# ATLANTIC SPATIAL: a data set of landscape, topographic, hydrologic and anthropogenic metrics for the Atlantic Forest

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## Open Research statement

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## Introduction

In ecology, space matters. Space affects the main drivers of biodiversity, since it regulates the underlying processes affecting the distribution and dynamics of species (Fletcher and Fortin 2018). These ecological processes, such as environmental filtering, biotic interactions, dispersal and ecological drift drive the response of organisms to environmental factors such as climate, topography, land use and land cover (LULC), soil types and habitat connectivity and heterogeneity (Anderle et al. 2022, Messager et al. 2023). Thus, space is a fundamental component in the face of rapid effects of climate and LULC changes at local and global scales, as well as their widespread consequences for habitat loss and fragmentation (Jetz et al. 2007, He et al. 2019, Williams and Newbold 2020). Having available geospatial environmental data is essential to assess these effects at different spatial and temporal scales, extents and grains (e.g., Lima-Ribeiro 2015, Vega et al. 2017, Fick and Hijmans 2017, Souza et al. 2020, Karger et al. 2020, Poggio et al. 2021, Potapov et al. 2022, Hawker et al. 2022, Hansen et al. 2022, Tang and Werner 2023). Comprehensive spatial data sets are important to address conservation and restoration efforts to maintain biodiversity and their ecological processes (Dirzo et al. 2014, He et al. 2015, Young et al. 2016, Johnson et al. 2017). Ultimately, such data sets would help to unravel frequent ‘spatial complications’ [neglected contribution of space in explaining ecological processes] (Kareiva 1994) in ecology and other geospatial disciplines.

Habitat loss and fragmentation are currently the major threats to biodiversity and ecological processes worldwide (Fahrig 2003, Haddad et al. 2015). Landscapes composition and configuration are essential factors determining biodiversity, population dynamics, species interactions, dispersal and movement, functions the biota perform across the space (Fahrig 2003, Driscoll et al. 2013, Duflot et al. 2017). Besides, different landscape metrics can be used as proxies of landscape heterogeneity to predict biodiversity and ecosystem function (Tonetti et al. 2023). This is especially relevant in fragmented landscapes where natural vegetation fragments are surrounded by different anthropogenic land cover types (Fischer and Lindenmayer 2007, Turner and Gardner 2015). Landscape metrics can also be used in the identification of priority areas for conservation (Tambosi et al. 2014), in addition to predicting species’ potential distribution (Fletcher et al. 2016). Furthermore, these metrics must be computed considering different scales depending on the phenomenon of interest (Jackson and Fahrig 2015, Miguet et al. 2016), and the specific species functional responses to landscape structure (Mimet et al. 2013, Riva and Nielsen 2020).

The Atlantic Forest of South America (AF) is among the global biodiversity hotspots due to its high species richness and endemism associated with severe habitat loss (Myers et al. 2000, Sloan et al. 2014). The AF covers almost the entire coast of Brazil and reaches inland portions of the continent in parts of Paraguay and Argentina, and its vegetation covered over 1.6 million km$^2$ before the European colonization (Marques et al. 2021). Due to its wide longitudinal, latitudinal and altitudinal range, the AF has high environmental heterogeneity with different vegetation types generated mainly by the rainfall distribution, from its coast as Mangrove and Sandy coastal plain vegetation (*restinga*), passing through humid forest (Dense Ombrophilous, Open Ombrophilous, Mixed Ombrophilous), and dry forest formations (Semideciduous and Deciduous Seasonal) (Joly et al. 2014). These geographical characteristics, combined with a large topographic variability and pre-historic process of formation, favored high species diversification rates and endemism (Carnaval et al. 2014, Peres et al. 2020).

The high diversification rate in AF is evidenced by its high biodiversity: it contains almost 18,000 species of plants (Flora e Funga do Brasil 2023); 2,645 species of Tetrapoda (Figueiredo et al. 2021); around 1,000 species of fish (Reis et al. 2016); 1400 species of social insects (Feitosa et al. 2021); more than 2,000 species of butterflies (Iserhard et al. 2017); more than 112,000 species of arachnids (Giupponi et al. 2017); and from 3 to 12 million species of unknown bacteria (Lambais et al. 2006). In addition to its high biodiversity, the AF directly provides ecosystem services for >150 million people, such as water provisioning and regulation, hydroelectric energy generation, food production, pollination, soil protection, climate regulation, carbon storage, air quality and cultural services (Joly et al. 2014, Pires et al. 2021). A great part of the AF biodiversity is highly threatened, especially birds (Bonfim et al. 2021), small mammals (Palmeirim et al. 2019), medium and large mammals (Rios et al. 2021b) and amphibians (Almeida-Gomes and Rocha 2014). Furthermore, ecological processes are also affected by landscape modifications, such as interaction networks (Marjakangas et al. 2020, Monteiro et al. 2022), carbon storage (Bello et al. 2015, de Lima et al. 2020, Pyles et al. 2022) and pollination (Varassin et al. 2021). In addition, other threats to the AF landscapes are defaunation (Galetti et al. 2017, 2021), the introduction of non-native species (Vitule et al. 2021) and climate change (Scarano and Ceotto 2015, Vale et al. 2021).

The AF covers the three countries (Argentina, Brazil and Paraguay) with the largest deforestation areas in the world between 1982 and 2016 (Song et al. 2018). Thus, landscape modifications within the AF have caused impacts reported by a series of studies that still show a warning scenario. Despite a temporal stability of around 28 Mha of forest, a considerable part of this forest is made up of the replacement of old native forests by young forests (Rosa et al. 2021). Furthermore, although recent estimates state that there are around about 23% of forest and 36% of natural vegetation, there is a high fragmentation scenario—97% of fragments are <50 ha, 60% are under edge effect (<90 m), and there is high isolation of vegetation fragments (mean of 250 to 830 m) (Vancine et al. 2023). Moreover, the high density of linear infrastructure (roads and railways) in AF affects the vegetation remnants—especially the large ones (>500,000 ha), proving to have a major negative impact on biodiversity (Cassimiro et al. 2023, Vancine et al. 2023).

The AF is one of the most intensely studied biomes in the world. A large initiative organized by Brazilian researchers – the ATLANTIC SERIES of data papers – have compiled hundreds of thousands of records of occurrence and abundance of animal and plant species in the AF (https://esajournals.onlinelibrary.wiley.com/doi/toc/10.1002/(ISSN)1939-9170.AtlanticPapers). Biodiversity data were collected for decades and have been recently synthesized for AF in numerous data papers from the collection (Bello et al. 2017, Bovendorp et al. 2017, Figueiredo et al. 2017, Lima et al. 2017, Muylaert et al. 2017, Gonçalves et al. 2018a, 2018b, Hasui et al. 2018, Vancine et al. 2018, Santos et al. 2018, Souza et al. 2019, Culot et al. 2019, Ramos et al. 2019, Rodrigues et al. 2019, Silva et al. 2022, Boscolo et al. 2023). These data sets have provided an unprecedented opportunity for the assessment of how environmental conditions and species interactions can predict biodiversity patterns from species to assemblages (e.g. Bovendorp et al. 2019, Palmeirim et al. 2019, Rios et al. 2021b, 2021a, Bonfim et al. 2021). However, such studies rely on a highly variable set of spatial data and require intensive data processing, usually differing in the scale and grain, as well as source and quality.

Here, we present the ATLANTIC SPATIAL data set, where we organize and synthesize spatial data on land cover and land use, landscape, topographic, hydrologic and anthropogenic metrics for the entire AF. Making these data available avoids complex and computationally demanding geoprocessing steps from having to be re-run and allows for different biodiversity studies to be more reproducible and potentially comparable, since they would use as source the same set of spatial data. We present raster maps at 30-m resolution, making it possible to easily integrate spatial and biodiversity data in ecological studies. We provide several metrics derived from different moving window sizes, so that it can be used as effect scales on multiple scale analyses (Jackson and Fahrig 2015). Our aim is to facilitate the use of these layers in a series of studies, within fields such as landscape ecology (Beca et al. 2017, Regolin et al. 2017, Marjakangas et al. 2020, Monteiro et al. 2022), species distribution modeling (SDMs) (Ferro e Silva et al. 2018, Bertassoni et al. 2019, Santos et al. 2020, 2022, Oshima et al. 2021, Tonetti et al. 2022), spatial prioritization (Tambosi et al. 2014, Rosa et al. 2021, Iezzi et al. 2022, Tonetti et al. 2023) and habitat restoration (Melo et al. 2013, Pinto et al. 2014, 2014, Zwiener et al. 2017, Lopes et al. 2022, Piffer et al. 2022, Schweizer et al. 2022, Zupo et al. 2022, Bicudo da Silva et al. 2023). We hope this information enables the integration of biodiversity and environmental data for the AF in ecological studies and expect it to be a common reference to be used as a basis for landscape planning, biodiversity conservation and forest restoration programs.

## METADATA

## Class I. Data set descriptors

### A. Data set identity

**Title**: ATLANTIC SPATIAL: a data set of landscape, topographic, hydrologic and anthropogenic metrics for the Atlantic Forests.

### B. Data set identification code

ATLANTIC_SPATIAL.csv
ATLANTIC_SPATIAL.zip

### C. Data set description

### 1. Originators

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### 2. Abstract

Space is one of the main drivers of biodiversity, once it regulates the underlying processes affecting the distribution and dynamics of species. It is a fundamental factor in face of the rapid climate and land use and land cover changes at local and global scales, which are linked to habitat loss and fragmentation and their impacts on various organisms. The Atlantic Forest of South America (AF) is among the global biodiversity hotspots because of its high species richness and endemism. Most of the threats to the AF biodiversity is due to the expansion of urbanization and industry, extensive agricultural and livestock production and mining. Here, we make available integrated and fine-scale spatial information (resolution = 30 m) for the entire AF extent for the year 2020. The metrics consider different vegetation classes (forest and forest plus other natural vegetation), effects of linear structure (roads and railways) and multiple scales (radius buffer from 50 m to 2,500 m and up to 10 km for some metrics). The entire data set is composed of 500 rasters and the AF delimitation vector, available

through the R package *atlanticr*, which we developed to facilitate the organization and acquisition of the data. The metrics consists of land cover (31 classes), distance to grouped land cover classes (forest vegetation, natural vegetation, pasture, temporary crop, perennial crop, forest plantation, urban areas, mining and water), a set of landscape, topographic and hydrologic metrics and anthropogenic infrastructure. The landscape metrics include landscape morphology (classification as matrix, core, edge, corridor, stepping stone, branch and perforation), fragment area and proportion, area and number of patches, edge and core areas and proportion, structural and functional connectivity (for different organisms' gap-crossing capabilities), distance to fragment edges, fragment perimeter and perimeter-area ratio and landscape diversity. Topographic metrics include elevation, slope, aspect, curvatures and landform elements (peak, ridge, shoulder, spur, slope, hollow, footslope, valley, pit and flat), hydrologic metrics comprise potential springs and its kernel and potential streams and respective distances and anthropogenic infrastructure maps contain roads, railways, protected areas and indigenous territories and the respective distance to each of them. These data sets will allow for efficient integration of biodiversity and environmental data for the AF in future ecological studies, and we expect it to be an important reference and data source for landscape planning, biodiversity conservation and forest restoration programs.

