Development of a Mining Restricted Areas Map at a Global Scale

Greenpeace International, FERN, Rainforest Foundation Norway, Mighty Earth v2.0 June 2026

Summary

The global Restricted Areas framework and map for mining have been developed by Greenpeace International, Mighty Earth, FERN and Rainforest Foundation Norway to identify areas with high ecological, natural and social values that should be off-limits to destructive extractive activities such as raw material mining. By ensuring Restricted Areas are protected, it retains the possibility of remaining within the Earth's planetary boundaries as well as ensuring a just energy transition through respecting the rights of Indigenous Peoples and those of local communities.

Based on the six criteria: protected areas, high conservation value areas, high carbon stock areas, significant natural ecosystems, critical water bodies, and the territories of Indigenous Peoples and local communities, relevant spatial datasets were identified and compiled. Valid global spatial datasets were reliable and credible sources, available to the public, the most up-to-date version, of the highest available spatial resolution and accuracy, and with a functional data format (polygon, raster).

The selected datasets were processed in Google Earth Engine to allow dynamic visualisation in order to analyse the datasets, performing, for instance, qualitative, comparative, and spatial representation checks. The initial variables were grouped into several normalised aggregated layers. Some of the datasets were considered as default off-limits Restricted Areas due to their critical importance, such as protected areas, Intact Forest Landscapes, mangroves, and the global ocean. Whereas other datasets were reclassified to importance classes based on their values - Medium, High, and Very High such as High Conservation Value and High Carbon Stock. Data was also analysed to determine the overlap of global mining areas with Restricted Areas.

Through an iterative process of review by experts and selected national level consultation and validation, the methodology was optimised to produce the global Restricted Areas framework and map. Four types of Restricted Areas were defined: a precautionary blanket layer of Restricted Areas requiring the Free Prior and Informed Consent of Indigenous Peoples and local communities (RA-FPIC), areas that are off-limits to mining by default (RA1a), areas that are off-limits to mining by value (RA1b), and additional areas with high natural values (RA2). A 'hotspot' layer displays the overlap of mining with RA1 & 2.

The resulting map is an indicative landscape-level map that helps identify areas where mining poses unacceptable environmental or social risks, and serves as a starting point for further discussion and more detailed mapping of Restricted Areas. The map is also not intended as a land-use decision-making tool - this requires local assessments and inputs from experts, especially Indigenous Peoples, and has a number of limitations including the spatial resolution of the data, the reliance on global data sets, and the lack of availability of consistent and complete data, especially on the territories of Indigenous Peoples.

Introduction

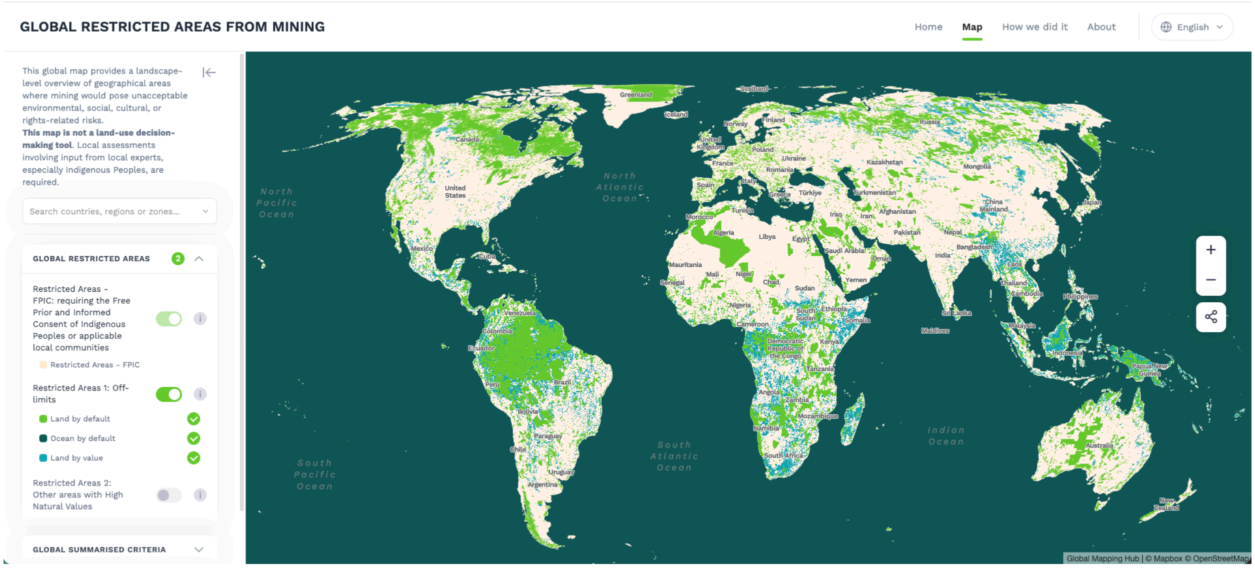
Defining Restricted Areas (RA) is a crucial step in ensuring that mineral exploration and extraction activities do not compromise areas of exceptional environmental and ecological importance, as well as Indigenous Peoples' territories, and the territories of local communities. We have now breached 7 out 9 planetary boundaries that define the safe living space on Earth *(Stockholm University, 2023)* and RA elements are integral to at least four of these boundaries (Climate Change, Biosphere Integrity, Land System Change and Freshwater Change). RA are places where extractive activities are considered incompatible with the need to safeguard biodiversity, ecosystem services, carbon storage, freshwater systems, and the rights of Indigenous Peoples and also those of local communities.

The Restricted Areas concept (otherwise termed as No-Go Zone mapping) is not new and has been used by the IUCN in relation to mining in protected area categories I-IV for over a decade and in the IUCN Netherlands recent resolution, as well as the Banks and Biodiversity initiative and Auriga in Indonesia. Restricted Areas or zones that should be off-limits to mining are identified based on internationally recognised standards, local laws, scientific assessments, and ethical considerations, with the aim of protecting irreplaceable natural and cultural values. Establishing clear RA criteria helps align conservation goals with development and provides guidance for governments, industries, and stakeholders on where mining or similar activities should be strictly avoided.

Greenpeace International, Rainforest Foundation Norway, Fern and Mighty Earth are identifying Restricted Areas from mining to inform governments, businesses, investors, certification systems, and the public on which areas of the Earth should not be mined.

The criteria for defining the Restricted Areas were based on identifying areas with 'sensitive' values as per the previously Greenpeace International published report 'Minerals for Energy Transition: Greenpeace's Guiding Principles' (2025), including protected areas, areas with high conservation values, high carbon stock areas, significant natural ecosystems, critical water bodies, and Indigenous Peoples' lands where mining is prohibited. It means defining areas with biological, ecological, social, rights or cultural values which are considered significant or critically important at the national, regional, or global level. The Restricted Area map *version 2.0 (June 2026)* has an additional analysis layer that identifies 'hotspots' of mining areas that overlap with some Restricted Area categories.

Version 2.0 of the map is publicly available online at https://restrictedareasfrommining.org/ (Picture 1).



Picture 1. *Screenshot of the Global Restricted Area map (June 2026), showing the following:*

- *an overarching layer ‘Restricted Area requiring FPIC’, covering all lands due to a lack of complete data sets.*
- *areas off-limits to mining ‘by default’ on land (green), in the ocean (dark green) and ‘by values’ (blue), all of which combine to form ‘RA1’.*

1.Restricted Areas Criteria and Data

Building on the aforementioned guiding principles ‘Minerals for Transition’, the operational definition of Restricted Areas requires clear and measurable criteria. These criteria translate broad critical natural ecosystems and nature protection, and rights-based values into specific spatial categories that can be consistently identified, mapped, and monitored at global and national levels. They serve as a practical foundation for distinguishing areas where mining activities are fundamentally incompatible with environmental and natural ecosystem protection, carbon storage, and the safeguarding of Indigenous Peoples’ rights and local communities’ rights. The criteria for defining the RA include the following key elements:

1. Protected Areas and Areas Recognised by International Conventions and Agreements (PA). These are all categories of protected lands and marine areas, including IUCN protected area categories I-VI, Indigenous Protected Areas (IPAs) and Territories and Areas Conserved by Indigenous Peoples and Local Communities (ICCAs), World Heritage Areas, Ramsar sites, Antarctica, UNESCO Global Geoparks and Biosphere Reserves.

2. High Conservation Value Areas (HCV). These are areas with particular biological, ecological, social, or cultural significance, including Intact Forest Landscapes and Key Biodiversity Areas. They are identified as having one or more of the following six HCVs *(Areendran et al., 2020)*: species biodiversity, landscape-level ecosystems, habitats, ecosystem services, community needs, and cultural values. These areas need to be appropriately managed to maintain or enhance their intrinsic values.

3. High Carbon Stock Areas (HCS). This includes areas of vegetation or soils, particularly forests and peatland, that have high amounts of stored carbon, that if cleared for mining would create considerable emissions *(Mervine et al., 2025)*. These areas act as carbon sinks, absorbing carbon dioxide from the atmosphere and storing it in their biomass and soil. They are therefore significant for climate change mitigation. They are often also a proxy for high biodiversity. These areas include all tropical primary forests, mangroves, and high biomass peatland soils but also may include other forest areas and some wetlands or grasslands. Protecting HCS areas is crucial for climate change mitigation by maintaining their carbon storage capacity and preventing the release of stored carbon into the atmosphere.

