \sum_{z=1}^z \left(\frac{\sum_{i=1}^1 x_{i,z} r_{i,f,z} v_{i,f,z}}{T_f} \times 100 \right)$$

where:

$$T_f = \sum_{z=1}^z \sum_{i=1}^1 r_{i,f,z} v_{i,f,z}$$

Here, $x_{i,z}$ is the decision variable (e.g., whether a planning unit i has been included (1) in a specific zone z or not (0)), $r_{i,f,z}$ is the total amount of feature f in planning unit i in zone z , and $v_{i,f,z}$ is the impact value of feature f in planning unit i in zone z .

The zone impact value ($v_{i,f,z}$) specifies how each action (protect, restore, manage, urban greening) impacts each planning feature in that zone. A value of 1.0 indicates a neutral impact, values >1 indicate enhanced impacts, and values <1 indicate reduced impacts relative to simple spatial coverage.

Representation reflects both spatial coverage and action impact - a feature may achieve high representation through either extensive coverage or through placement in zones where actions provide higher impact to that feature.

In addition to the ELSA priority action map, ELSA heatmaps disaggregated by each nature-based action (protect, restore, manage and urban green) were produced. These heatmaps identify important locations for achieving NBSAP Targets 1, 2, 3, 5, 8, 9, 12, and 13, and KMGBF Targets 1, 2, 3, 4, 8, 10, 11, and 12. They are the normalized sum of planning features' values in each planning unit, multiplied by the user weights given to each planning feature. Important areas (where more planning features occur, adjusted for weighting) are shown in a range of colors from green to yellow, with those in bright yellow being the most important. Heatmaps can be used to identify areas where the overall contribution of planning features to NBSAP Targets 1, 2, 3, 5, 8, 9, 12, and 13, and KMGBF Targets 1, 2, 3, 4, 8, 10, 11, and 12 is greatest.

By evaluating heatmaps, national experts can view the aggregated user-weighted planning feature data to determine if the patterns for each nature-based action match their expectations and personal knowledge of the region. If a particular region which national stakeholders believe is particularly important for the implementation of protected areas is showing up as 'cold' within the heatmap relating to the protect action, then stakeholders could utilize the ELSA Integrated Spatial Planning Tool to increase the weight of planning features affected by the protect action that are present in this region to reflect a 'warmer' presence in the heatmap, and therefore increase the likelihood of this region being allocated the 'Protect' action in future spatial prioritization scenarios yielding ELSA priority action map (Figure 3).

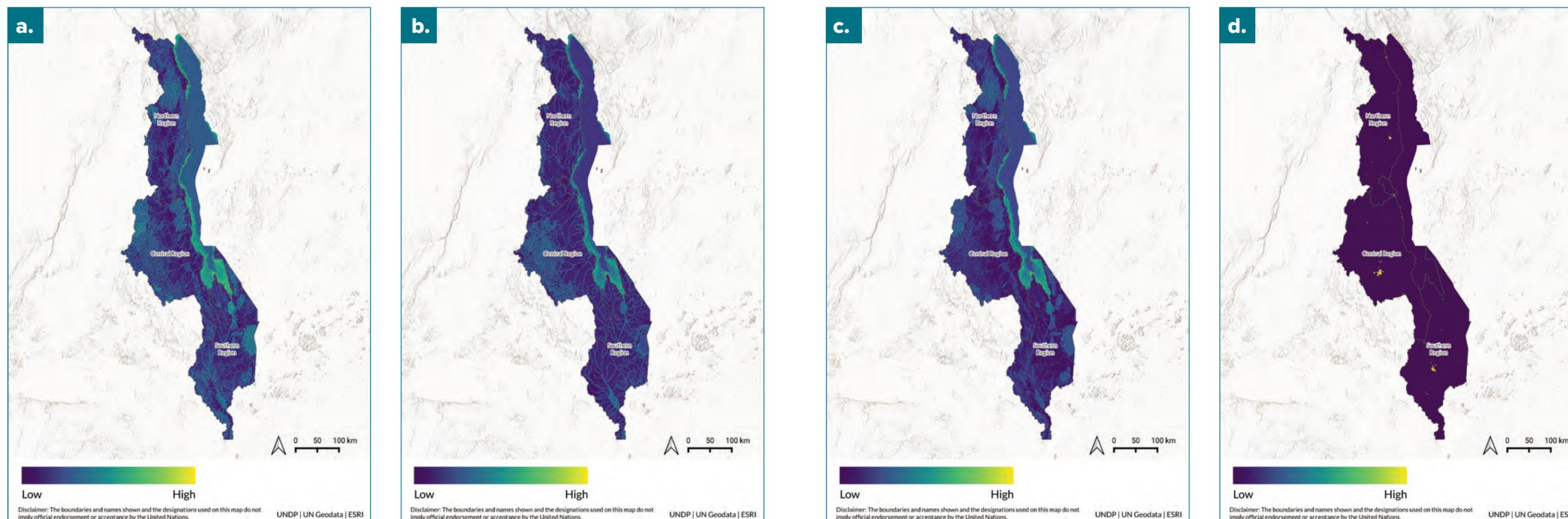


Figure 5. Heatmaps for a) protection, b) restoration, c) sustainable management and d) urban greening, depicting cold areas (dark purple) where the lowest number of planning features affected by the respective action overlap, and hot areas (yellow) where the largest number of planning features affected by the respective action overlap.

MAP APPLICATION: National stakeholders in Malawi could use these heatmaps to compare the extent to which areas identified as important for achieving NBSAP and KMGBF targets related to each nature-based action reflect their understanding of particular regions and therefore use these heatmaps as tools to evaluate the accuracy of the ELSA priority action map (Figure 3) and iterate additional, well-informed spatial prioritization scenarios using the ELSA Integrated Spatial Planning Tool.

MAP ACCESS: The image files for the heatmaps can be accessed [here](#). The underlying GIS file for all heatmaps created using the ELSA Integrated Spatial Planning Tool can be accessed [here](#). These maps should be cited as:

Environmental Affairs Department & UN Biodiversity Lab, 2025. Technical Report for the UNBL-GBF Mapping Project in Malawi. Heat maps created using spatial data and the UNBL Essential Life Support Area Integrated Spatial Planning Tool on 12 December 2025.

MAP UPDATES: These maps can be further updated, and complemented with additional optimization runs for different scenarios, through use of the ELSA Integrated Spatial Planning Tool configuration for Malawi. Please see Annex 3 for detailed guidance on accessing and using the tool.