## D. Keywords

Tropical, hotspot, habitat loss, fragmentation, covariates, spatial, rainforest.

## Class II. Research origin descriptors

### A. Overall project description

### 1. Identity

A compilation of spatial covariates data of landscape, topographic, hydrologic and anthropogenic metrics for the entire AF at fine spatial resolution (30-m) for the year 2020.

### 2. Originators

The ATLANTIC SPATIAL project was coordinated by Maurício H. Vancine and Bernardo Brandão Niebuhr at the São Paulo State University (UNESP), and the data set was assembled with help from all the other authors. This is part of ATLANTIC SERIES, which is led by Mauro Galetti and Milton Ribeiro at the São Paulo State University (UNESP).

### 3. Period of study

Data were processed for the year 2020.

## 4. Objectives

The aim of this data paper was to provide a spatial covariates data set of landscape, topographic, hydrologic and anthropogenic metrics for the entire Atlantic Forest (AF) at fine spatial resolution (30-m) for the year 2020.

## 5. Abstract

Same as above.

## 6. Sources of funding

The compilation of this data set was supported by São Paulo Research Foundation (FAPESP) grants #2022/01899-6 (MVH), #2021/02132-8 (JEFO), #2020/11129-8 (EMZ), Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) grants fellowships 88887.513979/2020-00 and 1588183 (MVH) and Conselho Nacional do Desenvolvimento Científico e Tecnológico (CNPq) grants #130909/2020-3 (EMZ). BBN is supported by the Research Council of Norway (Grant #287925) and by the NINA basic funding (Research Council of Norway, Grant #160022/F40). RLM is supported by Bryce Carmine and Anne Carmine (née Percival), through the Massey University Foundation. CHG is a research fellow of the National Council for Scientific and Technological Development - CNPq (grant #311209/2021-1). MCR was supported by FAPESP (processes #2013/50421-2, #2020/01779-5, #2021/08322-3, #2021/08534-0, #2021/10195-0, #2021/10639-5, #2022/10760-1) and CNPq (processes #442147/2020-1, #440145/2022-8, #402765/2021-4, #313016/2021-6, #440145/2022-8) and São Paulo State University - UNESP for their financial support. This study was financed in part by CAPES Brazil – Finance Code 001. This study is also part of the Center for Research on Biodiversity Dynamics and Climate Change, which is financed by FAPESP.

## B. Specific subproject description

### 1. Site description

AF extends from 3ºS to 33ºS, and from 35ºW to 58ºW with ~163 Mha, covering coastal and inland portions of Brazil, Argentina and Paraguay (Marques et al., 2021) (Figure 1). Due to this large extension, the AF boundaries create important ecotones with other vegetation domains such as Cerrado, Caatinga, Chaco and Pampa (Marques et al., 2021). The vegetation from AF is a complex mosaic composed of five main vegetation types—Dense Ombrophilous, Open Ombrophilous, Mixed Ombrophilous, Semideciduous Seasonal and Deciduous Seasonal (Joly et al., 2014). Additionally, the AF also includes mangroves and coastal scrub vegetation (Marques et al., 2021). Furthermore, there are many associated ecosystems such as altitude grasslands (*campos rupestres* and *campos de altitude*), oceanic islands, beaches, rocky shores, dunes, marshes, inland swamps and mountain forest (*brejos de altitude*) in the Northeast region (Scarano, 2002).

## 2. Experimental or sampling design

None.

## 3. Research methods

*Atlantic Forest delimitation*

We used the integrative AF delimitation adapted from Muylaert et al. (2018), a general delimitation encompassing the main proposed delimitations across several associated ecosystems (Muylaert et al. 2018, Cunha et al. 2019, Marques et al. 2021). We adapted this delimitation by merging the following original maps and most recent ones: 1. AF delimitation defined by Brazilian legislation (Federal Decree No. 750/93 and Atlantic Forest Law No. 11,428/2006) named Atlantic Forest Law by IBGE (2018); 2. AF limit defined by (Da Silva and Casteleti 2003); 3. AF delimitation defined by IBGE (2004); 4. AF most recent delimitation defined by IBGE (2019) and; 5. AF delimitation defined by (Dinerstein et al. 2017) and used in the Ecoregions 2017® (https://ecoregions.appspot.com). Finally, we adjusted the resulting delimitation for the coastal areas using the Brazilian territorial delimitation from IBGE (https://www.ibge.gov.br) for 2021, to align the limit considering the most current delimitations of mangrove, dunes and sandy coastal plain vegetation (*restinga*) (Scarano 2002). The final delimitation has an area total of 162,742,129 ha, that covers 3653 municipalities from 18 Brazilian states (151,470,253 ha, 93.07%), and parts of Argentina (2,668,855 ha, 1.64%) and Paraguay (8,603,022 ha, 5.29%) (Figure 1).

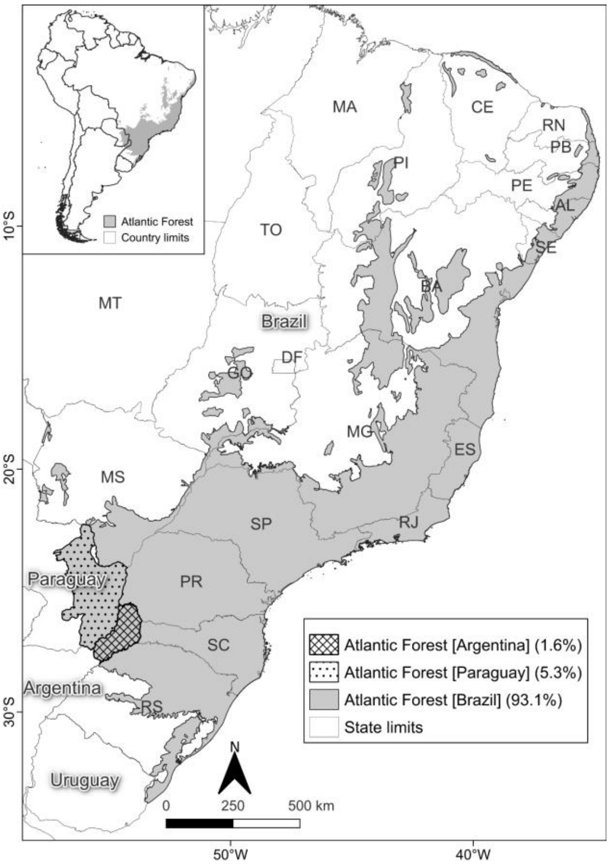


**Figure 1. Integrative Atlantic Forest delimitation, adapted from (Muylaert et al. 2018).**

*Raster resolution and coordinate system*

All geospatial data sets were rasterized or adjusted the raster resolution to 30 m (~1.8 billion cells with values). All rasters were reprojected to Albers Conical Equal Area Brazil (SIRGAS 2000) (https://spatialreference.org/ref/sr-org/albers-conical-equal-area-brazil-sirgas-2000) and are therefore presented in meters.

*Land use and land cover data*

We compiled Land Use and Land Cover (LULC) maps from MapBiomas Brazil collection 7 (https://mapbiomas.org) and MapBiomas Bosque Atlántico collection 2 (https://bosqueatlantico.mapbiomas.org) (Souza et al. 2020). These data sets reconstruct annual LULC information at the 30-m spatial resolution from 1985 to 2021, based on a pixel-based random forest classifier of Landsat satellite images processed through Google Earth Engine, and with posterior accuracy of 89.8% for the AF (Souza et al. 2020). We considered the LULCs map for 2020 to provide the most recent data that included data validation for the previous year (2019) and subsequent year (2021), guaranteeing better accuracy for the LULC classes.

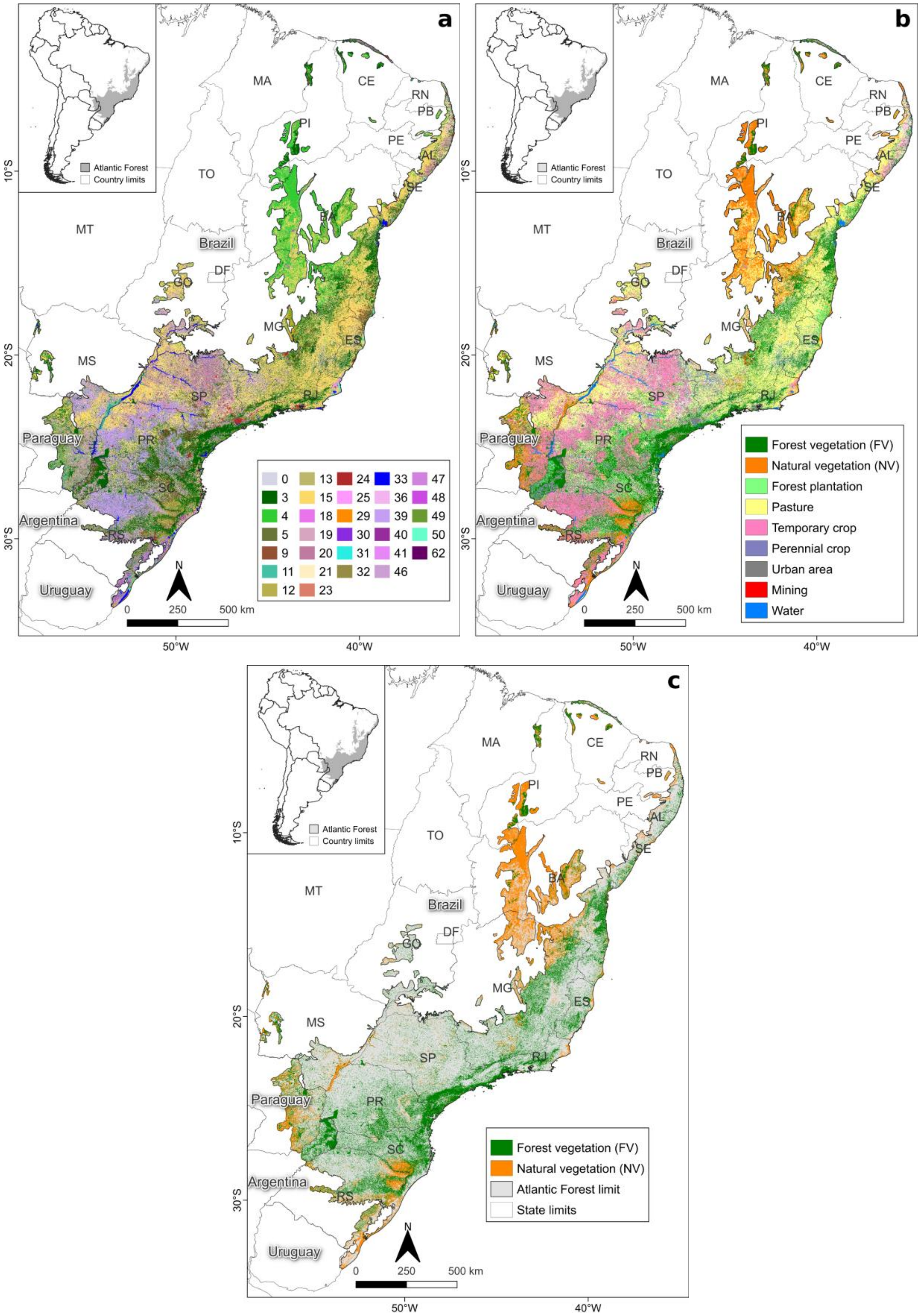


**Figure 2. Data framework used to summarize land use land cover (LULC) classes into Atlantic Forest habitat types.** (a) The LULC classes refer to MapBiomas in the AF (Brazil, Argentina and Paraguay). (b) Grouped land cover classes. (c) Two vegetation classes were

considered as habitat to calculate the landscape metrics. MapBiomas classes are presented in Table 1.