4. Significant Natural Ecosystems (SNE). This includes ecologically important natural grasslands, wetlands, mangroves, small islands, coral reefs, shrublands, and savannah systems that may have high values. Many of their values may be captured also in other criteria, including, to a limited degree, desert ecosystems. Also many SNE will need to be evaluated for significance in local contexts. In all cases, further local assessment and consideration of local datasets is needed. This, for instance, concerns water-stressed desert ecosystems and intact desert ecosystems that play a crucial role as carbon sinks (Yap, Prabhala & Anderson, 2023; Thomey et al., 2014).

5. Critical Water Bodies (CWB). The marine environment, including both shallow waters and the deep oceans (>200m depth), is categorised for protection due to their significant biodiversity and carbon values as well as the fundamental inability, based on the precautionary approach, to foresee and manage the environmental impacts of any mining of the seabed compared to on land, including the negative impact on marine biodiversity and fisheries, and coastal fishing community customary rights. Also includes all rivers, lakes, glaciers, and other types of water bodies, significant streams, or drinking water supply sources as well as a buffer zone that is sufficient to ensure their protection.

6. Indigenous Peoples' territories and the territories of local communities[1]**.** These include traditional and customary lands, territories, waters, coastal and communally-owned areas, and the natural resources on which they depend, where their Free, Prior, and Informed Consent (FPIC) is required, and additionally the territories of Indigenous Peoples in voluntary isolation or initial contact.

Based on the broad criteria mentioned above, global spatial datasets were chosen and analysed based on free availability, the most up-to-date, highest spatial resolution, and appropriate accuracy, with minimum redundancy and well described methodology. Relevant spatial data layers that have been selected and used in the process are listed in Table 1.

[1] The term "local community" (lc) is used in the methodology in a broad manner that can encompass "African-descent peoples", "tribal peoples" (as per International Labour Organisation (ILO) Convention 169), "forest people", "coastal fishers", "peasant communities", "riparian communities", and "local resource dependent communities" who have long-standing collective relationships and linkages with their lands, ecosystems, waters, and natural resources, and play a central role in their stewardship. For these categories of local communities, FPIC must be applied. This in no way undermines the specific self-determination, non-discrimination, and collective rights basis of FPIC of Indigenous Peoples. In cases where the local community groups in question do not have collective rights and governance structures, the use of the concept FPIC, which is a collective decision-making right, would be inappropriate, and alternative concepts such as informed consultations leading to broad community support, should be considered.Sources: Greenpeace International (2025). Minerals for Energy Transition: Guiding Principles, FPP (2013). The Rights of Non-Indigenous 'Forest Peoples' with a focus on Land and Related Rights. Existing International Legal Mechanisms and Strategic Options https://www.forestpeoples.org/fileadmin/uploads/fpp/migration/publication/2013/11/therightsofnonindigenousforest-peoplessept2013.pdf and Chao, S. (2012). Free, Prior and Informed Consent and Oil Palm Expansion in Southeast Asia From Principles to Practice https://www.forestpeoples.org/fileadmin/uploads/fpp/migration/publication/2012/11/fpicoilpalmexpansionmedanconferencepapersophie-chao.pdf

Table 1. *Variables for Global Restricted Areas mapping*

Variables	Source (see references)	RA Element
Protected Areas	*UNEP-WCMC and IUCN, 2025*	1.Protected areas
World Heritage Sites	*UNEP-WCMC and IUCN, 2025*	1.Protected areas
Ramsar Sites	*UNEP-WCMC and IUCN, 2025*	1.Protected areas
Antarctica	*GADM, 2025*	1.Protected areas
Key Biodiversity Areas	*BirdLife International, 2025*	2.High conservation value areas
Important Bird and Biodiversity Areas	*Waliczky et al., 2019*	2.High conservation value areas
Relative Species Richness	*UNEP-WCMC, 2025*	2.High conservation value areas
Plants Species Richness	*Sabatini et al., 2022*	2.High conservation value areas
Intact Forest Landscapes	*Potapov et al., 2008/2025*	2.High conservation value areas
Forest Integrity Index	*Grantham et al., 2020*	2.High conservation value areas
Aboveground Live Woody Biomass	*Xu et al., 2021*	3.High carbon stock areas
Aboveground and Belowground Biomass Carbon Density	*Spawn et al., 2020*	3.High carbon stock areas
Peatlands Carbon Stock	*Widyastuti et al., 2025*	3.High carbon stock areas
Peatlands Thickness	*Widyastuti et al., 2025*	4.Significant natural ecosystems
Mangroves	*Mazur et al., 2025*	4.Significant natural ecosystems
Wetlands	*Zhang et al., 2023*	4.Significant natural ecosystems
Grasslands	*Parente et al., 2024*	4.Significant natural ecosystems
Small Islands	*Sayre, 2022*	4.Significant natural ecosystems
Steep Slopes	*Jarvis et al., 2008*	4.Significant natural ecosystems
Permanent and Natural Waters	*Potapov et al., 2022, Pekel et al., 2016*	5.Critical water bodies
Inland Waters Surface Density	*Lehner et al., 2024*	5.Critical water bodies
River Basins Physical Risks	*WWF, 2024*	5.Critical water bodies
Glaciers	*GLIMS Consortium, 2005*	5.Critical water bodies
Global Ocean	*Mikelsons et al., 2021*	5.Critical water bodies
Hongana-Manyawa voluntary isolation tribal territory	*Survival International, 2024*	1.Protected Areas / 6. IP&lc territories

1.1. Protected Areas and Areas Recognised by International Conventions and Agreements (PA)

Variables included that represent PA:

- Protected Areas, World Heritage Sites and Ramsar Sites - obtained from the World Database on Protected Areas and Other Effective Area-Based Conservation Measures dataset (UNEP-WCMC and IUCN, 2025). It represents the most comprehensive global spatial dataset encompassing both terrestrial and marine protected areas, which by their meaning have the highest conservation value. The dataset includes areas classified under all six[2] International Union for Conservation of Nature (IUCN) protected area management categories, as well as areas for which no IUCN category was reported, assigned, defined, or deemed applicable - such as *Terras Indígenas* in Brazil. Although

[2] Recognising the IUCN categories V and VI may include some human use, including extractive activities.

more specialised or comprehensive datasets may exist for certain site types (e.g., Ramsar Sites or World Heritage Sites), the WDPA/WDOECM version was used to ensure consistency and comparability across all protected area designations. *Certain categories of protected and conserved areas were not fully represented in the version of the dataset used in this study, specifically, some Indigenous Protected Areas (IPAs), Indigenous and Community Conserved Areas (ICCAs), etc.*

- Antarctica - obtained from the global administrative areas database (GADM, 2025).

1.2. High Conservation Value Areas (HCV)[3]

Variables included that represent HCV:

- Key Biodiversity Areas - obtained from a global map of Key Biodiversity Areas (BirdLife International, 2025) with more than 16,000 polygons worldwide safeguarding important populations of more than 13,100 species of conservation concern. They are sites that contribute significantly to the global persistence of biodiversity identified using internationally agreed scientific criteria. They represent places that are critical for the survival of species and ecosystems, ranging from habitats for threatened or geographically restricted species to areas that support large ecological processes. KBAs can be found across terrestrial, freshwater, and marine environments, and they often overlap with or complement existing protected areas. By highlighting the most important places for nature, KBAs provide a foundation for conservation planning, policy, and investment to ensure the long-term protection of biodiversity.
- Important Bird and Biodiversity Areas - obtained from an Important Bird and Biodiversity (BirdLife International, 2025) map with globally recognised sites that are critical for the conservation of bird populations and broader biodiversity. Identified through standardised criteria based on species' vulnerability, population size, and habitat significance, IBAs highlight key habitats for threatened, endemic, and migratory birds. While initially focused on avian conservation, IBAs are also valuable indicators of ecosystem health and often overlap with other priority sites for nature, such as protected areas and Key Biodiversity Areas. They serve as practical tools for guiding conservation action, policy development, and sustainable land and resource management.
- Relative Species Richness - obtained from the dataset (data dated 2022, 3 km/pix resolution) that shows the relative abundance of species of amphibians, birds, mammals, reptiles, and a representative set of plant taxa. Derived from Areas of Habitat maps created from data from the IUCN Red List, BirdLife International, the Global Assessment of Reptile Distributions (GARD), the Botanical Information, and Ecology Network (BIEN) database. Additional vascular plant species ranges were created from point data from the IUCN Red List, Botanic Gardens Conservation International (BGCI), the Global Biodiversity Information Facility (GBIF), and iNaturalist. *Due to the low resolution of the source dataset, we additionally used the WWF Hydro Atlas (Linke et al., 2019) to assign*

[3] Based on the High Conservation Value Approach - HCV1 - 4.

each species richness value to its corresponding basin, ensuring better alignment with the other datasets used in this study.