3. Additional monitoring and reporting support for Malawi on UN Biodiversity Lab

In addition to co-creating the ELSA heat maps and ELSA priority action map, several ad hoc activities were undertaken through workstream 2 to further advance Malawi's monitoring and reporting around NBSAP and KMGBF targets. These activities were implemented with a subset of national stakeholders identified by EAD to contribute to Working Group 2 on monitoring and reporting. These national stakeholders include: Department of Fisheries, Department of Forestry, Department of Land Resources Conservation, Wildlife and Environmental Society of Malawi (WESM), and National Herbarium and Botanical Gardens (NHBG). In addition, MUST participated as a partner in implementation of the project.

The activities selected as most important for national efforts around monitoring and reporting on the NBSAP and KMGBF in Malawi included:

1. **Creating a central repository for national data in Malawi's UNBL workspace:** centralizing key national datasets on biodiversity, climate, and human well-being in Malawi's secure UNBL workspace. This provides a central repository to review national data relevant to NBSAP implementation, filter by KMGBF target and/or national target, and support visualization in tandem with global datasets on the UNBL platform. It also enables different actors to work better together, and synergize their efforts towards conservation and sustainable development.
2. **Executing capacity building and training on UNBL:** inviting decision makers and key stakeholders to take part in a series of lectures and hands-on training sessions around the various functionalities of the UNBL public platform, secure UNBL workspaces, and the ELSA Integrated Spatial Planning Tool, which supplied stakeholders with relevant knowledge and practical experience related to leveraging UNBL for their country's monitoring efforts.
3. **Update of a national indicator on ecosystem protection level:** enabling national experts to evaluate how effectively Malawi's 69 ecosystem types are represented within the country's protected area network, aligned with the KMGBF target of conserving at least 30% of each ecosystem type by 2030. This work provided both an important input into the ELSA integrated spatial planning analysis and can support monitoring and production of the 7NR.

Activity 1

Central repository for national data in Malawi's UNBL workspace

UNBL workspaces provide a secure work area where national or subnational data can be added and shared with a set of specified users. They offer users with any level of GIS expertise the ability to collaborate on important work to use spatial data as part of the development of a national monitoring plan and/or system for the KMGBF. Government policymakers and technical specialists can use a UNBL workspace to:

- Invite a community of users relevant to the development of a national monitoring plan for the KMGBF.
- Connect to existing national spatial data repositories, enabling all relevant data to be consolidated in one location and ensuring automatic updates from the original source.
- Upload national/subnational datasets and areas of interest to UNBL.
- Tag national data to clearly identify the goal, target, and indicator type that it will be used to calculate.
- Visualize national/subnational datasets alongside any of the global data layers available on UNBL.
- Calculate any UNBL metrics using the official national boundary layer or official sub-national boundary layers.

Through the UNBL-GBF Mapping Project, national datasets identified as important for NBSAP and KMGBF implementation were added to Malawi's national workspace on UNBL and made available for external viewing and sharing. The goal was to provide a stable central repository to review national data relevant to NBSAP implementation, increase the visibility of Malawi's national data used around reporting on NBSAP and KMGBF targets, and bolster its effectiveness by allowing it to be viewed in tandem with over 1,000 global-scale data layers on biodiversity, climate change, and human well-being available on UNBL. Each national dataset was tagged using the format 'KMGBF/NBSAP Target X' to allow users and stakeholders to easily filter and view national datasets based on the relevant policy target which they are used as proxies for. In total, 28 national data layers were uploaded to UNBL.

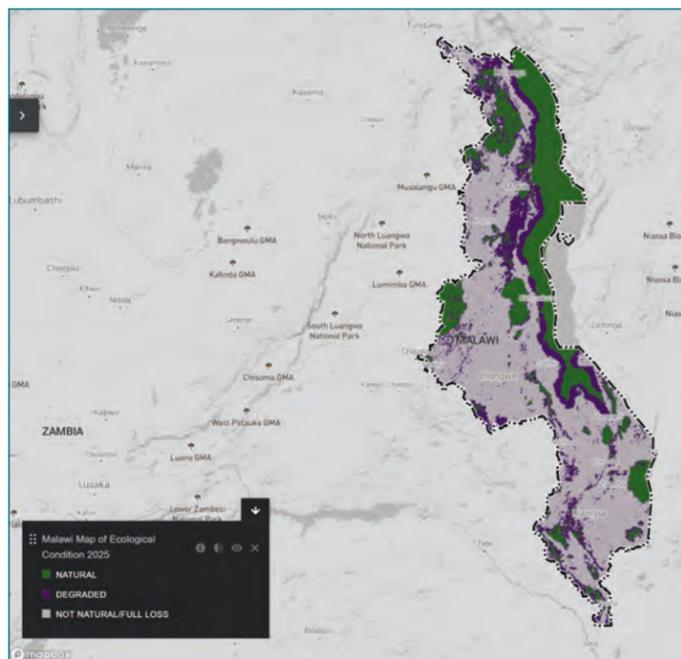


Figure 6. National datasets for Malawi on UNBL. The map shows the national Malawi Map of Ecological Condition 2025, uploaded to Malawi's secure workspace

When setting up the UNBL workspaces, government policymakers and technical specialists can assign roles to individuals or user groups to determine their level of access. These roles include:

- **Owners:** Nominated by the country to take control of the workspace. The owners will be responsible for inviting and granting access to other users, as well as adding other administrators.
- **Admins:** Can add and manage users, assign roles to users as editors and viewers, manage workspace assets via the admin tool, and view all workspace assets in the map view.
- **Editors:** Can manage workspace assets via the admin tool and view all workspace assets in the map view. Editors should have experience using GIS software to enable them to upload and edit data layers.
- **Viewers:** Can view all workspace assets on the map view. Viewers cannot access the admin tool.

The owner for the Malawi workspace on UNBL is: Tiwonge Gawa (tgawa@must.ac.mw). To request access to the workspace, please contact her directly.

Activity 2

Capacity building and training on UNBL

A series of UNBL lectures and training sessions were held in October and November for national stakeholders to acquaint them with all functionalities and applications of the platform. Through two lecture sessions and two training sessions centered around UNBL's public platform and secure workspaces, national stakeholders gained key knowledge and hands-on experience around viewing UNBL datasets, calculating dynamic metrics and viewing headline indicators for their country, managing their national workspace, and using the ELSA Integrated Spatial Planning Tool configuration for their country. Stakeholders that were present in the sessions should now be equipped with the practical knowledge and tools necessary to provide training to other interested groups around utilizing UNBL to support planning and implementation of the NBSAP and KMGBF in Malawi (see Table 1 for relevant UNBL functionalities covered during the trainings).

The recordings and presentations are available [here](#). In addition, user guides for UNBL are available in Annex 3.