The LULC map from MapBiomas consists of a map with 31 classes (Table 1; Figure 2a). To calculate the distance from land cover classes metrics, we grouped the classes into seven broad categories: pasture, temporary crop, perennial crop, forest plantation, urban areas, mining and water (Table 1; Figure 2b). For the landscape metrics, we defined two vegetation classes for analysis: "Forest Vegetation" (FV), selecting the land cover classes of "Forest" and "Natural Vegetation" (NV), selecting the land cover classes of "Forest" and "Non-Forest Natural Formation" (Table 1; Figure 2c). The only exception for landscape metrics was heterogeneity, for which we used all 31 classes in the calculation.

**Table 1. Land use and land cover classes grouped as vegetation classes.** The Atlantic Forest spatial maps were based on MapBiomas collection 7.

| Land use and land cover class | MapBiomas class code | Grouped land cover classes | Vegetation class |
|---|---|---|---|
| Not specified | 0 | Not used | Not used |
| Forest Formation | 3 | Forest vegetation | Forest vegetation (FV) and Natural vegetation (NV) |
| Savanna Formation | 4 | Natural vegetation | Natural vegetation (NV) |
| Mangrove | 5 | Forest vegetation | Forest vegetation (FV) and Natural vegetation (NV) |
| Forest Plantation | 9 | Forest plantation | Not used |
| Wetland | 11 | Natural vegetation | Natural vegetation (NV) |
| Grassland | 12 | Natural vegetation | Natural vegetation (NV) |
| Other non-Forest Formations | 13 | Natural vegetation | Natural vegetation (NV) |
| Pasture | 15 | Pasture | Not used |
| Temporary Crop | 19 | Temporary crop | Not used |
| Sugar cane | 20 | Temporary crop | Not used |

|  |  |  |  |
|---|---|---|---|
| Mosaic of Uses | 21 | Not used | Not used |
| Non vegetated area | 22 | Not used | Not used |
| Beach, Dune and Sand Spot | 23 | Not used | Not used |
| Urban Area | 24 | Urban area | Not used |
| Other non-Vegetated Areas | 25 | Not used | Not used |
| Rocky Outcrop | 29 | Not used | Not used |
| Mining | 30 | Mining | Not used |
| Aquaculture | 31 | Not used | Not used |
| Salt Flat | 32 | Natural vegetation | Natural vegetation (NV) |
| River, Lake and Ocean | 33 | Water | Not used |
| Perennial Crop | 36 | Perennial crop | Not used |
| Soybean | 39 | Temporary crop | Not used |
| Rice | 40 | Temporary crop | Not used |
| Other Temporary Crops | 41 | Temporary crop | Not used |
| Coffee | 46 | Perennial crop | Not used |
| Citrus | 47 | Perennial crop | Not used |
| Other Perennial Crops | 48 | Perennial crop | Not used |
| Wooded Sandbank Vegetation | 49 | Forest vegetation | Forest vegetation (FV) and Natural vegetation (NV) |
| Herbaceous Sandbank Vegetation | 50 | Natural vegetation | Natural vegetation (NV) |
| Cotton | 62 | Temporary crop | Not used |

We used linear infrastructure (roads and railways) to trim FV and NV areas overlapping with these structures. This way we avoided overestimating large fragments, since roads can decrease the connectivity of large patches (Martinez Pardo et al. 2023) and for different taxa (Cassimiro et al. 2023). Roads and railways data were downloaded from official geospatial databases for the three countries: Brazil (Instituto Brasileiro de Geografia e Estatística – IBGE; IBGE, 2021; https://www.ibge.gov.br), Argentina (Instituto Geográfico Nacional – IGN; IGN, 2022; https://www.ign.gob.ar) and Paraguay (Instituto Nacional de Estadística – INE; INE, 2022; https://www.ine.gov.py). The data summed 14,072 km of railways and 125,483 km of roads, with a total of 139,554 km (Fig. 3). We did not find official railway data for Paraguay, so there may be an underestimation of this effect for this country. For Brazil, we selected paved, operational and constructed roads, and railways that were selected by relative surface position and train section for 2021. For Argentina, we consider national and provincial roads paved for the year of 2021. For Paraguay, we only considered the main roads (according to the Atlas nomenclature) for the year 2012, without making a distinction regarding the paving of roads, since this information was not available. The road and railway layers were rasterized using a parameter that creates densified lines, i.e., all cells touched by the line were included as data for rasterization, which implied in more densified lines. This guaranteed that the roads and railways would trim the fragments. After the lines were rasterized, the resulting raster covered 528,983 ha (0.33% from the AF delimitation). We trimmed the fragments of vegetation from the rasterized data generated (Vancine et al. 2023).

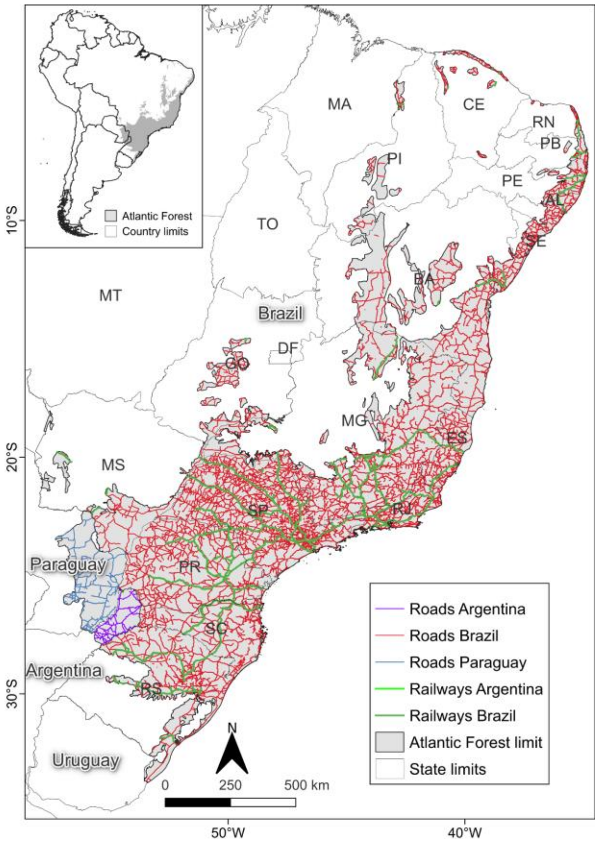


**Figure 3. Linear infrastructure (roads and railways) network used to trim the forest vegetation (FV) and native vegetation (NV) fragments within the Atlantic Forest.**

Urban areas for Brazil were selected from MapBiomas. For Argentina, this data was downloaded from Instituto Geográfico Nacional (Instituto Geográfico Nacional – IGN, https://www.ign.gob.ar) and for Paraguay from Instituto Nacional de Estadística (Instituto Nacional de Estadística – INE, https://www.ine.gov.py) (Fig. 4), and covered 2,401,850 ha (1.48% from the AF limit).

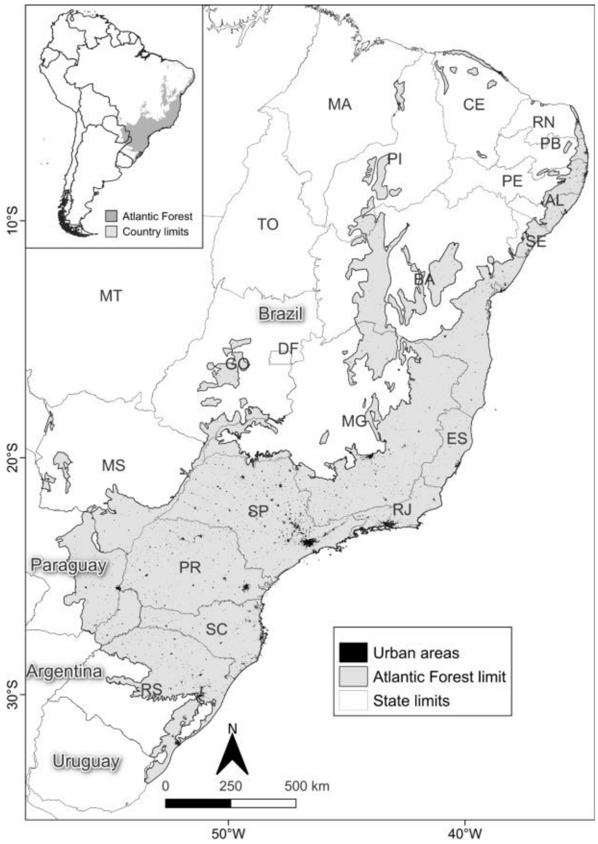


**Figure 4. Urban areas within the Atlantic Forest.**

*Protected areas and indigenous territories*

The limits of the protected areas (PA) were downloaded from Protected Planet (UNEP-WCMC and IUCN, 2022, www.protectedplanet.net) for the IUCN categories of protected areas (“Ia”, “Ib”, “II”, “III” and “IV”), which comprises 986 reserves (4,620,245 ha; 2.84% from AF limit) (Fig. 5a). These IUCN categories encompass the following protection categories of the Argentina (Municipal Nature Park, National Park, Nature Monument, Private Refuge, Private Wildlife Refuge, Provincial Park, Strict Nature Reserve, Wilderness Nature Reserve and Wildlife Reserve), Brazil (Area of Relevant Ecological Interest, Biological Reserve, Ecological Station, Natural Heritage Private Reserve, Natural Monument, Park, Ramsar Site, Wetland of International

Importance, Wildlife Refuge) and Paraguay (National Park, Natural Private Reserve, Natural Reserve, Scientific Monument and Scientific Reserve). Indigenous territories (IT) for Brazil were downloaded from Fundação Nacional dos Povos Indígenas (Fundação Nacional dos Povos Indígenas, 2020, https://www.gov.br/funai/pt-br) selecting only "Homologated", and for Paraguay from Tierras Indígenas (Tierras Indígenas, 2022, https://www.tierrasindigenas.org), which comprises 1023 territories (1,324,973 ha; 0.81% from AF limit) (Fig. 5b).