- Plant Species Richness - derived from a dataset (data dated 2013, 1 km/pix resolution) that represents the global patterns of vascular plant alpha-diversity from 170,272 georeferenced vegetation plots worldwide, covering both forest and non-forest ecosystems at three spatial grains. The maps reveal spatial “scaling anomalies” - places where areas with high fine-scale richness differ from those with high coarse-scale richness - and help disentangle how environmental and sampling factors drive patterns of plant biodiversity. *Due to the low resolution of the source dataset, we additionally used the WWF Hydro Atlas (Linke et al., 2019) to assign each species richness value to its corresponding basin, ensuring better alignment with the other datasets used in this study.*
- Intact Forest Landscapes - obtained from a global dataset of Intact Forest Landscapes (data dated 2025, 30 m/pix resolution) which represent seamless mosaic of forest and naturally treeless ecosystems within the zone of current forest extent exhibiting no remotely detected signs of human economic activity or habitat fragmentation and are large enough to maintain all native biological diversity, including viable populations of wide-ranging species. IFLs are defined as a territory within today's global extent of forest cover which contains forest and non-forest ecosystems minimally influenced by human economic activity, with an area of at least 50,000 ha and a minimal width of 10 km (measured as the diameter of a circle that is entirely inscribed within the boundaries of the territory). They have high conservation value and are critical for stabilising terrestrial carbon storage, harboring biodiversity, regulating hydrological regimes, for the livelihoods of Indigenous Peoples, and providing other ecosystem functions.
- Forest Integrity Index - obtained from a Forest Landscape Integrity Index dataset (data dated 2020, 30m/pix) that represents observed and inferred forest pressures and lost forest connectivity as determined by degree of anthropogenic modification.

1.3. High Carbon Stock Areas (HCS)

Variables included that represent HCS:

- Aboveground Live Woody Biomass - derived from a global map of Aboveground Live Woody Biomass Density (data dated 2021, 30m/pix), counted in tonnes (megagrams) biomass per hectare. Aboveground biomass was estimated using a multi-step process of calculating above ground biomass at more than seven hundred thousand points with LiDAR with regional allometric equations, then using those to train a wall-to-wall model based on Landsat imagery.
- Aboveground and Belowground Biomass Carbon Density - derived from a Global Aboveground and Belowground Biomass Carbon Density map (data dated 2010, 30m/pix) that provides temporally consistent and harmonised global maps of aboveground and belowground biomass carbon density. The aboveground biomass map

integrates land-cover specific, remotely sensed maps of woody, grassland, cropland, and tundra biomass. Input maps were amassed from the published literature and, where necessary, updated to cover the focal extent or time period. The belowground biomass map similarly integrates matching maps derived from each aboveground biomass map and land-cover specific empirical models.

- Peatlands Carbon Stock - derived from PEATGRIDS/carbon dataset (data dated 2024, 1km/pix) containing peat thickness and carbon stock estimated over peatlands area across the globe. Carbon stock was calculated across all depths of the predicted peat thickness across five depths: 0-15 cm, 15-30 cm, 30-60 cm, 60-100 cm, and 100-200 cm.

1.4. Significant Natural Ecosystems (SNE)

Variables included that represent SNE:

- Peatlands Thickness - derived from PEATGRIDS/depth dataset (2024, 1km/pix) containing peat thickness and carbon stock estimated over peatlands area across the globe.
- Mangroves - extracted from the Natural Lands dataset (data dated 2024, 30m/pix) that represents the global extent of “natural” versus “non-natural” lands, covering the following land cover classes: forest, short vegetation, water, mangroves, bare, and snow/ice. The dataset is a compilation of the best available local and global land cover datasets. It synthesizes multiple global and regional land cover / land use datasets (e.g. ESA WorldCover, UMD land cover, MapBiomas, cropland, and mining footprints) and overlays supplementary data to distinguish naturally functioning ecosystems from areas transformed by agriculture, built environments, plantations, or intensive management.
- Wetlands - derived from the global Wetland map (data dated 2022, 30m/pix) with a fine classification system using multi-sourced and time-series remote sensing imagery. It includes five inland wetland sub-categories (permanent water, swamp, marsh, flooded flat, and saline) and coastal tidal wetland sub-categories (mangrove, salt marsh, and tidal flats).
- Grasslands - extracted from global Global Pasture Watch grassland (data dated 2022, 30 m/pix) in which the extent, dominant class, and probability is mapped annually for 2000-2022, including cultivated and natural/semi-natural grassland. *For this study only the natural / semi-natural grassland area for the year 2022 was used. Savanna and tundra areas are part of these grasslands. The results with probability more than 50% were taken for the analysis.*
- Small Islands - derived from Landsat-based, Global Islands polygon datalayer (data dated 2022, 30m/pix) produced from a semi-automated interpretation. *Only the islands less than 20,000 ha in size were taken into analysis for this study.*
- Steep Slopes - extracted from Shuttle Radar Topography Mission (data dated 2000, 90m/pix) Digital Elevation Model. *Data for the entire world with slopes of more than 20*

degrees were filtered from the dataset. These areas are highly sensitive to erosion and impact on water bodies.

1.5. Critical Water Bodies (CWB)

Variables included that represent CWB:

- Permanent and Natural Waters - aggregated from water dynamics and water change datasets: Seasonal water and ice dynamics (data dated 2022, 30m/pix) and Atlas of global surface water dynamics (data dated 2020, 30m/pix). They represent the location and temporal distribution of water surfaces at the global scale over the past 4 decades and provide statistics on the extent and change of those water surfaces. *These two datasets were merged into one variable to extend the time range.*
- Inland Waters Surface Density - obtained from Global Lakes and Wetlands Database (data dated 2025, 500m/pix), a comprehensive and seamless global map of inland surface waters distinguished into 33 waterbody and wetland types.
- River Basins Physical Risks - obtained from the physical risk data from Water Risk Filter (data dated 2024) that represent both natural and human-induced conditions of river basins. It comprises four risk categories covering different aspects of physical risks: water availability, drought, flooding, water quality, and ecosystem services status. Therefore, physical risks account for conditions where water is too little, too much, unfit for use, and/or the surrounding ecosystems are degraded in turn negatively impacting water ecosystem services.
- Glaciers - derived from the Global Land Ice Measurements from Space (GLIMS) Glacier database (data dated 2005) provides comprehensive data on more than 200,000 glaciers worldwide.
- Global Ocean - extracted from a global land/water mask for satellite ocean color studies in a medium resolution (data dated 2021, ~230 m). *Only an ocean mask was taken for this study.*

1.6. Indigenous Peoples' Territories and Local Communities' Territories

The primary element of Indigenous Peoples' territories and local community territories is treated as **a precautionary overarching '*Restricted Area requiring Free Prior Informed Consent*' (RA-FPIC).** While there is emerging global and national data on IP territories and waters, and local community territories and waters *(e.g. Indigenous Region Registration Agency, 2025; Native Land Digital, 2025, Terras Indigenas Brazil, Indonesian Indigenous Lands Registration Agency)* it is still incomplete and inconsistent. Thus it may be misleading to map only partial or incorrect data sets as it could be wrongly interpreted that, because areas do not appear on the map as IP territories or local community territories, these areas are not registered or claimed territories (meaning it could lead to disrespecting these territorial rights). Furthermore, to display publicly these data sets of the IP territories and local community territories requires their Free Prior and Informed Consent.

Therefore, to take the strongest position possible on respecting IP territories and local community territories, as well as applying the precautionary approach, **all lands are assumed and considered as a '*Restricted Area requiring FPIC' (RA-FPIC)***. Data on any IP territories and local community territories are not displayed in the global map. However, Indigenous Peoples' lands that are considered protected or conservation areas[4], or the territories of Indigenous Peoples in voluntary isolation or initial contact (where data exists, such as the Hongana Manyawa in Indonesia) are included in protected areas data layer.