UNBL features relevant to NBSAP implementation and the 7NR included in the training series included:

- Secure workspaces for non-commercial users to upload and manage national spatial data, tag by NBSAP target and indicator, and share privately with a curated group of users. UNBL secure workspaces have been further enhanced through the UNBL-GBF Mapping Project with user-friendly features to seamlessly connect to data from diverse national and global repositories.
- Push-button calculation of dynamic metrics at the national level and display of select headline indicators. New metrics will continue to be added for display of select KMGBF indicators and additional metrics.
- Access to over 1,000 global spatial data layers, including data referenced in the metadata of the KMGBF monitoring framework, curated for national use on biodiversity, ecosystem services, and human well-being to fill national data gaps, as needed.
- Curated data collections for policymakers that could be used to calculate indicators to monitor implementation of the KMGBF at national level as well as on objectives related to protected areas (Target 3), restoration (Target 2), and nature-based solutions for climate change (Target 8).
- Extensive documentation and guidance to enable new users to easily apply UNBL for their needs.
- Ability to develop prioritized spatial plans for KMGBF Targets 1, 2, and 3, that provide powerful co-benefits for Targets 4-12 using the ELSA Integrated Spatial Planning Tool.

Activity 3

Update of the Malawi Ecosystem Protection Assessment

Introduction

The Malawi Ecosystem Protection Assessment evaluates how well Malawi's diverse ecosystem types are represented within the country's protected area network. This assessment aligns with, and is used for reporting on, the KMGBF Target 3 of conserving at least 30% of terrestrial, inland water, and coastal/marine areas by 2030 (Convention on Biological Diversity, 2022)⁴. The assessment is critical for guiding national conservation strategies, spatial planning, and policy development.

Although methods for assessing ecosystem threat status have been adopted globally, i.e., IUCN's Red List of Ecosystems (IUCN, 2016)⁵, there is currently no standardised global approach to assessing Ecosystem Protection Levels. We have hence applied the approach set out in the UNEP-WCMC and SANBI guidelines on Mapping Biodiversity Priorities and the associated technical guidelines for assessing Ecosystem Protection levels (Botts et al., 2016⁶; Holness and Botts, 2023⁷). The approach has been extensively tested in Africa and was previously applied in Malawi in the Mapping Biodiversity Priorities projects. The current assessment is an updated version (based on improved data and the new KMGBF targets) of an assessment that has previously been applied in the country and is well understood by decision-makers.

The Assessment

Ecosystem Protection Level is an indicator that tracks how well represented an ecosystem type is in the protected area network. It is computed by intersecting the map of remaining natural areas of each ecosystem type with the map of protected areas. Ecosystem types are then categorised based on the proportion of the target for each ecosystem type that is included in one or more protected areas.

Ecosystem Protection Level evaluations are relative to a percentage target of the original extent of each ecosystem type. To some extent it is not important what percentage is used, as the assessments will still identify which ecosystems are relatively well protected and which are not. However, strong alignment with national (i.e. the NBSAP) and global targets (i.e. the KMGBF Target 3 of 30% effective protection) as well as reporting requirements is achieved by using a 30% target for each ecosystem type.

The proportion of each ecosystem's target met was calculated as

$$\left(\frac{\text{intact area in P/A}}{\text{target area}} \right) \times 100$$

Ecosystems were then classified into four categories based on the thresholds shown in Table 1, with categories ranging from 'Well Protected' where the 30% target has been achieved down to 'Not Protected' where no intact areas or effectively no areas of the ecosystem have been included in the protected area network.

4 Convention on Biological Diversity. (2022). Kunming-Montreal Global Biodiversity Framework. Decision 15/4. Secretariat of the Convention on Biological Diversity, Montreal, Canada. <https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-04-en.pdf>

5 IUCN. (2016). An introduction to the IUCN Red List of Ecosystems: The categories and criteria for assessing risks to ecosystems. International Union for Conservation of Nature, Gland, Switzerland. <https://doi.org/10.2305/IUCN.CH.2016.RLE.2.en>

6 Botts, E., Holness, S., Ling, M., Arnell, A., and Tayleur, J. (2016). Mapping Biodiversity Priorities: A practical, science-based approach to national biodiversity assessment and prioritisation.

7 Holness, S., and Botts, E. (2023). Technical Guide Series 5: Map of ecosystem protection level. UN Environment Programme – World Conservation Monitoring Centre, Cambridge, UK.

Table 1. Ecosystem Protection Levels are evaluated based on the proportion of the 30% target met in a Protected Area (or Other Effective Area-based Conservation Measure)

Ecosystem Protection Level	Proportion of 30% target met in Protected Areas	Total % of Ecosystem Type Protected
Not Protected	Under 5% of target met	From 0% to under 1.5%
Poorly Protected	From 5% to less than 50% of target	From 1.5% to under 15%
Moderately Protected	From 50% to less than 100% of target	From 15% to under 30%
Well Protected	Target met or exceeded	Over 30%

Importantly, the assessment only includes intact or degraded areas in the evaluation. Excluding areas categorized as "not natural" ensures that infrastructure, urban development, mining areas, and other heavily modified lands do not inflate the perceived protection of ecosystems. This conservative approach provides a more realistic estimate of effective conservation.

We undertook two related assessments:

- **Ecosystem Protection Level:** where the results are divided into the four categories displayed in Table 1, and which is aimed at mapping and strategy / policy documents. This is the primary assessment and results which should be mapped and shared.
- **Ecosystem Protection Index:** which looks more precisely at how much of each target has been met and is aimed for use in spatial analyses such as the ELSA spatial prioritization analysis. The Ecosystem Protection Index is based on the same data and assessment but examines the percentage of a 30% target met for each ecosystem type. Values linearly range from 100 which equates to 0% of target met to 0 which equates to the full 30% target being met or exceeded. This index is not discussed further as it would generally only be used as an input for further spatial analyses. To request more information, please contact support@unbiodiversitylab.org.

Data Sources

The assessment builds on three key datasets developed by the SBAPP Regional Project.

- **Map of Ecosystem Types:** This dataset provides a comprehensive spatial delineation of Malawi's 69 ecosystem types. It represents the original extent of each ecosystem type, based on a robust integration of floristic, vegetation, and hydrological data, validated through national workshops. The updated 2025 Map of Ecosystem Types used for this analysis includes key improvements such as the identification of 14 specific lake ecosystem types. The map went through a robust national workshopping and validation process.
- **Map of Protected Areas:** This map includes legally gazetted protected areas and OECMs. The protected area dataset was updated to include previously missing areas and adjusted boundaries.
- **Map of Ecological Condition:** This map classifies land into three categories, namely natural (intact or near-natural ecosystems), semi-natural (degraded but still contributing to conservation), and not natural (urban areas, agriculture, roads, mines). Only areas classified as natural or semi-natural within protected areas are considered effectively protected.