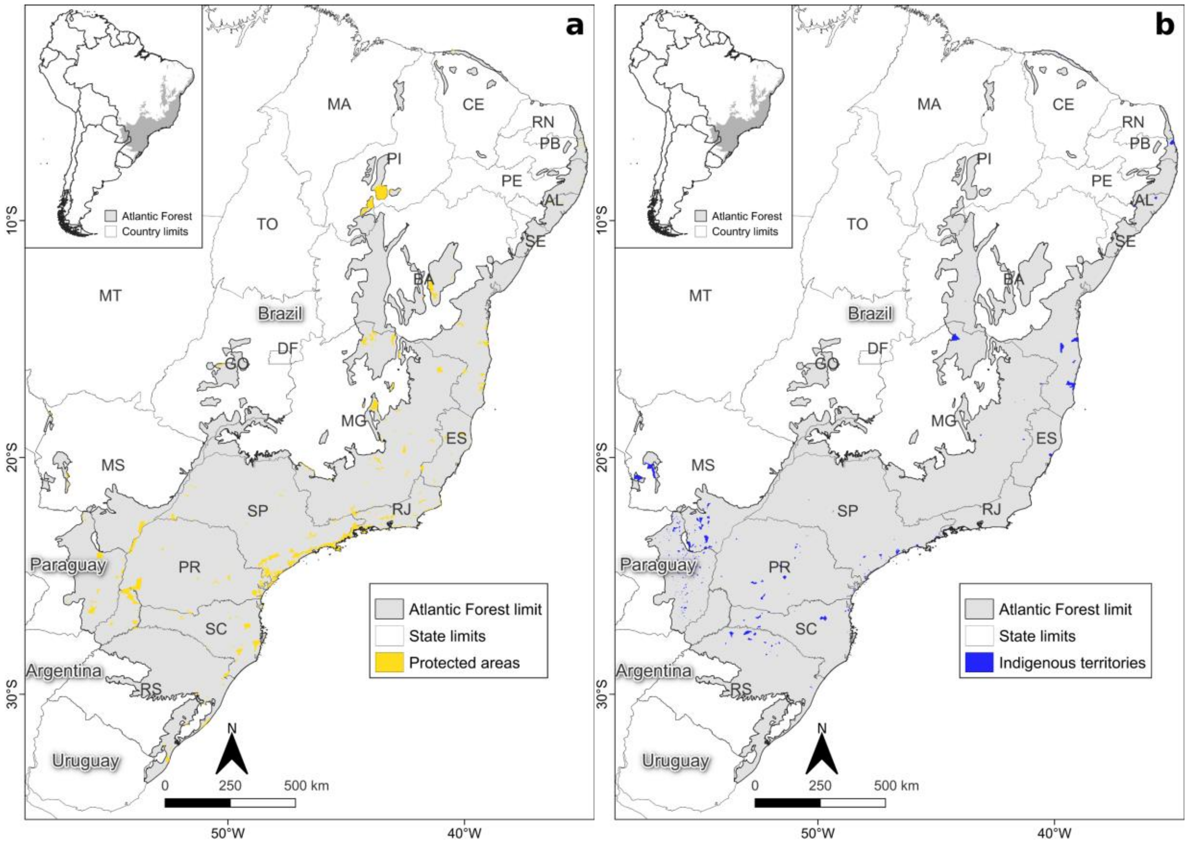


**Figure 5. Protected areas (PA) (a) and indigenous territories (IT) (b) within the Atlantic Forest.**

### *Topography data*

Topographic metrics were calculated from FABDEM v1.2 (forest and buildings removed Copernicus DEM), an elevation raster map that used machine learning to remove buildings and tree height biases from the Copernicus GLO 30 Digital Elevation Model (DEM) (Hawker et al. 2022) (Figure 6).

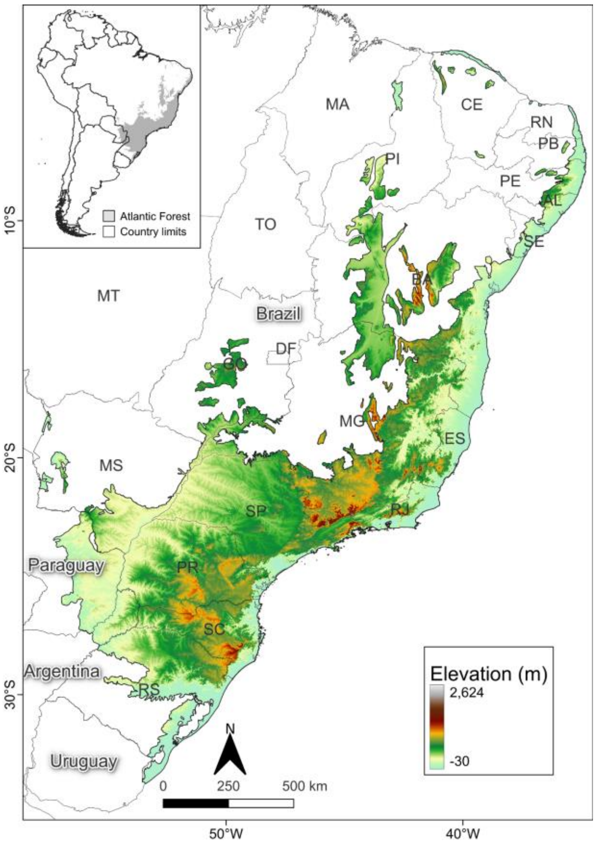


**Figure 6. Elevation (meters above sea level) from FABDEM v1.2 across the Atlantic Forest.**

*Data set source description*

Table 2 summarizes all the sources and descriptions of spatial information used to integrate spatial variables presented in the ATLANTIC SPATIAL data set.

**Table 2. Source and description of spatial information.**

| Type of information | Institution | Description |
|---|---|---|
| Land Use and Land Cover (LULC) | MapBiomas | Annual LULC information at the 30-m spatial resolution from 1985 to 2021, based on pixel-based random forest classifier of Landsat satellite images using Google Earth Engine.<br>Source: Souza et al. (2020)<br>Site: https://mapbiomas.org |

| | | |
|---|---|---|
| Roads and railways | Instituto Brasileiro de Geografia e Estatística (IBGE)<br>Instituto Geográfico Nacional (IGN)<br>Instituto Nacional de Estadística (INE) | Continuous Cartographic Base of Brazil, 1:250,000.<br>Catalog of Geographical Objects of the Organism and forms part of the Institutional Geospatial Database.<br>Digital Cartography 2012, Directorate General of Statistics, Surveys and Censuses and is merely referential.<br>Sources: Instituto Brasileiro de Geografia e Estatística (IBGE); Instituto Geográfico Nacional (IGN); and Instituto Nacional de Estadística (INE)<br>Sites: https://www.ibge.gov.br; https://www.ign.gob.ar; and https://www.ine.gov.py |
| Urban areas | MapBiomas<br>Instituto Geográfico Nacional (IGN)<br>Instituto Nacional de Estadística (INE) | Annual LULC information at the 30-m spatial resolution from 1985 to 2021, based on pixel-based random forest classifier of Landsat satellite images using Google Earth Engine.<br>Catalog of Geographical Objects of the Organism and forms part of the Institutional Geospatial Database.<br>Digital Cartography 2012, Directorate General of Statistics, Surveys and Censuses and is merely referential. |

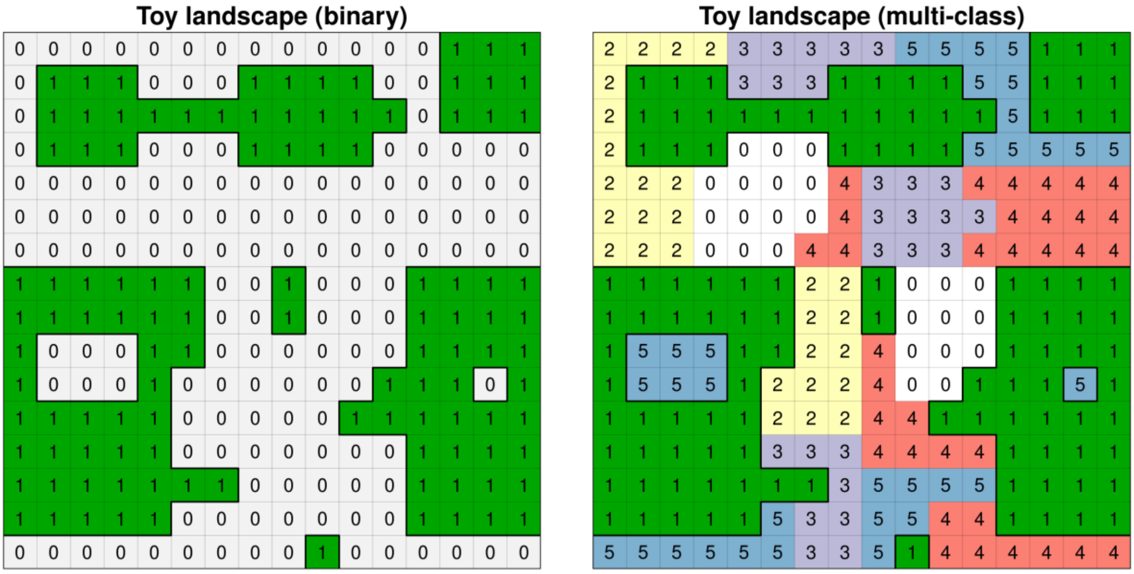
| | | |
|---|---|---|
| | | Sources: Souza et al. (2020), Instituto Geográfico Nacional (IGN) and Instituto Nacional de Estadística (INE)<br>Sites: https://mapbiomas.org, https://www.ign.gob.ar and https://www.ine.gov.py |
| Protected areas | Protected Planet | Up-to-date and complete source of data on protected areas and other effective area-based conservation measures, updated monthly with submissions from governments, non-governmental organizations, landowners and communities.<br>Source: Protected Planet<br>Site: www.protectedplanet.net |
| Indigenous territories | Fundação Nacional dos Povos Indígenas (FUNAI)<br>Tierras Indígenas | Official indigenist body of the Brazilian State, which promotes studies of identification, delimitation, demarcation, land regularization and registration of lands occupied by indigenous peoples, in addition to monitoring and inspecting indigenous lands.<br>Interactive online platform that provides accurate maps and critical information on the lands and territories of indigenous peoples and communities in Paraguay. |

| | | |
|---|---|---|
| | | Sources: FUNAI and Tierras Indígenas<br>Sites:<br>https://www.gov.br/funai/pt-br<br>and<br>https://www.tierrasindigenas.org |
| Topography | Forest and Buildings Removed Copernicus DEM (FABDEM) v1.2 | Elevation raster map that used machine learning to remove building and tree height biases from the Copernicus GLO 30 Digital Elevation Model (DEM)<br><br>Source: Hawker et al. (2022)<br>Site:<br>https://www.fathom.global/product/fabdem |

### *Landscape metrics*

We calculated 39 landscape metrics of nine types (Table 3) based on the habitat map (binary habitat/non-habitat map, Figure 2c) of FV and NV and multi-class map (31 classes, Figure 2a). The values of the landscape metrics were spatialized to the cells. The metrics derived from FV and NV were based on data trimmed by linear structure (roads and railways). Here, to exemplify the method used for calculating of landscape metrics, we display two toy landscapes (Fletcher and Fortin 2018): a binary raster and a multi-class raster (Figure 7).