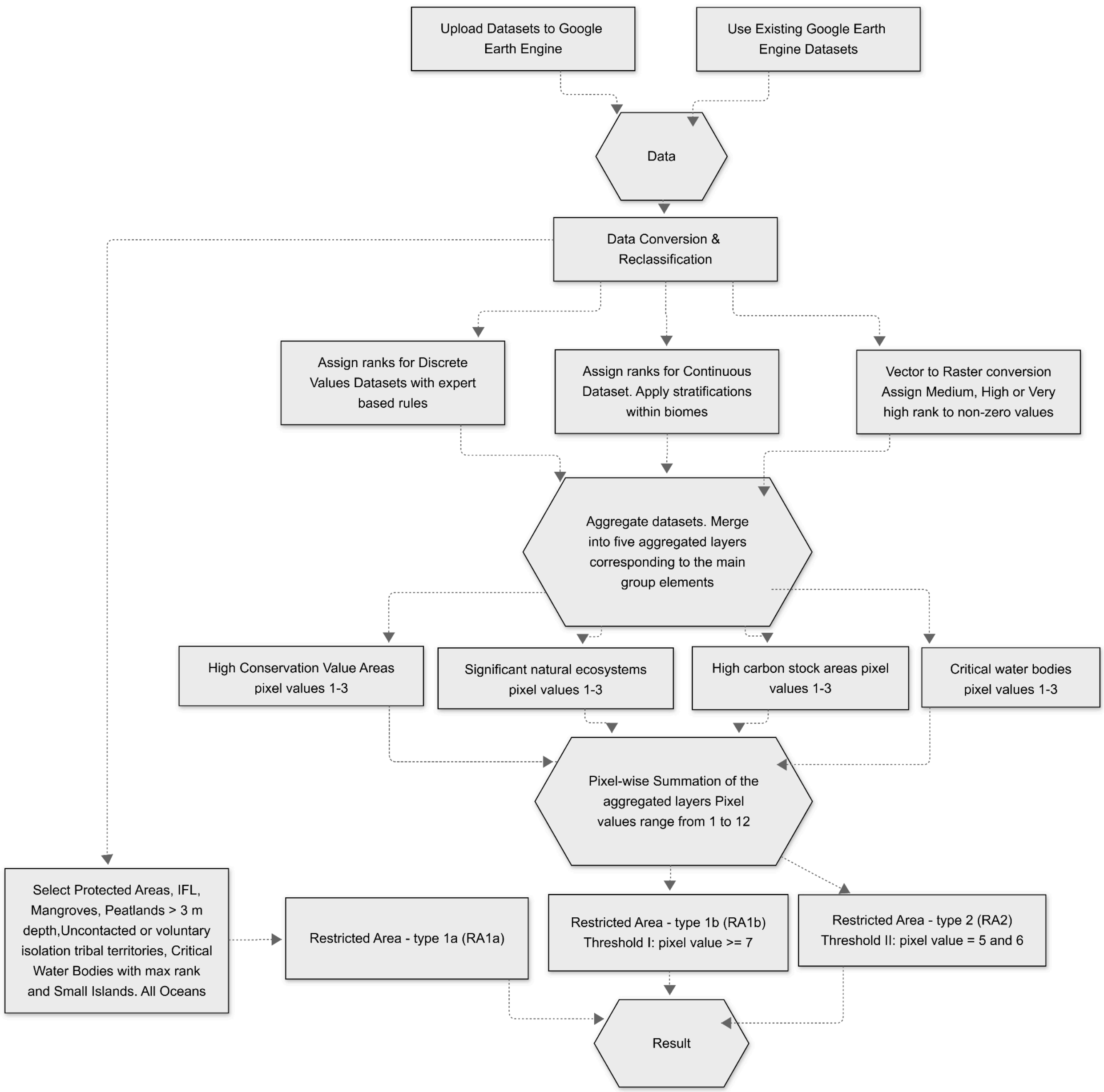
In some countries where there are more complete and verified IP territory data sets such as *Terras Indigenas*, as well as those of local communities, and after consultation with and consent from IP organisations, this data could be included for national or regional level Restricted Area maps and analysis.

2. Methods

To perform the analysis, we transformed the quantitative and qualitative metrics into comparable normalised raster layers with the same spatial resolution and projection. Normalisation includes reclassification to three classes - *Medium, High, Very High* - reflecting the importance of each metric. We then aggregated normalised datasets in groups referred to Restricted Areas criteria picking maximum value for each cell. At the later stage all aggregated layers were combined into a single, comprehensive layer. Each cell in this final layer was assigned one of three restriction types, corresponding to the three categories of restriction described in *Section 2.4: Restricted Areas Map*.

We used Google Earth Engine (GEE) as a platform for global datasets processing and analysis. GEE application with analytical tools was developed for testing and choosing the appropriate parameters. The overall scheme of analysis applied for land ecosystems is shown on Picture 2.

[4] E.g. the demarcated territories of Indigenous Peoples in Brazil (Terras Indigena) are included in the World Database on Protected Areas (UNEP, WCMC and IUCN 2025) data set of protected areas.



Picture 2. *Data analysis scheme*

2.1. Data preprocessing

To extract quantitative parameters from all spatial datasets, we converted them into the global raster layers in geographic coordinates (EPSG:3426 WGS84) with the same spatial resolution of 0.0025 degree/pixel (about 300 m at the equator). Vector reference maps were converted to the same raster format and reprojected. All further computations were performed using these raster datasets.

For some dataset preprocessing include extraction of the proposed metric, for example, a steep slope layer was obtained using a threshold of value ≥ 21 degree from a worldwide digital elevation model data or we extracted particular classes of data, like mangroves from the Natural Lands dataset. Details of preprocessing for each layer shown in Annex 1.

2.2. Reclassification of variables

To make consistent and comparable layers we reclassified all data using ranking *Medium / High / Very high* (*pixel value = 1, 2, or 3* respectively). Details of reclassification and stratification for each variable is shown in Annex 1.

For *binary* datasets a rank according to their importance was assigned to all non-zero values.

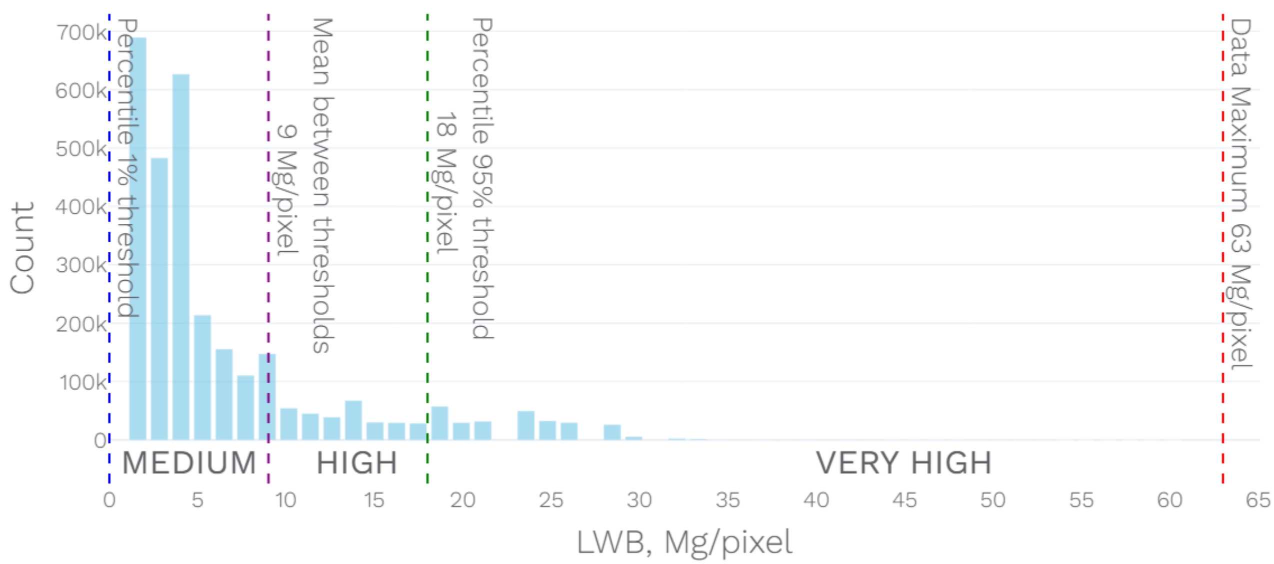
Discrete layers were manually reclassified for class importance/class description and converted to ranked dataset.

For *continuous* datasets, all values were assigned to three ranked classes with the values above 95th percentile representing the maximum rank value (*Very high*). Values below maximum rank threshold were equally splitted into two other classes *Medium and High.* This scaling minimises the impact of extreme values from the overall distribution on the thresholds selection. Sensitivity tests have not yet been carried on using the 95th percentile vs a different percentile.

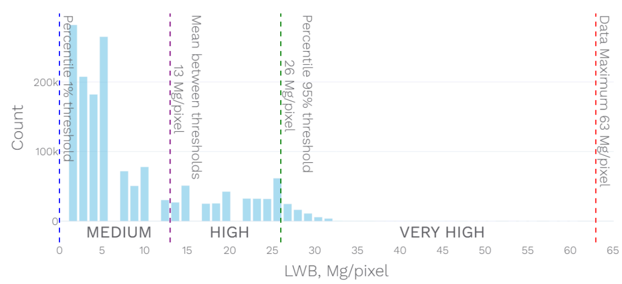
For some continuous datasets, in addition to the analysis across the *Whole extent*, we applied an additional stratification based on natural biomes following *Mazur et al., 2025.* Specifically, within two biomes - *Forest* and *Short Vegetation -* the minimum and maximum ranks were estimated separately. All derived layers were then used as independent variables. In some cases, we also applied a *Natural Areas* mask based on the same dataset *(Mazur et al., 2025)*, which includes all *Forests, Short Vegetation, Water, Bare, and Snow* classes.

For example, the Aboveground Live Woody Biomass (LWB) dataset was classified into three categories in the whole dataset extent (Picture 3): *Medium (0 < LWB < 9 Mg/pix), High (9 ≤LWB < 18 Mg/pix), and Very high (18 ≤ LWB ≤ 63).* The same LWB dataset was additionally reclassified separately for forests and short vegetation biomes. This additional step allows us to highlight not only pixels with maximum value of carbon stock but also maximum values of carbon stock in particular biome. As shown in Picture 3, the differentiation between ecosystems becomes apparent: forest biomes display a much wider spread of biomass values, while short-vegetation biomes are concentrated at the lower end of the scale. These results demonstrate how reclassification through stratification not only makes datasets comparable but also preserves ecological relevance, allowing for consistent ranking across diverse environments.