Methods

The assessment followed the raster-based GIS workflow as outlined in the Mapping Biodiversity Priorities Technical Guide 5 (Holness and Botts, 2023)⁸:

- **Raster Preparation:** All input datasets (ecosystem types, protected areas, ecological condition) were converted to a common raster format with matching spatial extent, projection, and pixel size.
- **Calculation Table Setup:** A table was created listing each ecosystem type with fields for original area (ha), protection target area (30 %of original extent), intact area within protected areas, percentage of protection target met, and protection level classification.
- **Original Extent Calculation:** The original extent of each ecosystem type was calculated.
- **Protection Target Calculation:** The target protection area was calculated as 30% of the original ecosystem extent, consistent with the NBSAP and KMGBF.
- **Protected Area Overlap:** The intersection of ecosystem types with protected areas was computed, excluding areas classified as 'not natural' to ensure only effectively conserved habitats were counted.
- **Protection Percentage and Classification:** The proportion of each ecosystem's target met was calculated and then classified into four categories based on the thresholds (Table 1).

Results

The results from the ecosystem protection level assessment for Malawi are mapped in Figure 7. Key highlights of the analysis are:

- **Overall Coverage:** Out of 69 ecosystem types, 19 types, or 42%, are not effectively represented in any protected area and are 'Not Protected'. A further 18 types are 'Poorly Protected' with less than half of the target met. Only 13 ecosystem types (mostly terrestrial ecosystems in the north) have their full 30% target met; with another 9 types being 'Moderately Protected' with at least half the target met.
- **Lake and Wetland Ecosystems:** Lake ecosystems remain disproportionately underprotected, with all of Lake Malawi's ecosystem types being 'Not Protected'. Similarly, most Palustrine Wetlands and River and Stream types are also underprotected. Key ecosystems such as the Elephant Marsh Wetlands, Lake Chilwa Wetlands, and Lake Chiuta Wetlands have no protection.
- **Terrestrial Ecosystems:** Terrestrial ecosystems have better representation overall but still face significant conservation gaps, including Terminalia Sericea Woodland, classified as Critically Endangered, which is 'Not Protected' with only 0.13% of its target area protected, and Zambezian Miombo Woodland which is also 'Not Protected'. Nevertheless, protection targets have been achieved for some montane forests and miombo woodland types, such as Brachystegia-Juberrnadia Woodlands and Mulanje Mountain Miombo Woodlands.

⁸ Holness, S., Botts, E., 2023. Technical Guide Series 5: Map of ecosystem protection level. UN Environment Programme – World Conservation Monitoring Centre, Cambridge, UK.

- **River Ecosystems:** River ecosystems have mixed results with some rivers like North Rukuru Catchment Rivers being moderately to well protected, while others such as Songwe Catchment Rivers are not protected.

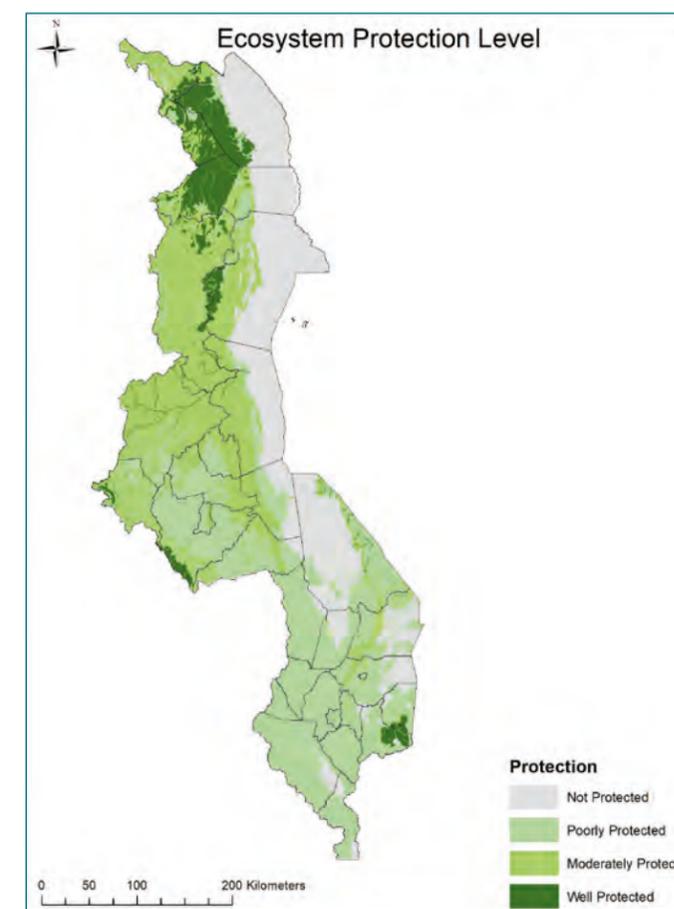


Figure 7. Map showing Ecosystem Protection Levels based on the proportion of each ecosystem type protected relative to the 30% NBSAP and KMGBF Target

4 Project's outcomes and policy options

Through the UNBL-GBF Mapping Project, a series of stakeholder engagement sessions and spatial analyses were undertaken with Working Group 1 on spatial planning with the central objective of providing actionable science to support planning and implementation for NBSAP Target 2 as well as KMGBF Target 2 on restoration, NBSAP Target 3 and KMGBF Target 3 on protected areas and OECMs, NBSAP Target 11 KMGBF Target 10 on sustainable management, and NBSAP Target 13 and KMGBF Target 12 on urban greening. Our specific objectives, guided by national stakeholders and the national priorities of the country, were to develop a national ELSA priority action map that identifies priority areas to protect, manage, restore, and urban green in Malawi. The results are presented through figures with associated 'map application' insights through this report. Here we provide some further insights that span these results.

KMGBF Target 3 to protect 30% of land, sea, and freshwater areas represents the goal of ensuring enough areas of particular importance for biodiversity are protected to contribute (alongside other goals and targets) to reversing the extinction crisis and stabilizing the global climate system, and do so in an inclusive and participatory way. However, past area targets (e.g., Aichi Biodiversity Target 11) have resulted in protected areas being established primarily in sub-optimal locations, often places that are simply high and far from human settlements, irrespective of their environmental values.⁹ The integrated spatial planning tools and maps provided as a result of this project respond to the ambition outlined in KMGBF Target 1 around biodiversity-inclusive spatial planning and could inform further protected area expansion and OECM recognition in more optimal locations, ensuring that these new conservation areas lead to significant conservation of important ecosystems and species, prioritizing those with additional ecosystem service co-benefits. Moreover, KMGBF Target 2 represents the most ambitious target within the CBD Framework to restore native and essential ecosystems at the national and global levels. Targets 10 and 12 likewise raise ambition around sustainable management practices and urban greening.