**Toy landscapes (Figure 7)**: two raster layers (16×16 cells with spatial resolution of 100 m). Cells of the toy landscape (binary) were filled with 0 and 1 values, where 0 represents not-habitat and 1 represents habitat. For the toy landscape (multi-class), cells were filled with values from 0 to 5, where each value represents a different LULC class.



Toy landscape (binary)

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 |
| 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

Toy landscape (multi-class)

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 5 | 5 | 5 | 5 | 1 | 1 | 1 |
| 2 | 1 | 1 | 1 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 5 | 5 | 1 | 1 | 1 |
| 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 5 | 1 | 1 | 1 |
| 2 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 5 | 5 | 5 | 5 | 5 |
| 2 | 2 | 2 | 0 | 0 | 0 | 0 | 4 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 |
| 2 | 2 | 2 | 0 | 0 | 0 | 0 | 4 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 |
| 2 | 2 | 2 | 0 | 0 | 0 | 4 | 4 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 |
| 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| 1 | 5 | 5 | 5 | 1 | 1 | 2 | 2 | 4 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| 1 | 5 | 5 | 5 | 1 | 2 | 2 | 2 | 4 | 0 | 0 | 1 | 1 | 1 | 5 | 1 |
| 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 4 | 4 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 5 | 5 | 5 | 5 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 5 | 3 | 3 | 5 | 5 | 4 | 4 | 1 | 1 | 1 | 1 |
| 5 | 5 | 5 | 5 | 5 | 5 | 3 | 3 | 5 | 1 | 4 | 4 | 4 | 4 | 4 | 4 |

**Figure 7. Toy landscapes**. Toy landscape (binary, on the left) has 0 and 1 values (non-habitat/habitat) and toy landscape (multi-class, on the right) has values from 0 to 5 (land cover classes). Each cell has 100 m of resolution.

**Table 3. Landscape metrics used and their description.** Edge depth is the minimum distance at which cells are classified as edges, those that are further away are classified as cores. Gap-crossing considers the ability of an organism to cross non-habitat gaps, characterizing the distance to functional connectivity. Scale is the radius of the buffer to which the moving window is rotated to impute the effect of different scales on landscape metrics.

| **Metric** | **Metric type** | **Short description** | **Values** | **Edge depth (in meters)** | **Gap-crossing (in meters)** | **Scale (buffer radius in meters)** | **Reference** |
|---|---|---|---|---|---|---|---|
| 1. Fragment ID | Fragment | Fragment identification (cells clumped in its vicinity, considering the 8 neighboring cells) | Units | None | None | None | McGarigal et al. (2023) |
| 2. Fragment area | Fragment | Fragment area (sum of the area of all cells belonging to each fragment ID) | Hectares | None | None | None | McGarigal et al. (2023) |
| 3. Percentage of fragments | Fragment | Percentage of fragments in the vicinity (average neighborhood values for different buffer sizes) | 0 to 100 | None | None | 50, 100, 150, 200, 250, 500, 750, 1000, 1500, 2000, 2500, 5000, 7500, 10000 | McGarigal et al. (2023) |

| Metric | Metric type | Short description | Values | Edge depth (in meters) | Gap-crossing (in meters) | Scale (buffer radius in meters) | Reference |
|---|---|---|---|---|---|---|---|
| 4. Patch ID | Patch | Patch identification (cells clumped in its vicinity, considering the 8 neighboring cells), discarding branches and corridors | Units | 30 | None | None | McGarigal et al. (2023) |
| 5. Patch area | Patch | Patch area (sum of the area of all cells belonging to each patch ID), discarding branches and corridors | Hectares | 30 | None | None | McGarigal et al. (2023) |
| 6. Patch area original | Patch | Patch area assigned to the original fragment. Here each cell of a fragment will be assigned the value of the sum of the areas of all patches contained in the | Hectares | 30 | None | None | McGarigal et al. (2023) |

| Metric | Metric type | Short description | Values | Edge depth (in meters) | Gap-crossing (in meters) | Scale (buffer radius in meters) | Reference |
|---|---|---|---|---|---|---|---|
| | | fragment | | | | | |
| 7. Number of patches | Patch | Number of patches (number of patch ID within a fragment) assigned to the original fragment. Here each cell of a fragment will be assigned the value number of patches contained in the fragment | Units | 30 | None | None | McGarigal et al. (2023) |
| 8. Morphology | Morphology | Identifies landscape morphologies: matrix (0), core (1), edge (2), corridor (3), stepping stone (4), branch (5) and perforation (6) | 0 to 6 | 30 | None | None | Soille and Vogt (2009) |
| 9. Matrix | Morphology | Identify matrix | 0 and 1 | 30 | None | None | Soille and Vogt |

| Metric | Metric type | Short description | Values | Edge depth (in meters) | Gap-crossing (in meters) | Scale (buffer radius in meters) | Reference |
|---|---|---|---|---|---|---|---|
| | | (non-habitat cells = 1) | | | | | (2009) |
| 10. Core | Morphology | Identify fragment cores (core cells = 1) | 0 and 1 | 30 | None | None | Soille and Vogt (2009) |
| 11. Edge | Morphology | Identify fragment edges (external edge cells = 1) | 0 and 1 | 30 | None | None | Soille and Vogt (2009) |
| 12. Corridor | Morphology | Identify corridors (linear elements that connect core cells = 1) | 0 and 1 | 30 | None | None | Soille and Vogt (2009) |
| 13. Branch | Morphology | Identify branches (linear elements that do not connect core cells = 1) | 0 and 1 | 30 | None | None | Soille and Vogt (2009) |
| 14. Stepping stone | Morphology | Identify stepping stones (isolated small elements without core cells = 1) | 0 and 1 | 30 | None | None | Soille and Vogt (2009) |

| Metric | Metric type | Short description | Values | Edge depth (in meters) | Gap-crossing (in meters) | Scale (buffer radius in meters) | Reference |
|---|---|---|---|---|---|---|---|
| 15. Perforation | Morphology | Identify perforations (edge that compose the internal edge of a fragment = 1) | 0 and 1 | 30 | None | None | Soille and Vogt (2009) |
| 16. Core | Core and edge | Identify core cells (core = 1) | 0 and 1 | 30, 60, 90, 120, 240 | None | None | McGarigal et al. (2023) |
| 17. Core ID | Core and edge | Core identification (core cells clumped in its vicinity, considering the 8 neighboring cells) | Units | 30, 60, 90, 120, 240 | None | None | McGarigal et al. (2023) |
| 18. Core area | Core and edge | Core area (sum of the area of all core cells belonging to that core ID) | Hectares | 30, 60, 90, 120, 240 | None | None | McGarigal et al. (2023) |
| 19. Core area original | Core and edge | Core area assigned to the original fragment. Here each cell of a | Hectares | 30, 60, 90, 120, 240 | None | None | McGarigal et al. (2023) |

| Metric | Metric type | Short description | Values | Edge depth (in meters) | Gap-crossing (in meters) | Scale (buffer radius in meters) | Reference |
|---|---|---|---|---|---|---|---|
|  |  | fragment will be assigned the value total area of all cores contained in the fragment |  |  |  |  |  |
| 20. Number of cores | Core and edge | Number of cores within a fragment. Here each cell of a fragment will be assigned the value number of cores contained in the fragment | Units | 30, 60, 90, 120, 240 | None | None | McGarigal et al. (2023) |
| 21. Edge | Core and edge | Identify edge cells (edge = 1). This includes both external and internal edges (perforations) | 0 and 1 | 30, 60, 90, 120, 240 | None | None | McGarigal et al. (2023) |
| 22. Edge ID | Core and edge | Edge identification (cells clumped in its vicinity, considering the | Units | 30, 60, 90, 120, 240 | None | None | McGarigal et al. (2023) |

| Metric | Metric type | Short description | Values | Edge depth (in meters) | Gap-crossing (in meters) | Scale (buffer radius in meters) | Reference |
|---|---|---|---|---|---|---|---|
|  |  | 8 neighboring cells) |  |  |  |  |  |
| 23. Edge area | Core and edge | Edge area (sum of the area of all edge cells belonging to that edge ID) | Hectares | 30, 60, 90, 120, 240 | None | None | McGarigal et al. (2023) |
| 24. Edge area original | Core and edge | Edge area assigned to the original fragment. Here each cell of a fragment will be assigned the value total area edge in the fragment | Hectares | 30, 60, 90, 120, 240 | None | None | McGarigal et al. (2023) |
| 25. Percentage of core | Core and edge | Percentage of core cells within the vicinity (average neighborhood values for different buffer sizes) | 0 to 100 | 30, 60, 90, 120, 240 | None | 50, 100, 150, 200, 250, 500, 750, 1000, 1500, 2000, 2500 | McGarigal et al. (2023) |
| 26. Percentage of edges | Core and edge | Percentage of edge cells in the | 0 to 100 | 30, 60, 90, 120, 240 | None | 50, 100, 150, 200, 250, 500, | McGarigal et al. (2023) |

| Metric | Metric type | Short description | Values | Edge depth (in meters) | Gap-crossing (in meters) | Scale (buffer radius in meters) | Reference |
|---|---|---|---|---|---|---|---|
| | | vicinity (average neighborhood values for different buffer sizes) | | | | 750, 1000, 1500, 2000, 2500 | |
| 27. Perimeter | Perimeter | Perimeter (number of cells sides of a fragment facing the matrix, including any internal holes) | Meters | 30 | None | None | McGarigal et al. (2023) |
| 28. Perimeter-area ratio | Perimeter | Perimeter-area ratio (ratio between fragment perimeter and fragment area) | 0 to infinity | 30 | None | None | McGarigal et al. (2023) |
| 29. Distance inside | Distance | Euclidean distance to the nearest fragment edge cell, inside the fragment | Meters | None | None | None | Ribeiro et al. (2009) |
| 30. Distance outside | Distance | Euclidean distance to the nearest fragment | Meters | None | None | None | Ribeiro et al. (2009) |

| Metric | Metric type | Short description | Values | Edge depth (in meters) | Gap-crossing (in meters) | Scale (buffer radius in meters) | Reference |
|---|---|---|---|---|---|---|---|
|  |  | edge cell, outside the fragment |  |  |  |  |  |
| 31. Distance | Distance | Euclidean distance to the nearest fragment edge cell, both inside (negative) and outside (positive) the fragment | Meters | None | None | None | Ribeiro et al. (2009) |
| 32. Structural connectivity | Structural connectivity | Structural connectivity (represents the area of habitat structurally connected to a patch, taking into account corridors, branches and possibly other patches, but disregarding the area of the own patch) | Hectares | 30 | None | None | Ribeiro et al. (2009) |
| 33. Structurally | Structural | Structurally | Hectares | 30 | None | None | Ribeiro et al. |