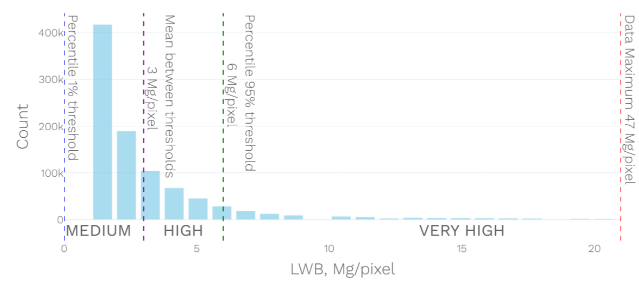
A.



B.



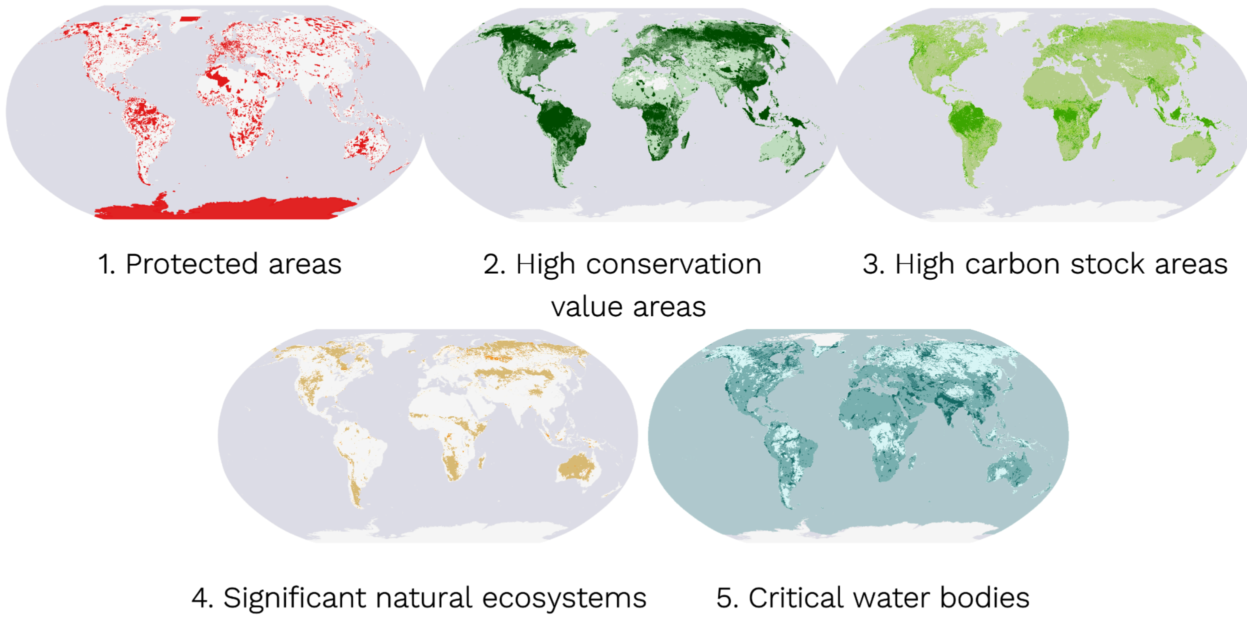
C.



Picture 3. *Aboveground Live Woody Biomass (LWB) distribution in Whole extent (A) and by biomes: Forest (B) and Short vegetation (C)*

2.3. Aggregated layers

Reclassified variables were merged into five aggregated layers corresponding to the main Restricted Areas (RA) elements (Table 1; i.e. Protected Areas, High Conservation Value Areas, High Carbon Stock Areas, etc). For each aggregated layer, pixels with the maximum rank value across all datasets in the respective group were selected. The resulting values in each aggregated layer were thus categorised into three classes: *Medium (pixel value = 1)*, *High (pixel value = 2)*, and *Very High (pixel value = 3)*. Aggregated layers shown on Picture 4.



Picture 4. *Aggregated layers according to each Restricted Areas element and ranked with three classes. Global Ocean on Map 5 (Critical Water Bodies) is shown in a lighter color for better visualisation*

2.4. Restricted Areas map

The critical element of Indigenous Peoples' territories and local community territories is treated as **a precautionary overarching '*Restricted Area requiring Free Prior Informed Consent*' (RA-FPIC)** covering all countries, meaning that the first step is to identify if there are IP or applicable local community rights, presence, tenure or claims, and if so, apply FPIC. However, due to a lack of complete and consistent data sets, these territorial and water areas are not specifically displayed.

Then there are three types of Restricted Areas that are generated through combining all aggregated data layers, with each being defined according to slightly different criteria.

a) Firstly, we defined **Restricted Areas - type 1a (RA1a)**. These are all areas that due to their critical importance should be ***off-limits to mining by default***, including: all Indigenous Peoples' lands that are considered protected or conservation areas[5], or the territories of Indigenous Peoples in voluntary isolation or initial contact (where data exists, such as the Hongana Manyawa in Indonesia), Protected Areas including IUCN

[5] E.g. the demarcated territories of Indigenous Peoples in Brazil (Terras Indigena) are included in the World Database on Protected Areas (UNEP, WCMC and IUCN 2025) data set of protected areas.

protected area categories I-VI, Indigenous Protected Areas (IPAs) and Indigenous and Community Conserved Areas (ICCAs), World Heritage Areas, Ramsar sites, Antarctica, UNESCO Global Geoparks and Biosphere Reserves; Intact Forest Landscapes, areas of deep peat (>3m), mangroves, small islands, and most of the critical water bodies with very high rank of importance, including the Global Ocean (see Annex 1). These areas were identified across all aggregated layers regardless of their cumulative (summative) values and combined into a single class (RA1a). There are no additional masks applied for these areas. They were then excluded from further classification in subsequent analysis.

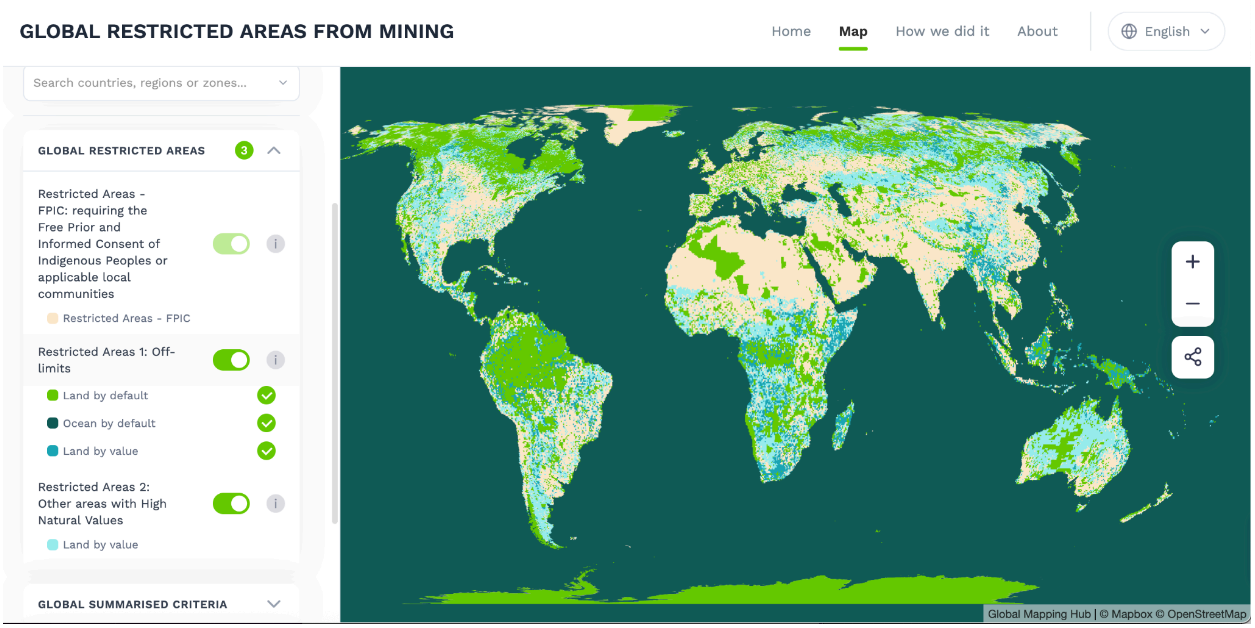
b) **Restricted Areas 1b:** After RA1a analysis we summarised the rest of the aggregated layers. Each aggregated layer containing pixel-wise rankings from 1 to 3, were first combined through pixel-wise summation to create a composite layer with values ranging from 1 to 12.

   A threshold value of 7 was then selected based on it capturing a pixel that has at least one layer with very high value ranking (*pixel value = 3*) and one layer with high value ranking (*pixel value* = *2*) or three or more with high rankings (*pixel value* = *2*). Applied to this composite raster, this produces a binary map (*pixel value ≥ 7*) which additionally was cropped with natural lands mask *(Mazur et al., 2025)*. We defined them as **Restricted Area - type 1b (RA1b)**. These are areas that due to their combination of **high natural values** should also be ***off-limits to mining by value**.* Having multiple combinations of both very high and high values was considered sufficient justification for this categorisation. In other words, these areas have a combined value of ≥ 7 according to the four aggregated layers / Restricted Areas criteria of: High Conservation Value areas, High Carbon Stock areas, Significant Natural Ecosystems, and Critical Water Bodies.

c) The last, **Restricted Area - type 2 (RA2),** also based on values**,** is defined from the same layers but with a lower summative pixel value, in this case not less than 5 (*5 ≤ pixel value* < *7*) which additionally was cropped with natural lands mask *(Mazur et al., 2025)*. We consider these areas with combinations of very high, high or moderately high natural values as still important and considered as ***additional areas of high sensitivity or other areas with high natural values***, based on the presence of High Conservation Value areas, High Carbon Stock areas, Significant Natural Ecosystems and Critical Water Bodies.