The maps provided by this project are a response to help governments increase the necessary efforts around conservation, restoration, sustainable management, and urban greening and help decision makers to identify where to take appropriate actions in locations that will maximize environmental outcomes to deliver on NBSAP Targets 1-3, 5, 9, 12-13, as well as qualitative elements of KMGBF Targets 1-4, 8, and 10-12. The actions used in this spatial prioritization are additionally the functional equivalent of actions of the LDN response hierarchy supported under UNCCD. 'Protect' is the equivalent of 'avoid' land degradation, 'manage' is the equivalent of 'reduce' land degradation, and 'restore' is the equivalent of 'reverse' land degradation. In summary, this equates 'Protect-Manage-Restore' with 'Avoid-Reduce-Reverse', ensuring alignment across global biodiversity frameworks. The resulting ELSA priority action map can therefore also support the implementation of the LDN response hierarchy under UNCCD.

The ELSA priority action map that is derived from this project combines the best available national spatial data and state-of-the-art global spatial data with novel technology and a robust spatial planning methodology in SCP, thereby enabling national experts, practitioners and decision makers to undertake interactive spatial prioritization activities to support Malawi's national priorities. The resulting maps are useful for identifying the most critical regions and ecosystems to focus conservation, restoration, sustainable management, and urban greening efforts. This information could be used by EAD and other relevant ministries or equivalent entities, to identify the most critical subnational districts to engage. Much of the data is relevant at the subnational scale, but further ground truthing will be needed, such as incorporating more accurate subnational data or

⁹ Venter, O., Magrath, A., Outram, N., Klein, C.J., Possingham, H.P., Di Marco, M. and Watson, J.E. (2018). Bias in protected-area location and its effects on long-term aspirations of biodiversity conventions. *Conservation Biology*, 32 (1), pp.127-134. doi:10.1111/cobi.12970

undertaking field campaigns to validate national maps in the local context. For restoration in particular, the [resource guide to Target 2 of the KMGBF](#) could be helpful to identify site-specific practices for implementation of restoration activities. This is especially true within the lake ecosystems of Malawi, where more detailed planning might be required to determine the most suitable mix of site level restoration actions and protection measures. Moreover, some areas that are restored through improved management might later be evaluated for formal protection.

ELSA is listed as an example of relevant data sources and methods in the [metadata for KMGBF indicator 1.1](#). The ELSA priority action map produced by this project therefore could be used by EAD to answer questions for the [binary indicator 1.b](#). ELSA only applies to terrestrial land use change and inland water land use change.

In addition, the input data used as part of the ELSA integrated spatial planning tool has been selected to align with the data recommended in the metadata of the monitoring framework. Therefore, ELSA can be used as part of a continuous feedback loop between monitoring, implementation, and reporting. The ELSA priority action map can ensure that implementation is most likely to lead to benefits for the targets; as such, using the action map should positively influence monitoring outcomes. The priority action areas identified in the ELSA priority action map could likewise be considered as priority for on-the-ground monitoring efforts. However, the ELSA planning approach is not in itself an indicator for monitoring and reporting.

This report presents maps that were created through an extensive consultation process with national experts, yet they should not be viewed as static products that are inflexible to future updates. Since the methodology enables decision makers to undertake new iterations of the process through the ELSA Integrated Spatial Planning Tool (Annex 3), new alternate and updated scenarios going beyond those explored in this project could be developed. This may include updating datasets and running new scenarios using the ELSA Tool. For instance, during the weighting and co-creation sessions, the importance of wetlands and freshwater systems, especially Lake Malawi, was discussed. While there was general agreement that these systems were important, and some hypotheses about which specific areas were particularly important were discussed, it was felt there remained a lack of data mapping variability in condition and biodiversity across these aquatic systems. It was noted that additional data were available for the distributions of fish species, and these data were subsequently added to as planning features for Malawi integrated spatial planning. By rerunning the optimizations with these data on fish, improvements to the map were noted, including an increase in the agreement between the ELSA map and areas hypothesized as important by participants during the co-creation session. Specifically, by increasing the weight given to the two fish layers to 80, the overall prioritization of lake Malawi increased, with the distribution of areas selected aligning with expert opinion on critical areas to protect and restore.

Further capacity-building activities on these approaches were facilitated through a series of lectures and hands-on trainings with relevant national focal points on the use of the UNBL platform and the ELSA Integrated Spatial Planning Tool. The aim of these sessions was to cultivate national trainers that would continue strengthening capacities at national and subnational levels with additional relevant stakeholders.

In the case of the Malawi Ecosystem Protection Assessment, the results presented through the project reveal significant conservation gaps, especially within lake and wetland ecosystems, which are critical for biodiversity, water security, and ecosystem services. Urgent expansion of protected areas targeting these ecosystems is necessary. The assessment methodology, based on robust spatial data integration and exclusion of non-natural areas, provides an accurate and policy-relevant picture of ecosystem protection. The foundational ecosystem maps and protection level results have been added to Malawi's secure workspace on UNBL and should be integrated into national spatial planning platforms such as the [Malawi Spatial Data Platform \(MASDAP\)](#). Priority actions highlighted in the assessment results include:

- Expanding protected areas to cover unprotected and poorly protected ecosystems, with a focus on wetlands and lakes.
- Regularly updating ecosystem condition and protection data to monitor trends.
- Integrating ecosystem protection priorities into major development projects such as the Shire Valley Transformation Project.
- Establishing multi-sectoral technical working groups to maintain and improve spatial biodiversity assessments.



Photo credit: David Davies, 2014

Next steps

EAD and MUST are now equipped to continue using the ELSA Integrated Spatial Planning Tool configuration for Malawi on UNBL and further train national stakeholders to undertake new iterations of the spatial prioritization analysis to create new ELSA priority action maps. EAD and MUST are also able to utilize its UNBL workspace as well as other UNBL functionalities to support monitoring and reporting on the NBSAP and KMGBF.

Building on this foundation, Malawi plans to directly use the results of the UNBL-GBF Mapping Project maps to finalize and officially launch the new National Biodiversity Strategy and Action Plan (NBSAP III) in 2026. This ensures the results contribute to national goals related to KMGBF Targets 1, 2, and 3 following a specific national timeline. This established capacity, developed through dedicated training with technical experts from key ministries and institutions, is vital for the effective implementation of the NBSAP III and for the preparation of Malawi's Seventh National Report (7NR), ensuring the sustainable, evidence-based management of the country's natural capital moving forward.

Annexes

Annex 1: Input data list

This table depicts all data layers used in the integrated spatial planning process to identify priority action areas in Malawi and support implementation of the NBSAP and KMGBF.