| Metric | Metric type | Short description | Values | Edge depth (in meters) | Gap-crossing (in meters) | Scale (buffer radius in meters) | Reference |
|---|---|---|---|---|---|---|---|
| connected area | connectivity | connected area (calculated from the original fragment, where the structural connectivity of the patches was associated with the fragment) | | | | | (2009) |
| 34. Functionally connected dilation | Functional connectivity | Functionally connected dilation (fragments dilate by half the value of the organism's gap-crossing capacity) | Hectares | None | 60, 120, 180, 240, 300, 600 | None | Ribeiro et al. (2009) |
| 35. Functionally connected ID | Functional connectivity | Functionally connected identification (fragments that are at the shortest distance from the gap-crossing are grouped, receiving the | Hectares | None | 60, 120, 180, 240, 300, 600 | None | Ribeiro et al. (2009) |

| Metric | Metric type | Short description | Values | Edge depth (in meters) | Gap-crossing (in meters) | Scale (buffer radius in meters) | Reference |
|---|---|---|---|---|---|---|---|
| | | same ID) | | | | | |
| 36. Functionally connected area | Functional connectivity | Functionally connected area (area of these fragments with the same ID was summed) | Hectares | None | 60, 120, 180, 240, 300, 600 | None | Ribeiro et al. (2009) |
| 37. Functional connectivity | Functional connectivity | Functional connectivity (difference between the functionally connected area and the fragment size) | Hectares | None | 60, 120, 180, 240, 300, 600 | None | Ribeiro et al. (2009) |
| 38. Landscape Shannon diversity | Landscape diversity | Landscape Shannon diversity (consider the number of classes in each class cell within the window of analysis for Shannon index) | 0 to infinity | None | None | 50, 100, 150, 200, 250, 500, 750, 1000, 1500, 2000 | Rocchini et al. (2013) |
| 39. Landscape Simpson | Landscape diversity | Landscape Simpson | 0 to 1 | None | None | 50, 100, 150, 200, 250, 500, | Rocchini et al. (2013) |

| Metric | Metric type | Short description | Values | Edge depth (in meters) | Gap-crossing (in meters) | Scale (buffer radius in meters) | Reference |
|---|---|---|---|---|---|---|---|
| diversity | | diversity (consider the number of classes in each class cell within the window of analysis for Shannon index) | | | | 750, 1000, 1500, 2000 | |

**Fragment area metrics (Figure 8)**: considering a binary habitat map, all cells of habitat were clumped with other cells of habitat in its vicinity (considering the 8 neighboring cells). Each clump of habitat was called a fragment and was given an ID (**Metric 1: Fragment ID**). For each fragment ID, its area (**Metric 2: Fragment area**) was calculated as the sum of the area of all cells belonging to that fragment ID. The unit used to calculate the area is hectares. Non-habitat cells are returned as NULL values.

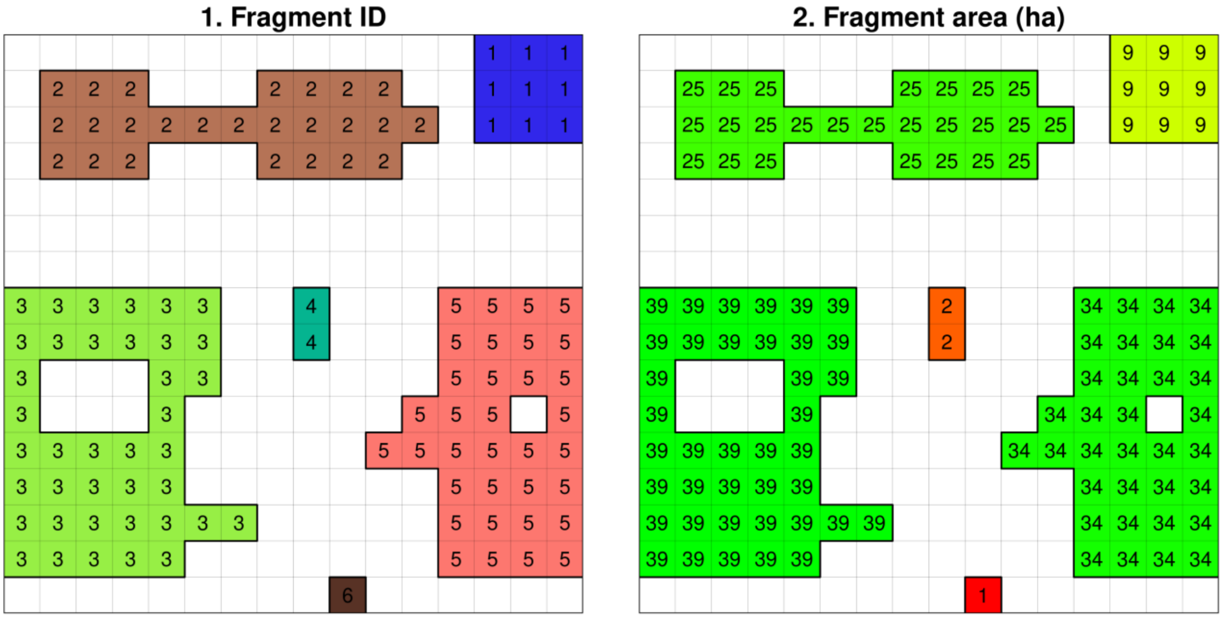
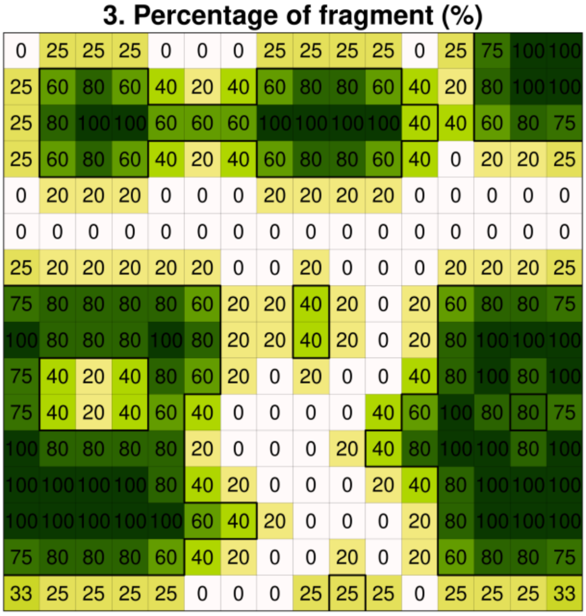


**Figure 8. Fragment area metrics**. Metric 1: Fragment ID is the fragment identification. Metric 2: Fragment area (ha) is the fragment area calculated in hectares. Each cell has 100 m of side length in the toy landscape.

**Percentage of fragments metric (Figure 9):** considering a binary habitat map, each cell of the map presented a value of the percentage of fragments within a circular window with a given size, centered in the focal cell (amount of habitat cells/total number of cells in the window). It varies between 0% and 100% (**Metric 3: Percentage of fragments**). Buffer radius represented half the size of a circular window, e.g., for a buffer size of 50 m, the window size was 100 m. Buffer radii used: 50 m, 100 m, 150 m, 200 m, 250 m, 500 m, 750 m, 1,000 m, 1,500 m, 2,000 m, 2,500 m, 5,000 m, 7,500 m, 10,000 m.


3. Percentage of fragment (%)

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 25 | 25 | 25 | 0 | 0 | 0 | 25 | 25 | 25 | 25 | 0 | 25 | 75 | 100 | 100 |
| 25 | 60 | 80 | 60 | 40 | 20 | 40 | 60 | 80 | 80 | 60 | 40 | 20 | 80 | 100 | 100 |
| 25 | 80 | 100 | 100 | 60 | 60 | 60 | 100 | 100 | 100 | 100 | 40 | 40 | 60 | 80 | 75 |
| 25 | 60 | 80 | 60 | 40 | 20 | 40 | 60 | 80 | 80 | 60 | 40 | 0 | 20 | 20 | 25 |
| 0 | 20 | 20 | 20 | 0 | 0 | 0 | 20 | 20 | 20 | 20 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 25 | 20 | 20 | 20 | 20 | 20 | 0 | 0 | 20 | 0 | 0 | 0 | 20 | 20 | 20 | 25 |
| 75 | 80 | 80 | 80 | 80 | 60 | 20 | 20 | 40 | 20 | 0 | 20 | 60 | 80 | 80 | 75 |
| 100 | 80 | 80 | 80 | 100 | 80 | 20 | 20 | 40 | 20 | 0 | 20 | 80 | 100 | 100 | 100 |
| 75 | 40 | 20 | 40 | 80 | 60 | 20 | 0 | 20 | 0 | 0 | 40 | 80 | 100 | 80 | 100 |
| 75 | 40 | 20 | 40 | 60 | 40 | 0 | 0 | 0 | 0 | 40 | 60 | 100 | 80 | 80 | 75 |
| 100 | 80 | 80 | 80 | 80 | 20 | 0 | 0 | 0 | 20 | 40 | 80 | 100 | 100 | 80 | 100 |
| 100 | 100 | 100 | 100 | 80 | 40 | 20 | 0 | 0 | 0 | 20 | 40 | 80 | 100 | 100 | 100 |
| 100 | 100 | 100 | 100 | 100 | 60 | 40 | 20 | 0 | 0 | 0 | 20 | 80 | 100 | 100 | 100 |
| 75 | 80 | 80 | 80 | 60 | 40 | 20 | 0 | 0 | 20 | 0 | 20 | 60 | 80 | 80 | 75 |
| 33 | 25 | 25 | 25 | 25 | 0 | 0 | 0 | 25 | 25 | 25 | 0 | 25 | 25 | 25 | 33 |

**Figure 9. Percentage of fragments metric**. Metric 3: fragment percentage for a buffer radius of 100 m (i.e., a circular window with 200 m size), as illustration in the toy landscape.

**Patch area metrics (Figure 10)**: considering a binary habitat map, these metrics are equivalent to the fragment area metric, but discards habitat branches and corridors that are closer than a given edge depth from the edge between the fragment and the matrix. The result is a map of clusters (considering the 8 neighboring cells) of cells, which does not consider corridors or branches. Each habitat cluster was called a patch and given an ID (**Metric 4: Patch ID**). For each patch ID, its area (**Metric 5: Patch area**) was calculated as the sum of the area of all cells belonging to that patch ID. The patch area has also been attributed to the original fragment ID, which sums the area of all patches belonging to the same fragment (**Metric 6: Patch area original**). The amount of different patch IDs for a fragment is also calculated (**Metric 7: Number of patches**). Edge depths considered: 30 m. The unit used to calculate the area was hectares. Non-habitat cells were assigned with NULL values.