   As an important note and caution, these RA2 areas in particular require additional local site-specific higher resolution data or assessments with input from local experts, including Indigenous Peoples, to both assess and identify clearly the values and then, through applying the precautionary approach, determine additional areas that should be off-limits and designated for protection.

The Global Restricted Areas map is presented in Picture 5.



Picture 5. *Resulting Global Restricted Areas from mining.*

d) **'Hotspot' Layer of Restricted Area overlap with mining and mineral areas**:
To evaluate the overlap of mining with Restricted Areas, data from Maus (2026) were harmonized and integrated with the "Reserves Proxy Areas" mapping from Teske et al. (2026). A contiguous hexagonal grid was developed (in the WGS84 geographic coordinate system, with all areas calculated as geodetic areas on the WGS84 ellipsoid to avoid projection-related distortions. The grid had a cell resolution of 0.1 decimal degrees (an approximate 5 km radius) to serve as the standardized unit of analysis.

Within each discrete hexagonal cell, spatial overlap measurements quantify five normalized areal proportions constrained between 0 and 1: i) the fractional area of Restricted Areas 1 (*pRA1*), ii) the fractional area of Restricted Areas 2 (*pRA2*), iii) the spatial overlap between Restricted Area 1 and mining polygons (*ovlRA1*), iv) the spatial overlap between Restricted Area 2 and mining polygons (*ovlRA2*), and v) the total fractional area occupied by mining activities (*pMine*).

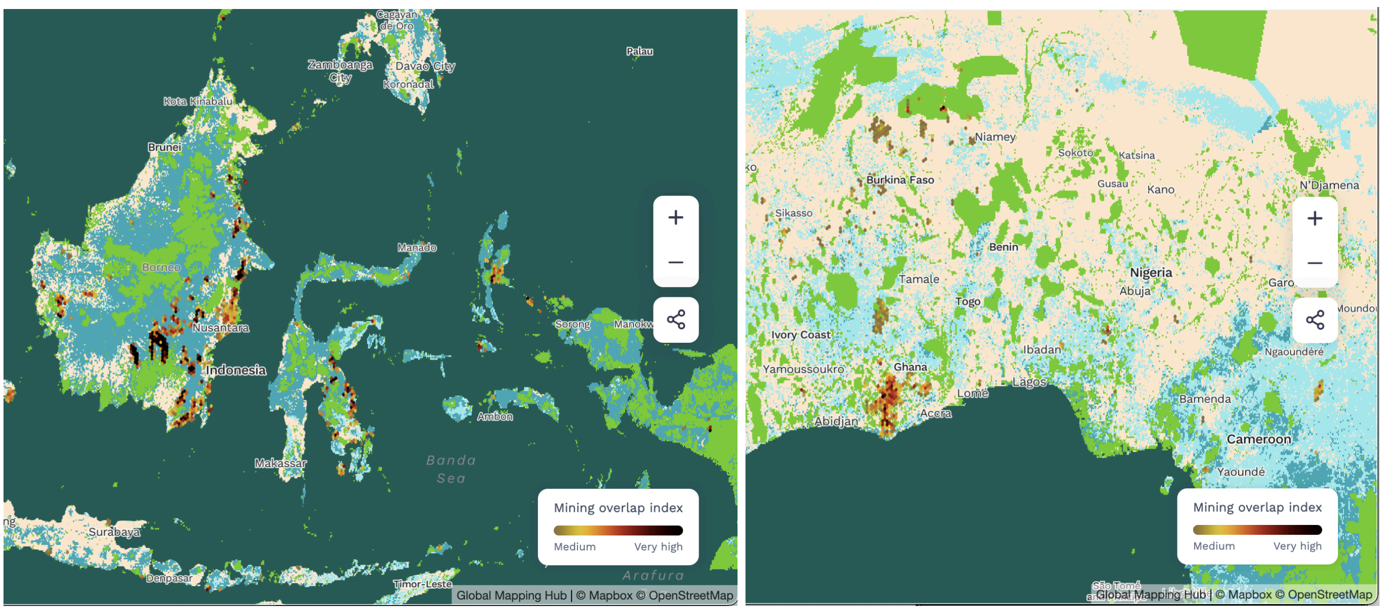
To evaluate cumulative spatial vulnerability and exposure, these distinct dimensions were compiled into an "overlap index" normalized by the localized mining footprint. The final rating, which yields a value range bounded between 0 and 3, was mathematically formulated for each individual grid cell using the following equation:

$$\text{Final\_rating (overlap index)} = (pRA1 + pRA2 + (ovlRA1 * 2) + ovlRA2) * pMine$$

The overlap index is displayed in a continuous color ramp showing geospatial “hot spots”, effectively highlighting geographic regions where current and potential future mining activities pose a high risk to the integrity of Restricted Areas 1 and 2.

The overlap index is highlighted for 13 specific raw materials of concern for this version: Aluminum (Bauxite), Coal, Cobalt, Copper, Gold, Graphite, Iron, Lithium, Manganese, Nickel, Phosphate, Rare Earths (including Neodymium and Dysprosium), and Vanadium. These raw materials were selected either due to their role in energy transition technologies, or because of their high inherent risk profiles, as outlined by Maus (2026).

Given the global scale of this analysis, some raw materials may be misclassified within the grid hexagons. Where such inaccuracies were identified, this source data was removed from the map. Common misclassifications amongst the 13 raw materials include peat extraction, oil and gas developments, and aggregate or industrial minerals mining. Consequently, local verifications remain a crucial step in accurately identifying the drivers of mining activity in any specific region.



***Picture 6**: Hotspot map of mining area overlap with Restricted Areas 1 and 2.*

3. Results and Discussion

Initial results of the analysis of the aggregated layers based on the six criteria using the Google Earth Engine platform were consulted on with allies, experts, and different Greenpeace offices. Input and feedback that was received was incorporated into the methodology and the presentation of the Restricted Areas. Key questions for the consultation included: what should the threshold be for the aggregated composite layer for the four values criteria, should this layer be considered ‘No Go’/off limits or simply categorised as ‘high risk’ or ‘high priority for protection’, do the data sources capture all the key values, and should all marine areas be a ‘No Go’/off limits zone. Following this, a validation process was carried out in two countries with very different contexts to check the global data against local data sets and local knowledge. Finally, additional consultation workshops were held in Indonesia and Brazil with local NGOs. Below, the general outcome of the global Restricted Area mapping is discussed, including its relevance and adjustment at a national level and the results of the validation process, as well as the strengths and limitations of the approach taken.

Additionally, in response to feedback and requests during the consultation process for a ‘hotspot’ layer that shows the overlap of mining areas with Restricted Areas 1 & 2, this analysis and layer was added. Also, while this global map is not able to show the overlap and possible threat to IP territories or those of local communities (other than those included in RA1a), there are examples of global research and mapping, including Owens et. al. (2022),[6] Kennedy et. al. (2023),[7] and regional ones such as InfoAmazonia, that have attempted to do this.

Additionally on the essential requirement of FPIC for Indigenous Peoples’ territories and applicable local communities (RA-FPIC) that is the primary layer in this map, there is considerable global guidance and documentation to support it, including, Sirge Coalition FPIC Guide[8], FAO Governance of Tenure Technical Guide 3 (2014)[9], Initiative for Responsible Mining Assurance (IRMA) *Supplementary Guidance on Indigenous Peoples and Free, Prior, and Informed Consent* (2025)[10], and the Aluminum Stewardship Initiative (ASI) guidance (2025)[11].

3.1. Global and national level of mapping

The Restricted Areas map represents a global-scale framework for identifying areas where mining poses unacceptable risks to climate stability, biodiversity and natural ecosystems, and people. This global framework and map is based on internationally available datasets that meet the criteria of: scientific reliability, openness, spatial resolution, and global consistency. It uniquely compiles these datasets for critical areas and values and acts as a common reference

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[6] Owens et. al., 2022. Energy transition minerals and their intersection with land-connected peoples. *Nature Sustainability* **volume 6**, pages 203–211 (2023). https://www.nature.com/articles/s41893-022-00994-6#Bib1

[7] Kennedy et. al. 2023. Indigenous Peoples’ lands are threatened by industrial development; conversion risk assessment reveals need to support Indigenous stewardship. *Science Direct*. https://www.sciencedirect.com/science/article/pii/S2590332223003408

[8] https://www.sirgecoalition.org/fpic-guide ;

[9] https://wp.aippnet.org/wp-content/uploads/2020/03/8-FAO-Respecting-FPIC.pdf

[10] https://responsiblemining.net/wp-content/uploads/2025/03/IRMA-Standard-v1.0-Supplementary-Guidance-Indigenous-FPIC-v202503-EN.pdf

[11] https://aluminium-stewardship.org/wp-content/uploads/2025/04/FPIC-A-Guidance-Document-for-Indigenous-Peoples-V1-22.04.25.pdf

point for consideration of mining at the planetary-scale, ensuring that decisions align with the urgent need to stay within the 1.5°C climate limit, safeguard biodiversity and natural ecosystems, and respect Indigenous Peoples' rights as well as those of local communities'.