Type	Theme	Layer name	Data scale	KMGBF Target	NBSAP Target	Source	UNBL map view
Planning features	Biodiversity	Intact Ecosystems	National	KMGBF Target 1	NBSAP Target 3	SBAPP Regional Project “Southern Africa: spatial biodiversity assessment, prioritisation and planning in South Africa, Namibia, Mozambique and Malawi”	View
	Biodiversity	High Integrity Forests	National	KMGBF Target 1	NBSAP Target 3	SBAPP Regional Project “Southern Africa: spatial biodiversity assessment, prioritisation and planning in South Africa, Namibia, Mozambique and Malawi”	View
	Biodiversity	Ecological Condition	National	KMGBF Target 1	NBSAP Target 3	SBAPP Regional Project “Southern Africa: spatial biodiversity assessment, prioritisation and planning in South Africa, Namibia, Mozambique and Malawi”	View
	Biodiversity	Degraded Areas for Restoration	National	KMGBF Target 2	NBSAP Target 2	SBAPP Regional Project “Southern Africa: spatial biodiversity assessment, prioritisation and planning in South Africa, Namibia, Mozambique and Malawi”	View
	Biodiversity	Significant Ecosystem Process Areas for Restoration	National	KMGBF Target 2	NBSAP Target 2	SBAPP Regional Project “Southern Africa: spatial biodiversity assessment, prioritisation and planning in South Africa, Namibia, Mozambique and Malawi”	View
	Biodiversity	Connected terrestrial landscapes for protection	National	KMGBF Target 2	NBSAP Target 3	SBAPP Regional Project “Southern Africa: spatial biodiversity assessment, prioritisation and planning in South Africa, Namibia, Mozambique and Malawi”	View
	Biodiversity	Threatened Ecosystems for Protection Limited to Natural and Degraded areas	National	KMGBF Target 3	NBSAP Target 3	SBAPP Regional Project “Southern Africa: spatial biodiversity assessment, prioritisation and planning in South Africa, Namibia, Mozambique and Malawi”	View
	Biodiversity	Ecosystem Service Protection Priorities	National	KMGBF Target 3	NBSAP Target 3	SBAPP Regional Project “Southern Africa: spatial biodiversity assessment, prioritisation and planning in South Africa, Namibia, Mozambique and Malawi”	View

Type	Theme	Layer name	Data scale	KMGBF Target	NBSAP Target	Source	UNBL map view
Planning features	Biodiversity	Ecosystem Protection Index	National	KMGBF Target 3	NBSAP Target 3	SBAPP Regional Project “Southern Africa: spatial biodiversity assessment, prioritisation and planning in South Africa, Namibia, Mozambique and Malawi”	View
	Biodiversity	Threatened and Underprotected Ecosystems	National	KMGBF Target 3	NBSAP Target 3	SBAPP Regional Project “Southern Africa: spatial biodiversity assessment, prioritisation and planning in South Africa, Namibia, Mozambique and Malawi”	View
	Biodiversity	Key Biodiversity Areas	National	KMGBF Target 3	NBSAP Target 1	SBAPP Regional Project “Southern Africa: spatial biodiversity assessment, prioritisation and planning in South Africa, Namibia, Mozambique and Malawi”	View
	Biodiversity	Fish Diversity	National	KMGBF Target 4	NBSAP Target 5	SBAPP Regional Project “Southern Africa: spatial biodiversity assessment, prioritisation and planning in South Africa, Namibia, Mozambique and Malawi”	View
	Biodiversity	Number Fish threatened	National	KMGBF Target 4	NBSAP Target 5	SBAPP Regional Project “Southern Africa: spatial biodiversity assessment, prioritisation and planning in South Africa, Namibia, Mozambique and Malawi”	View
	Human well-being	Clean water supply areas	National	KMGBF Target 11	NBSAP Target 12	SBAPP Regional Project “Southern Africa: spatial biodiversity assessment, prioritisation and planning in South Africa, Namibia, Mozambique and Malawi”	View
	Climate	High Carbon Stock	National	KMGBF Target 8	NBSAP Target 9	SBAPP Regional Project “Southern Africa: spatial biodiversity assessment, prioritisation and planning in South Africa, Namibia, Mozambique and Malawi”	View
	Climate	Potential Increase in SOC on Croplands	National	KMGBF Target 8	NBSAP Target 9	SBAPP Regional Project “Southern Africa: spatial biodiversity assessment, prioritisation and planning in South Africa, Namibia, Mozambique and Malawi”	View
	Climate	Priority Aquatic Systems for Improved Management	National	KMGBF Target 10	NBSAP Target 11	SBAPP Regional Project “Southern Africa: spatial biodiversity assessment, prioritisation and planning in South Africa, Namibia, Mozambique and Malawi”	View
	Climate	Flood Abatement Opportunities	National	KMGBF Target 8	NBSAP Target 9	SBAPP Regional Project “Southern Africa: spatial biodiversity assessment, prioritisation and planning in South Africa, Namibia, Mozambique and Malawi”	View

Type	Theme	Layer name	Data scale	KMGBF Target	NBSAP Target	Source	UNBL map view
Planning features	Climate	Aquatic and Wetlands	National	KMGBF Target11	NBSAP Target 12	SBAPP Regional Project “Southern Africa: spatial biodiversity assessment, prioritisation and planning in South Africa, Namibia, Mozambique and Malawi”	View
	Human well-being	Potential Clean Water Provision	National	KMGBF Target11	NBSAP Target 12	SBAPP Regional Project “Southern Africa: spatial biodiversity assessment, prioritisation and planning in South Africa, Namibia, Mozambique and Malawi”	View
	Human well-being	Urban Greening Potential	National	KMGBF Target12	NBSAP Target 13		View
Locking options	Lock-in restrictions	Existing Protected Areas	National	N/A		SBAPP Regional Project “Southern Africa: spatial biodiversity assessment, prioritisation and planning in South Africa, Namibia, Mozambique and Malawi”	View
Zones	Zones	Natural areas - From ecological condition layer	National	N/A		SBAPP Regional Project “Southern Africa: spatial biodiversity assessment, prioritisation and planning in South Africa, Namibia, Mozambique and Malawi”	
		Degraded areas - From ecological condition layer	National	N/A		SBAPP Regional Project “Southern Africa: spatial biodiversity assessment, prioritisation and planning in South Africa, Namibia, Mozambique and Malawi”	
		Agriculture Lands	National	N/A		SBAPP Regional Project “Southern Africa: spatial biodiversity assessment, prioritisation and planning in South Africa, Namibia, Mozambique and Malawi”	
		Urban areas	Global	N/A		Esri, 2024	

Annex 2: Links to relevant project documents

Key project links (scoping reports, workshop reports, capacity building materials, and all other relevant materials)