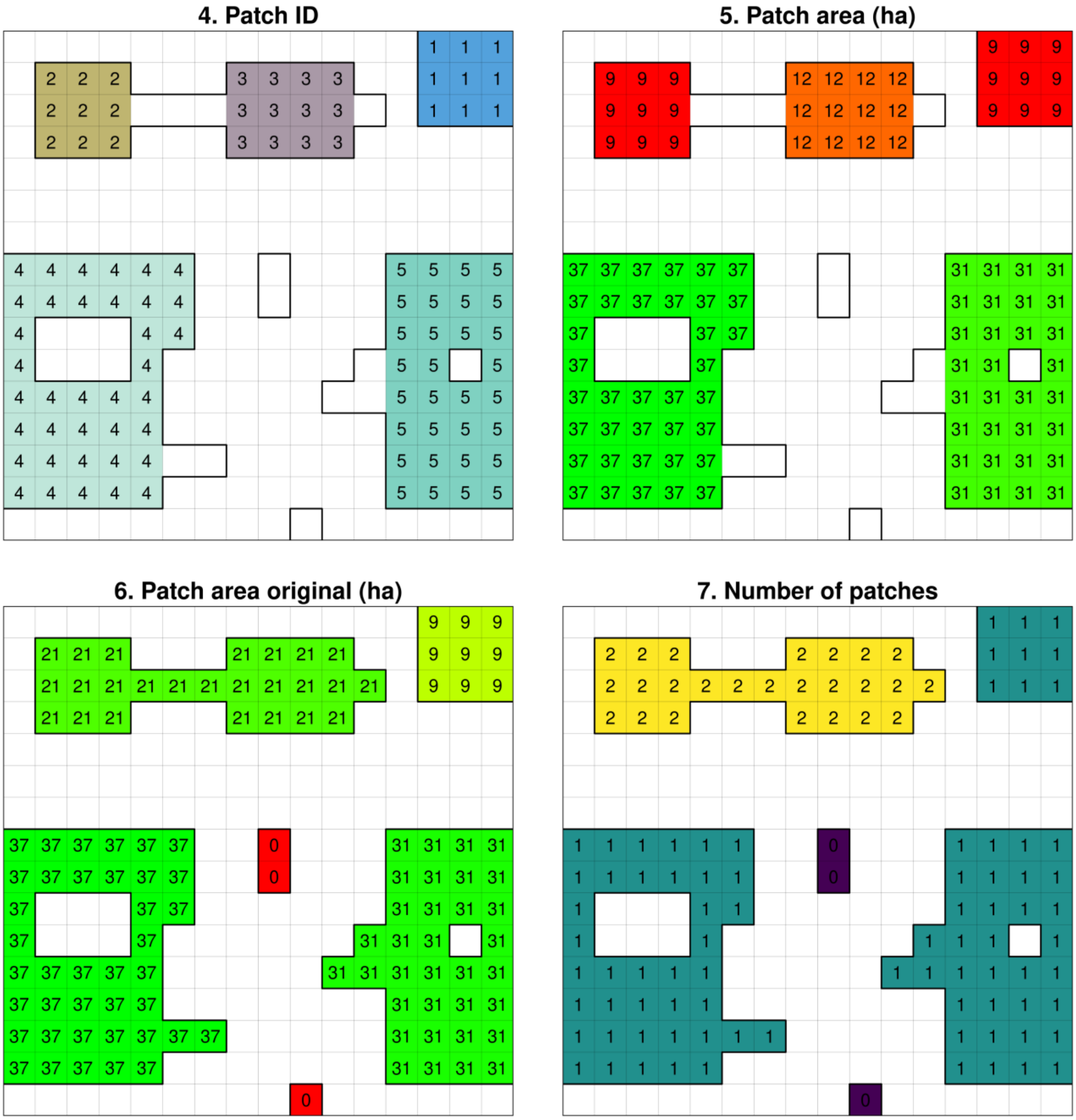
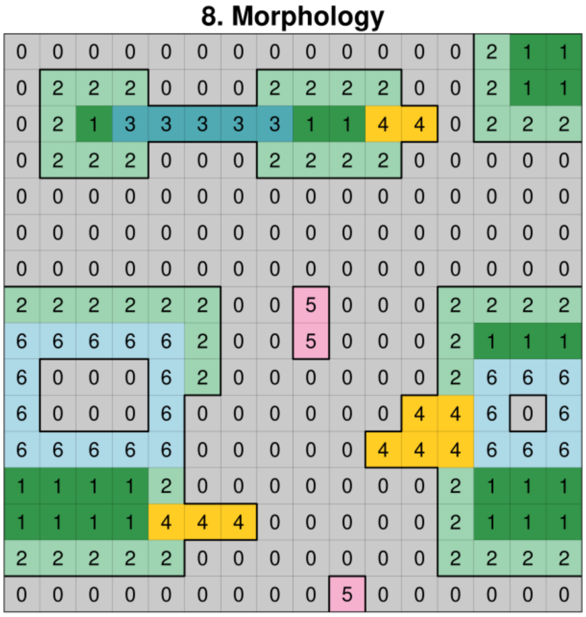
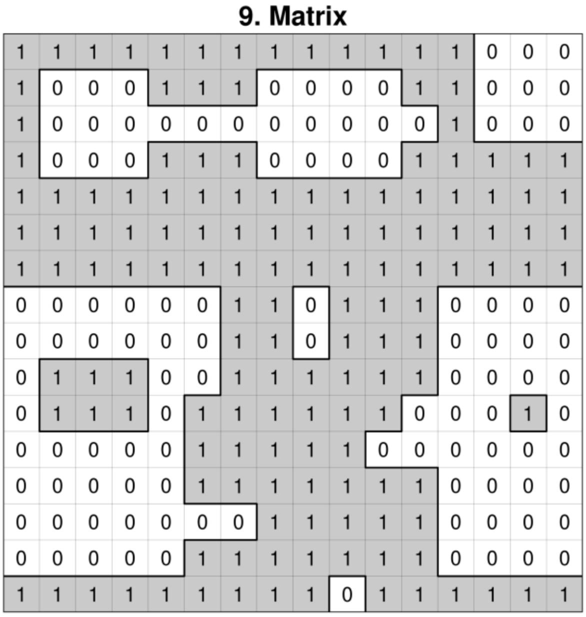


**Figure 10. Patch area metrics**. Metric 4: Patch ID is the patch identification. Metric 5: Patch area (ha) is the patch area in hectares. Metric 6: Patch area original (ha) is the patch area for the original fragment in hectares. Metric 7: Number of patches is the number of patches for the original fragment. The edge depth was chosen as 50 m in this illustrative example in the toy landscape.

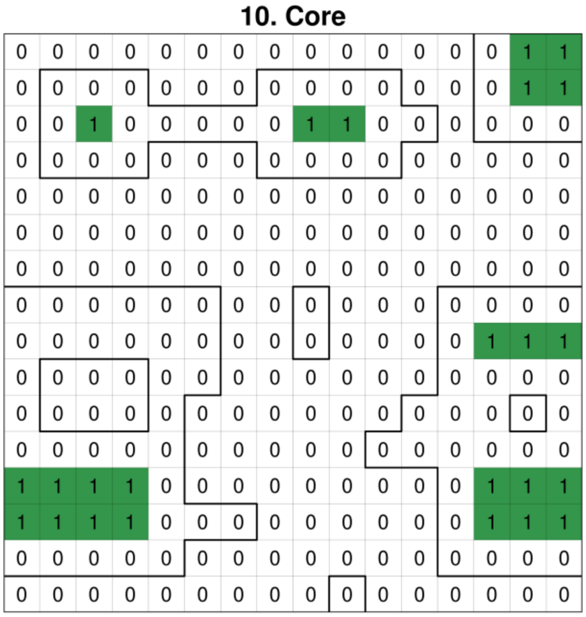
**4. Morphological metrics (Figure 11):** considering a binary habitat map, these metrics classify the landscape as a set of morphological/structural categories (**Metric 8: Morphology**), i.e., whether a cell is matrix, core, edge, corridor, branch, stepping stone or perforation. This classification is made by considering an edge depth to distinguish what if the edge and the core of a habitat fragment. Matrices are the non-habitat cells from the binary map (**Metric 9: Matrix**). Cores are habitat cells after removing the edge cells (**Metric 10: Core**). Edges are habitat cells that are closer to the edge than the chosen edge depth, but are not corridor, branch, stepping stone or perforation (**Metric 11: Edge**). Corridors are edge cells that connect two or more core cells (**Metric 12: Corridor**). Branches are edge cells that do not connect cores (**Metric 13: Branch**). Stepping stones are edge cells that do not have core cells inside them (**Metric 14: Stepping stone**). Perforations are edge cells that compose the internal edge of a fragment (**Metric 15: Perforation**). Edge depths considered: 30 m.


8. Morphology

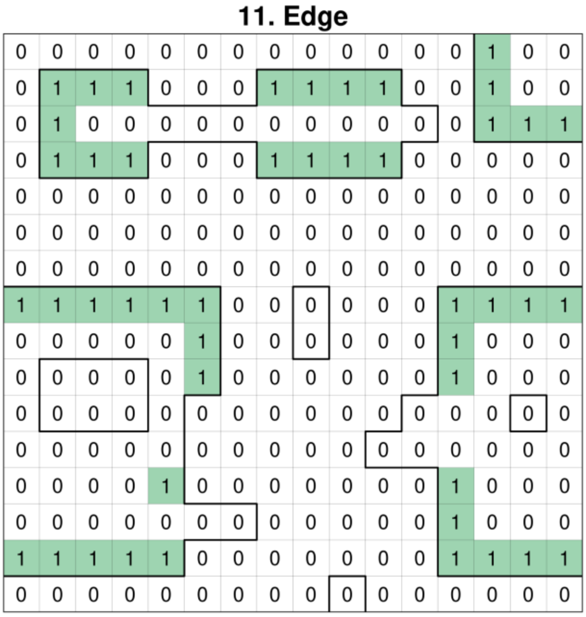
| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 1 |
| 0 | 2 | 2 | 2 | 0 | 0 | 0 | 2 | 2 | 2 | 2 | 0 | 0 | 2 | 1 | 1 |
| 0 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 4 | 4 | 0 | 2 | 2 | 2 |
| 0 | 2 | 2 | 2 | 0 | 0 | 0 | 2 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 5 | 0 | 0 | 0 | 2 | 2 | 2 | 2 |
| 6 | 6 | 6 | 6 | 6 | 2 | 0 | 0 | 5 | 0 | 0 | 0 | 2 | 1 | 1 | 1 |
| 6 | 0 | 0 | 0 | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 6 | 6 |
| 6 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 6 | 0 | 6 |
| 6 | 6 | 6 | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 4 | 6 | 6 | 6 |
| 1 | 1 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 4 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 2 | 2 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |