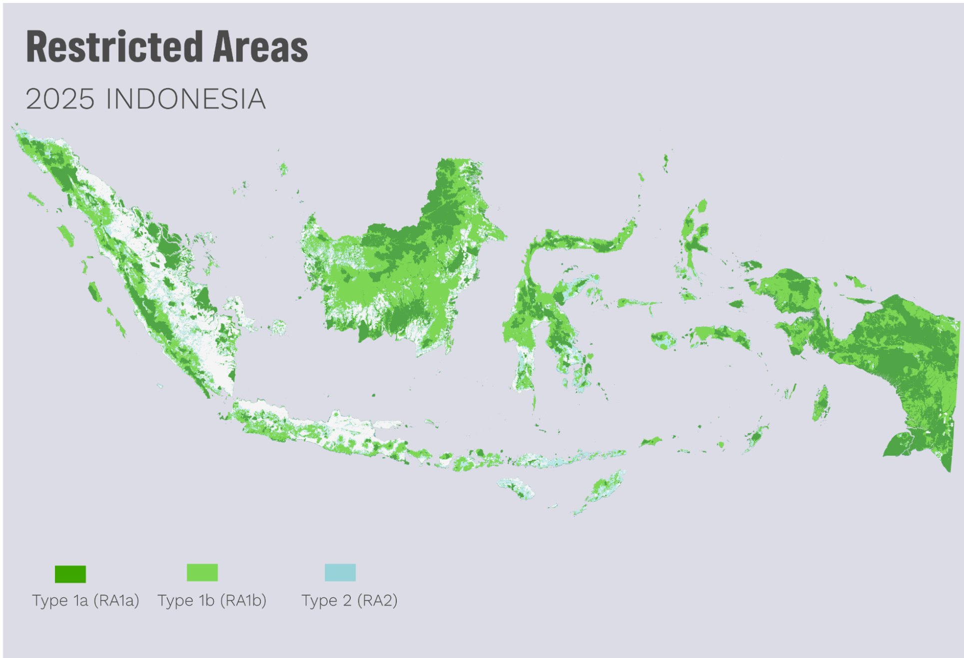
However, global-scale datasets have inherent limitations for decision-making at the national or local level. Their resolution and generalisation cannot fully capture local ecological conditions and environmental values, or more recent data that might be available within individual countries. Additionally, there are very few complete data sets on Indigenous Peoples' territories or local community territories. Therefore, while the **global Restricted Areas map provides a strong baseline, it is not intended to replace local assessment and local expert input**, especially from Indigenous Peoples, as well as consultation for operational decision-making.

Local maps can be created by applying the same methodology to integrate higher-resolution or more up-to-date national datasets, such as detailed habitat maps, national protected area registers, indigenous land boundaries, or local biodiversity surveys. Any additional datasets can be assigned to the relevant criteria (e.g. significant natural ecosystems or carbon storage) and classified into the 1-3 importance scale. As the methodology aggregates normalised layers, there is no limitation on how many additional local datasets can be included - each will contribute proportionally to the final integrated layers.

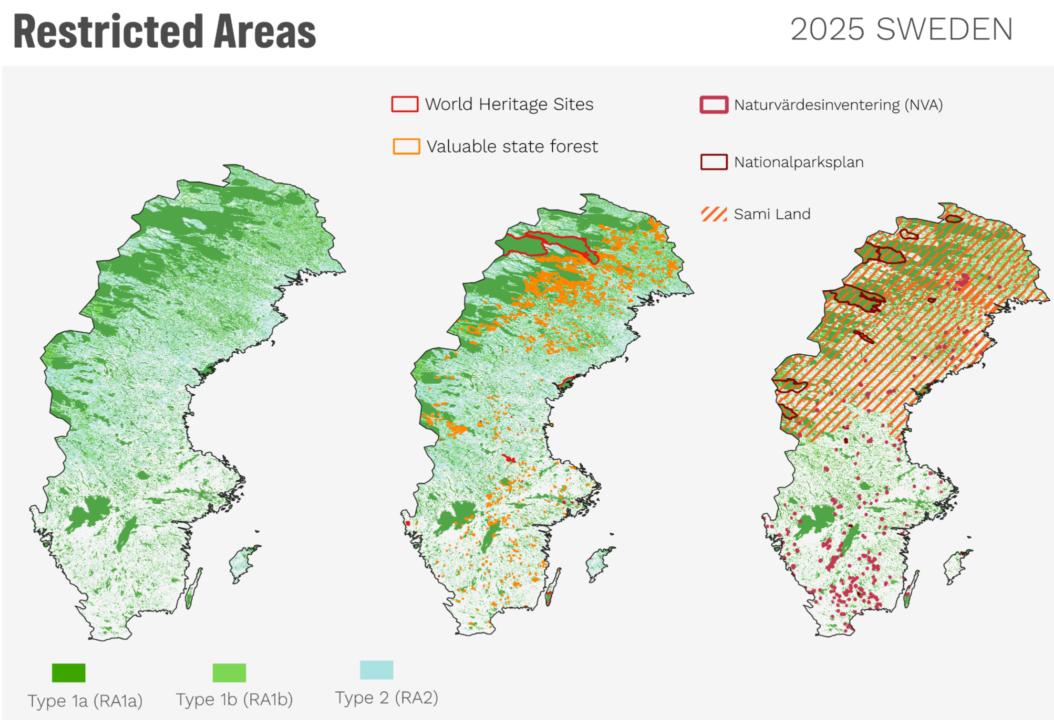
In particular due to the spatial resolution of the global map being approximately 300m x 300m, the determination of the exact boundaries for the different RA areas of off-limits to mining by default (RA1a), off-limits to mining by value (RA1b), and other restricted areas with high natural values (RA2), can be verified and adjusted according to the national, regional and local data, assessments and experts' knowledge.

The result would be a local Restricted Areas map that mirrors the structure of the global one, but with enhanced resolution and context-specific data that improves the local level accuracy. Greenpeace offices, partner organisations, and local experts are encouraged to suggest and contribute additional datasets based on their expertise and knowledge of local landscapes. In this way, the global framework serves as a foundation, while local maps provide the necessary detail to support informed decision-making, advocacy, and policy at the country or regional level.

A comparison with national data was carried out for Indonesia (Picture 7) and Sweden (Picture 8) to validate the global data and determine if there is additional national level data needed. Overall in both cases the global data sets represented well the national level data, within the limitations highlighted above of data resolution, generalisation, and date. In Indonesia small islands data was highlighted as an important data set, in part due to the national legal framework, and after consideration as result small island data was subsequently added to the global data sets. In Sweden the Sámi territory was used as a key data set for testing, as this was a complete, publicly available and validated data set of Indigenous Peoples' national territories but was not added to the global map. Such a dataset would be more appropriate to be included as part of a specific national/regional level Restricted Area map and layer requiring FPIC.



Picture 7. *Restricted Areas map - focused on Indonesia. The Ocean is not colored for better visualisation*



Picture 8. *Restricted Areas map - focused on Sweden. The Ocean is not colored for better visualisation*

3.2. Strengths and Limitations of the approaches for Restricted Areas mapping

The Restricted Areas mapping approach provides a useful global framework and screening tool for identifying areas that, due to their critical environmental, ecological, natural and/or social significance, should be considered restricted or off-limits for mining. By adding the hotspot analysis showing the overlap of mining with Restricted Areas 1 & 2, the map also provides an indication where mining may conflict with the protection of critical environmental, ecological, natural areas and values that are essential to not breaching further key planetary boundaries.

This methodology should be seen as a unique approach that, for the first time, compiles and analyses established and credible data sets on Restricted Areas in relation to the threat of the rapid expansion of raw material mining. It should be viewed as indicative at a landscape level rather than definitive at an operational or land use level, and is a methodological starting point that can be further tested, strengthened, adjusted, and expanded as needed. Moreover, this general method is scalable and designed to adapt and incorporate more detailed national, regional, and local data and maps.

It is important to note the following limitations to ensure appropriate interpretation and use of the map:

Data gaps and accuracy: The analysis relies on global datasets, which vary in detail, quality, and coverage - there are some gaps and inconsistencies in available data. In some parts of the world, data is missing, outdated, or too coarse to reflect local realities. This means that certain important areas - such as sites of ecosystem significance, localised biodiversity hotspots, or specific biodiversity habitats - may not be fully captured due to a lack of standardised, global-scale data. For example, remote sensing-derived land cover products often include misclassification errors, and slope models may be subject to topographic smoothing. The method excludes some data sets such as on population, residential areas, local ordinances, agricultural lands, climate vulnerability data (e.g., floods and landslides), and conflict areas, with the exception of protected areas that may include urban/residential areas. Many of the datasets used do not cover Arctic and Antarctic regions.