- [Policy brief](#)
- [Project concept note](#)
- Inception Workshop Recording: [EN](#)
- [List of stakeholders involved through the process](#)
- [Resource guide to Target 2 of the KMGBF](#)
- UNBL Lecture 1 on the Public Platform: [EN](#)
- UNBL Hands-on Training 1 on the Public Platform: [EN](#)
- UNBL Lecture 2 on Workspaces: [EN](#)
- UNBL Hands-on Training 2 on the Public Platform: [EN](#)
- UNBL National Workspace for Malawi (*see Annex 3 for access*)
- ELSA Integrated Spatial Planning Tool User Guide: [EN](#)
- UNBL Secure Workspaces User Guide: [EN](#)
- UNBL Public Platform User Guide: [EN](#)

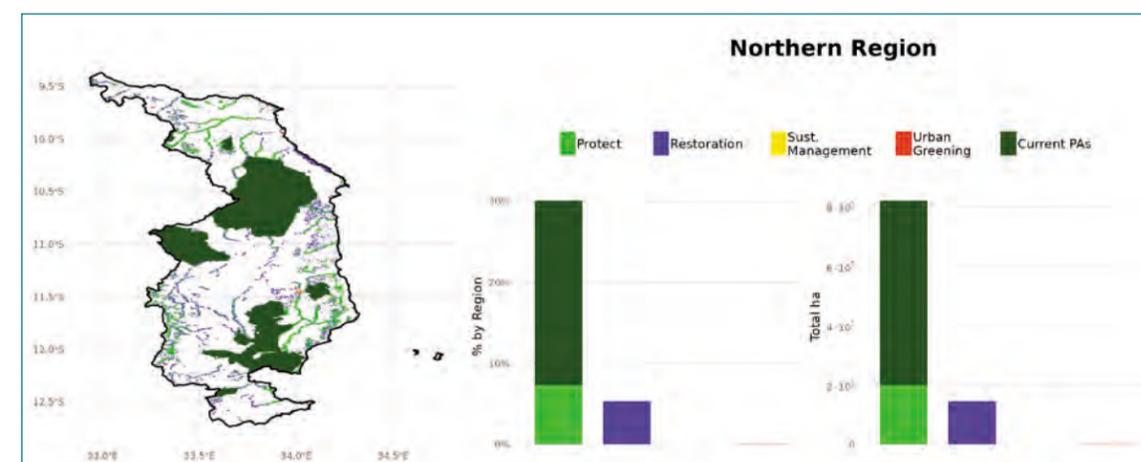
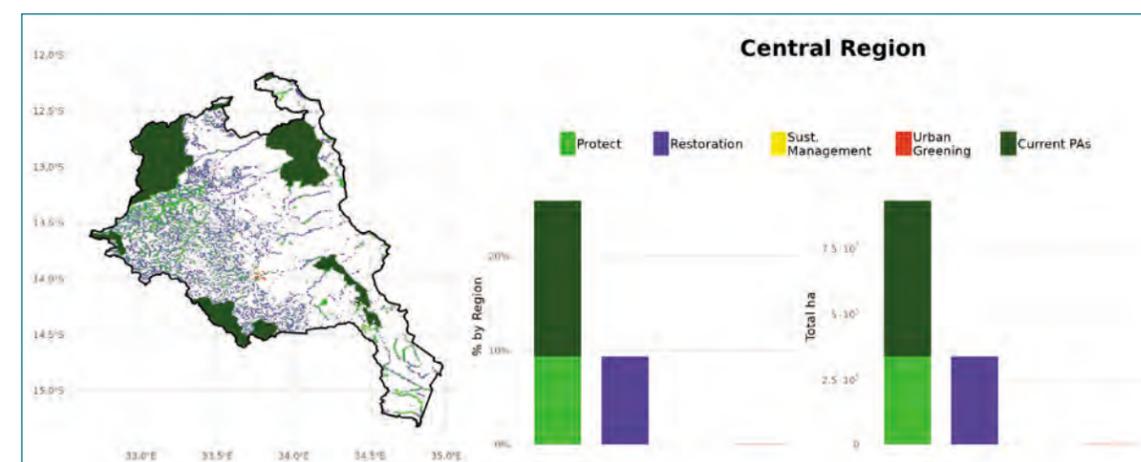
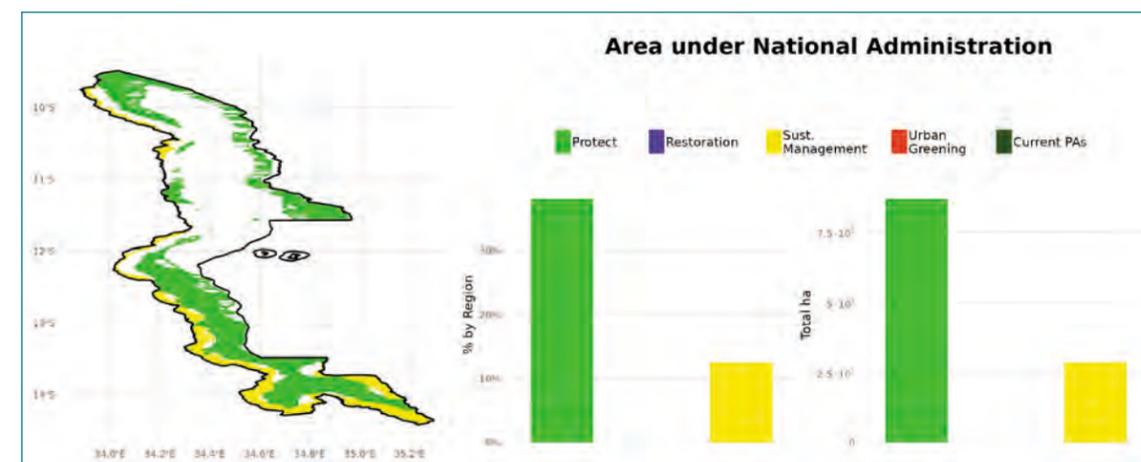
Annex 3: User's guide to using the UNBL public platform, accessing Malawi's secure workspace on UNBL and using the ELSA Integrated Spatial Planning Tool on UNBL

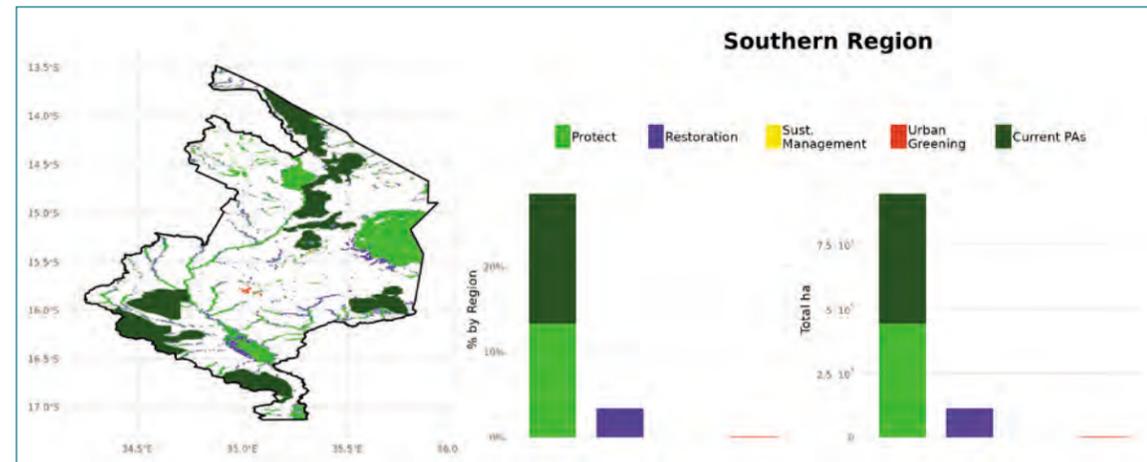
Users who want to explore the UNBL platform and accustom themselves to its basic functions should see the [UNBL Public Platform User Guide](#). Users who want to gain access to Malawi's secure workspace on UNBL and the ELSA Integrated Spatial Planning Tool used to undertake spatial prioritization scenarios Malawi need to request access to the workspace by undertaking the following steps:

1. Contact the national administrator of this workspace at tgawa@must.ac.mw, with a copy to support@unbiodiversitylab.org with the subject 'UNBL-GBF project workspace request for Malawi' and the e-mail address which the user registered an account on UNBL with. If the user has not yet registered an account on UNBL, they should follow instructions outlined here: [How do I register or log-in?](#)
2. After contacting the national administrator of Malawi's workspace, the UNBL team will reach out with an e-mail to confirm when the user has been added to the workspace.
3. To access Malawi's national workspace on UNBL, see [How do I access my workspace\(s\)?](#)
4. To access and use the ELSA Integrated Spatial Planning Tool for Malawi, as well as all other functionalities of Malawi's national workspace on UNBL, see the [ELSA Integrated Spatial Planning User Guide](#) and [UNBL Secure Workspaces User Guide](#).

Annex 4: Regional ELSA priority action maps and analyses

ELSA priority action maps at the regional level for Malawi. The image files for these maps are available [here](#).





Annex 5: Glossary of key terms

Term	Definition	Application in Malawi
Boundary Penalty Factor (BPF)	Solutions are penalized based on the total outer boundary or edge of the zones. By penalizing solutions with large edge length, this BPF can be used to promote spatial cohesion or clustering in the spatial prioritization zones of priority areas for NBSAP and KMGBF implementation.	A BPF of 500 was applied to produce the final priority area map.
Area-based constraint	The maximum area (expressed as a % of the total area of the country) that can be assigned to a specific action zone (protection, restoration, management, or urban greening).	Protect: 30% Restore: 2.5% Manage: 5% Urban Greening: 0.1%
Planning feature	A spatial dataset used to map spatial elements of NBSAP Targets 1, 2, 3, 5, 9, 12, and 13 and KMGBF Targets 1-4, 8, 10-12. Each KMGBF target may be mapped by one or more planning features depending on its complexity. Planning features may include ecological classifications, habitat types, species, physical objects, processes, or any element that can be measured in a planning unit.	The ELSA tool configuration for Malawi contains 21 total planning features, of which 21 are national datasets. These planning features map to NBSAP Targets 1, 2, 3, 5, 9, 12, and 13 and KMGBF Targets 1, 2, 3, 4, 7, 8, 10, 11, and 12.
Decision support software	A computer application that uses information about possible actions and the limitations of those actions to assist the decision-making process in achieving a stated objective.	The ELSA tool configuration for Malawi uses the prioritizr R package in the backend. Prioritizr is designed to build and solve conservation planning problems. No knowledge of R is required to use it.
Geographic Information System (GIS)	Computer system consisting of hardware and software necessary for the capture, storage, management, analysis and presentation of geographic (spatial) data.	The ELSA tool configuration for Malawi uses GIS software through UNBL's front-end display to present spatial data to users. No GIS knowledge is required to use it.
Planning units	Planning units are the basic elements of a reserve system. A study area is divided into planning units that are smaller geographic parcels of regular or irregular shapes. Examples are squares, hexagons, cadastral parcels and hydrological units.	Coordinate reference system for the UNBL-GBF Mapping Project in Malawi: Customized Mollweide Pixel resolution or pixel size: 375x375m
Representation	In Systematic Conservation Planning, a representative system captures the full range of planning features (species, ecosystems, and ecosystem services) occurring in the planning region, not just iconic species.	In the UNBL-GBF Mapping Project for Malawi, the representation measures how well each planning feature is captured/represented by the priority protection, restoration, sustainable management, and urban greening areas in the final priority area map of an executed analysis.

Term	Definition	Application in Malawi
Systematic Conservation Planning (SCP)	A formal method for identifying potential areas for conservation management that will most efficiently achieve a specific set of objectives, commonly some minimum representation of biodiversity. The process involves a clear and structured approach to priority setting, and is now the norm for both terrestrial and marine conservation. The effectiveness of systematic conservation planning lies in its ability to make the best use of limited fiscal resources to achieve conservation objectives and to do so in a way that is defensible, accountable, and transparently recognizes the needs of different resource users.	The SCP principle is the science that allows the identification of spatial prioritization areas to assist the implementation of NBSAP and KMGBF targets in Malawi.
User interface	The means by which people interact with a given computer application. A Graphical User Interface (GUI) presents information in a simple way using graphics, menus and icons.	The ELSA Integrated Spatial Planning Tool on UNBL is a graphical user interface that offers stakeholders the possibility to run the spatial prioritization analysis themselves.
Weights	The weights allow users to set relative priorities within their priority policy outcomes. Values typically range from “0” (no importance) to “10” (extremely high importance).	The default weightings for the UNBL-GBF Mapping Project in Malawi were developed collaboratively through stakeholder engagement sessions. Stakeholders can modify these weightings through the ELSA tool based on changes in priorities.
Action Zones	A land use zone, equivalent to a nature-based action, which serves to enhance specific planning objects. Zones are determined by restrictions that define where an action may or may not absolutely occur. For example, these hard restrictions limit protection to intact areas (e.g., low human footprint values) and protection/restoration to areas that are moderately impacted by human activity, but not totally dominated by humans (e.g., low and medium human footprint values).	For the UNBL-GBF Mapping Project in Malawi, the zoning analysis maps four different actions: protect, restore, manage, and urban green. Data used for zoning restrictions comes from a variety of hand-picked global and national sources, and includes degraded areas, protected areas, urban areas, built areas, and agricultural areas.





Photo credit: Savoche, Flickr, 2022