Simplification challenges: To achieve comparability, input layers were normalised and reclassified using percentile-based ranking for continuous data and expert-informed binary categorisation for discrete data. While this simplification was necessary for data harmonisation, it introduces subjectivity and may reduce the richness of original classifications. For certain environmental data, we adjusted analysis by ecological zones (biomes) to avoid unfairly penalizing some ecosystems, for example forests. While this improves balance at the global scale, it cannot fully account for local environmental variation or the unique importance of specific landscapes. Although informed by expert knowledge, the chosen approach may not align with policy-relevant or ecologically critical thresholds.

It must also be noted that:

- There is an overarching Restricted Areas classification requiring the Free, Prior, and Informed Consent of Indigenous Peoples or applicable local communities (RA-FPIC) which covers all countries. Due to a lack of complete data sets, these territorial and water areas are not specifically displayed.
- The Global Restricted Areas Map should be viewed as a global screening tool that provides indicative information on off-limits areas at landscape scale, not a final decision-making product. Site-specific and local data and assessments, expert input, rightsholder and stakeholder consultation are essential before any land-use decisions are made.
- The map is based on best-available global data from a range of credible and public sources. The NGOs behind this framework and map did not collect or use their own data for this map. The map's geographical base data such as country areas (linked under 'data sources') are not endorsed by the makers of this map.
- And importantly, the Restricted Areas map does not give a 'green light' or endorse mining activities outside of particular indicative RA1a&b (off-limits) areas. RA2 areas contain high values and following local assessments, expert input and stakeholder consultation may also be found to be required as off-limits. Additionally areas outside

of ‘off-limits’ areas may contain high values and must undergo comprehensive and strict environmental and social assessments and screening, including local assessment, prior to any mining development, and also of course primarily require FPIC for any consideration of mining development.

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Annexes

ANNEX 1. Preprocessing and classification details for datasets

Data	**Preprocessing and reclassification notes**	**Final Rank**	**Proposed Restricted Area**
Protected Areas World Heritage Sites Ramsar Sites	• *Select from source appropriate protected area types* • *Reproject to raster with ground level resolution 300 m/pixel* • *Assign maximum rank value = 3*	VERY HIGH	RA1a
Antarctica	• *Select from source appropriate protected area types* • *Reproject to raster with ground level resolution 300 m/pixel* • *Assign maximum rank value = 3*	VERY HIGH	RA1a
Intact Forest Landscapes	• *Reproject to raster with ground level resolution 300 m/pixel* • *Assign maximum rank value = 3*	VERY HIGH	RA1a
Key Biodiversity Areas	• *Reproject to raster with ground level resolution 300 m/pixel* • *Assign maximum rank value = 3*	VERY HIGH	RA1b

Data	Preprocessing and reclassification notes	Final Rank	Proposed Restricted Area
Important Bird and Biodiversity Areas	• *Reproject to raster with ground level resolution 300 m/pixel* • *Assign maximum rank value = 3*	VERY HIGH	RA1b
Relative Species Richness	• *Due to low resolution of source dataset (~3km/pixel) we used WWF Hydro Atlas (Linke et al., 2019) to assign each value from source dataset to basin used* `MEAN` *as aggregation function at scale 300 m/pixel* • *Result was converted to raster and reproject with ground level resolution 300 m/pixel* • *Reclassify to 3 rank classes using 1-95 percentiles range for min/max for whole data extent*	MEDIUM HIGH VERY HIGH	RA1b & RA2
Plants Species Richness	• *Due to low resolution of source dataset (~1km/pixel) we used WWF Hydro Atlas (Linke et al., 2019) to assign each value from source dataset to basin used* `MEAN` *as aggregation function at scale 300 m/pixel* • *Result was converted to raster and reproject with ground level resolution 300 m/pixel* • *Reclassify to 3 rank classes using 1-95 percentiles range for min/max for whole data extent*	MEDIUM HIGH VERY HIGH	RA1b and RA2
Forest Integrity Index	• *Reproject to raster with ground level resolution 300 m/pixel* • *Reclassify to 3 rank classes using 1-95 percentiles range for min/max for a) whole extent, b) forests and c) short vegetation biomes strata*	MEDIUM HIGH VERY HIGH	RA1b and RA2
Above Ground Live Woody Biomass	• *Reproject to raster with ground level resolution 300 m/pixel*	MEDIUM HIGH VERY HIGH	RA1b and RA2

Data	Preprocessing and reclassification notes	Final Rank	Proposed Restricted Area
	● *Reclassify to 3 rank classes using 1-95 percentiles range for min/max for a) whole extent, b) forests and c) short vegetation biomes strata*		
Aboveground and Belowground Biomass Carbon Density	● *Reproject to raster with ground level resolution 300 m/pixel* ● *Reclassify to 3 rank classes using 1-95 percentiles range for min/max for a) whole extent, b) forests and c) short vegetation biomes strata*	MEDIUM HIGH VERY HIGH	RA1b and RA2
Peatlands Carbon Stock	● *Reproject to raster with ground level resolution 300 m/pixel* ● *Reclassify to 3 rank classes using 1-95 percentiles range for min/max for whole extent*	MEDIUM HIGH VERY HIGH	RA1b and RA2
Peatlands Thickness	● *Reproject to raster with ground level resolution 300 m/pixel* ● *Reclassify to 3 rank classes using 1-95 percentiles range for min/max for a) whole extent, b) forests and c) short vegetation biomes strata* ● *Select more than* `3m` *depth for Type Ia*	MEDIUM HIGH VERY HIGH	RA1aa (> 3m) RA1b and RA2
Mangroves	● *Select from source all pixels with* `Mangrove` *class* ● *Reproject to raster with ground level resolution 300 m/pixel* ● *Assign maximum rank value = 3* ● *Crop data with natural areas (Natural Lands layer)*	VERY HIGH	RA1a
Wetlands	● *Select from source wetlands classes and assign ranks:* `'swamp=3','marsh=3','flooded flat=1','saline=3','salt marsh=3','tidal flat=2'` ● *Reproject to raster with ground level resolution 300 m/pixel*	MEDIUM HIGH VERY HIGH	RA1b and RA2

Data	Preprocessing and reclassification notes	Final Rank	Proposed Restricted Area
	• *Crop data with natural areas (Natural Lands layer)*		
Grasslands	• *Select from source pixels with* `Probability>50` • *Reproject to raster with ground level resolution 300 m/pixel* • *Assign rank value =2* • *Crop data with natural areas (Natural Lands layer)*	HIGH	RA1b and RA2
Small Islands	• *Select all islands less than* `20,000 ha` *from the source data* • *Reproject to raster with ground level resolution 300 m/pixel* • *Assign rank value = 3*	VERY HIGH	RA1a
Steep Slopes	• *Select from source pixels with slope* `> 20 degree` • *Reproject to raster with ground level resolution 300 m/pixel* • *Reclassify to 3 rank classes using 1-95 percentiles range for min/max for whole extent*	MEDIUM HIGH VERY HIGH	RA1b and RA2
Permanent and Natural Waters	• *Reproject to rasters with ground level resolution 300 m/pixel* • *Reclassify the first dataset to 3 rank classes using assign ranks :* `'Permanent Water=3','Water loss=3','Water gain=0','Lost seasonal=3','Stable seasonal=3','High frequency=3'` • *Reclassify the second dataset to 3 rank classes using assign ranks :* `'Permanent=3','Lost permanent=3','New permanent=0','Lost permanent=3','Seasonal=3','Ephemeral=3'` • *Merge two resulting layers*	VERY HIGH	RA1a

Data	**Preprocessing and reclassification notes**	**Final Rank**	**Proposed Restricted Area**
	• *Crop with natural areas (Natural Lands layer)*		
Inland Waters Surface Density	• *Reproject to raster with ground level resolution 300 m/pixel* • *Reclassify to 3 rank classes using 1-95 percentiles range for min/max for whole extent* • *Class 3 was cropped with natural areas (Natural Lands layer)*	MEDIUM HIGH VERY HIGH	RA1a (very high), RA1b and RA2
River Basins Physical Risks	• *Reproject to raster with ground level resolution 300 m/pixel* • *Reclassify source risk map to 3 ranks classes using assign ranks:* `'1,2,3=1', '4,5,6=2', '7,8,9,10=3'` • *Class 3 was cropped with natural areas (Natural Lands layer)*	MEDIUM HIGH VERY HIGH	RA1b and RA2
Glaciers	• *Reproject to raster with ground level resolution 300 m/pixel* • *Assign maximum rank value = 3*	VERY HIGH	RA1a
Global Ocean	• *Reproject to raster with ground level resolution 300 m/pixel* • *Assign minimum rank value = 3*	VERY HIGH	RA1a
Natural Lands	• *Twenty one source classes were reduced to five:* `1=Forests, 2=Short Vegetation, 3=Water, 4=Bare, 5=Snow` • *Used in stratification for masks creation. Select class 1 to produce Forest mask, select class 2 to produce Short Vegetation mask, select classes 1-5 to produce Natural areas class* • *Reproject to raster with ground level resolution 300 m/pixel*	-	
Hongana-Manyawa voluntary isolation tribal territory	• *Reproject to raster with ground level resolution 300 m/pixel* • *Assign maximum rank value = 3*	VERY HIGH	RA1a