9. Matrix

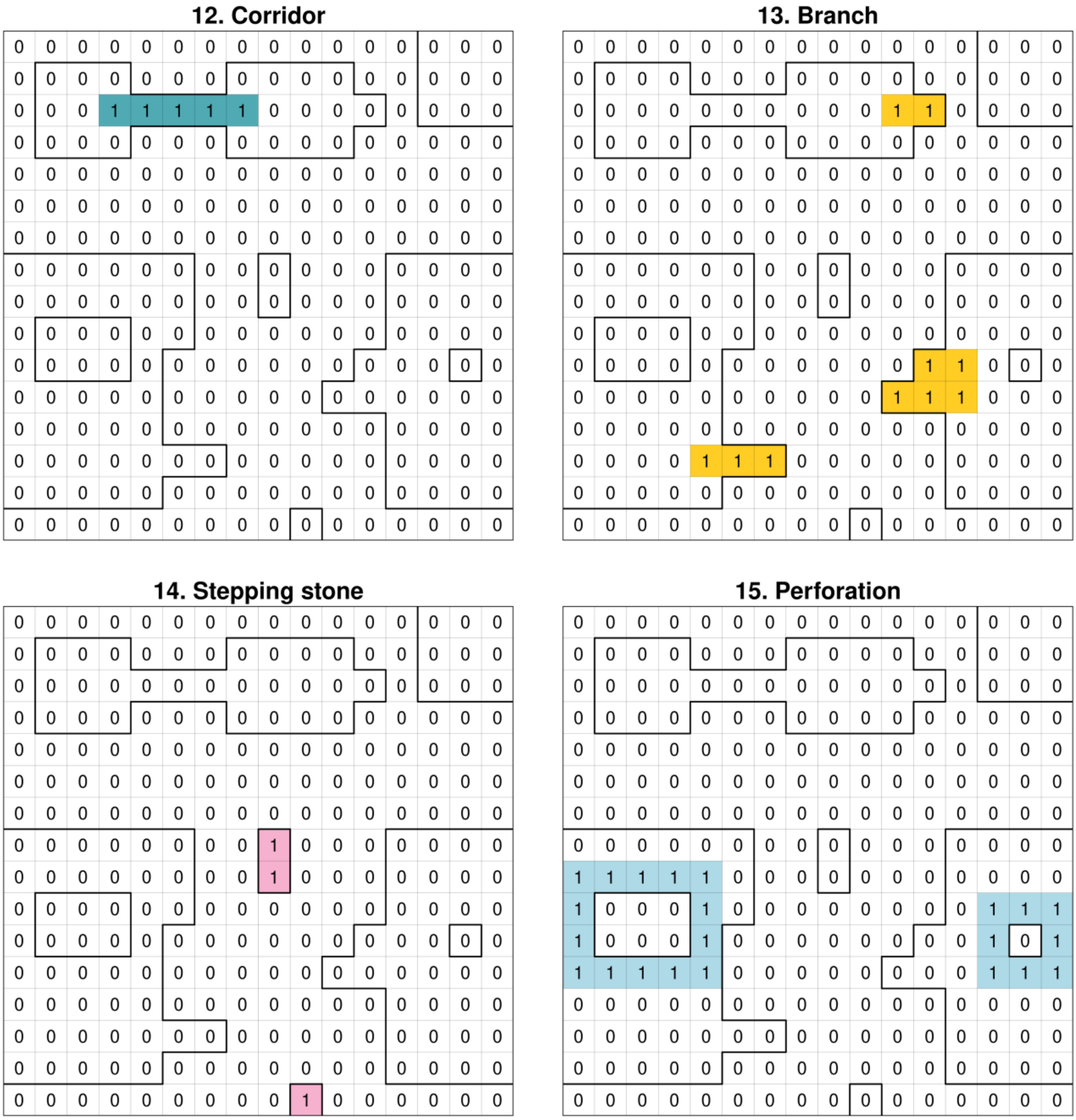
| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |


10. Core

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |


11. Edge

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |



12. Corridor

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

13. Branch

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

14. Stepping stone

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

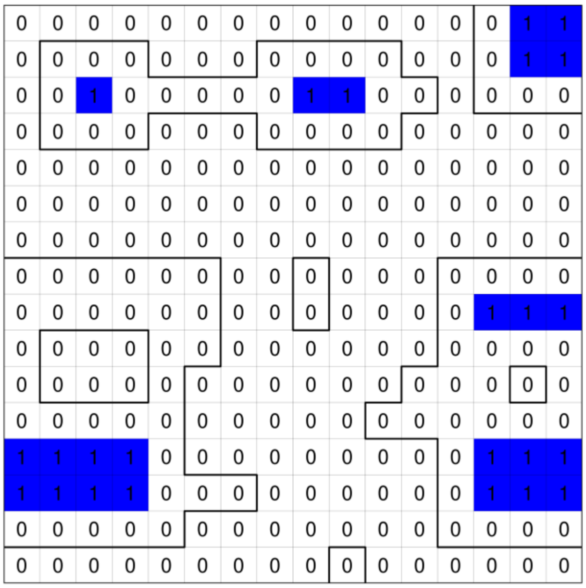
15. Perforation

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**Figure 11. Morphological metrics**. Metric 8: Landscape morphologies: matrix (0), core (1), edge (2), corridor (3), stepping stone (4), branch (5) and perforation (6). Metric 9: matrix = non-habitat cells. Metric 10: Core = habitat cells, removing the edge cells. Metric 11: Edge =habitat cells which are closer to the habitat edge than the chosen edge depth. Metric 12: Corridor = edge cells that connect two or more core cells. Metric 13: Branch = edge cells that do not connect cores. Metric 14: Stepping stone = edge cells that do not have core cells. Metric 15: Perforation = edge cells that compose the internal edge of a fragment. The edge depth used in this illustrative figure was 50 m.

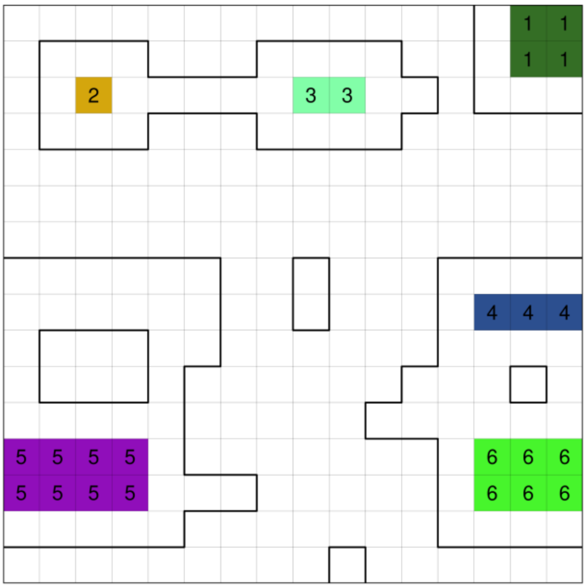
**Core and edge area metrics (Figure 12)**: considering a binary habitat map, these metrics classify cells in core or edge, considering a depth of edge. Cells that are closer (or at the same distance) from the edge than the edge depth are classified as edges, those that are further away inside the habitat patches are classified as core. We clumped the core and edge cells (considering the 8 neighboring cells; **Metric 16: Core** and **Metric 21: Edge**) and gave it an ID (**Metric 17: Core ID** and **Metric 22: Edge ID**). For each core and edge ID, its area was calculated as the sum of the area of all cells belonging to that core or edge ID (**Metric 18: Core area** and **Metric 23: Edge area**). We also calculated the area of a core or edge of the original fragment by summing the area of the core or edge cells belonging to a fragment (**Metric 19: Core area original** and **Metric 24: Edge area original**), and the number of cores (**Metric 20: Number of cores**), which was the number of different cores IDs for a fragment. Notice that the Metric 21 (Edge) differs from morphological classification of edges (Metric 11), because the latter subdivides edges cells into edges, corridors, branches, stepping stones and perforations. Metric 21 includes all these in a single category. Edge depths considered: 30 m, 60 m, 120 m, 240 m. The unit used to calculate the area was hectares. Non-habitat cells were assigned with NULL values, except for core and edge binary maps.

16. Core



| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

17. Core ID



| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | 1 | 1 |
| | | | | | | | | | | | | | | 1 | 1 |
| | | 2 | | | | | | 3 | 3 | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
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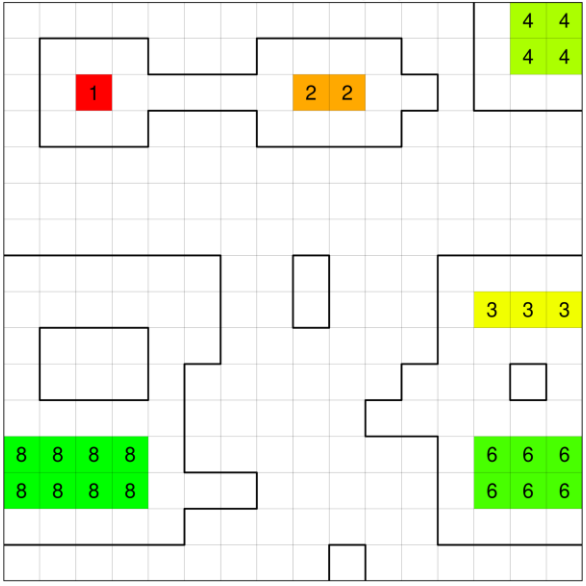
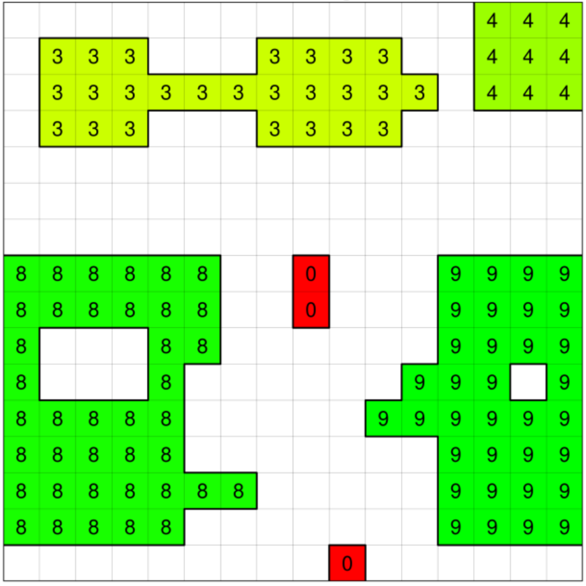
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | 4 | 4 | 4 |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| 5 | 5 | 5 | 5 | | | | | | | | | | 6 | 6 | 6 |
| 5 | 5 | 5 | 5 | | | | | | | | | | 6 | 6 | 6 |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |

18. Core area (ha)



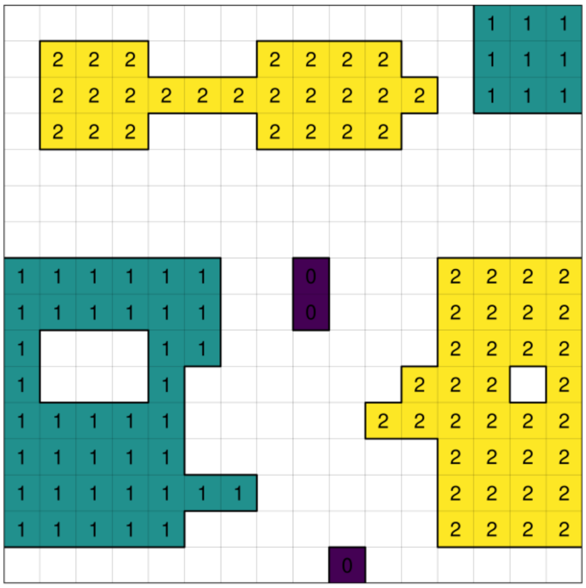
| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | 4 | 4 |
| | | | | | | | | | | | | | | 4 | 4 |
| | | 1 | | | | | | 2 | 2 | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | 3 | 3 | 3 |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| 8 | 8 | 8 | 8 | | | | | | | | | | 6 | 6 | 6 |
| 8 | 8 | 8 | 8 | | | | | | | | | | 6 | 6 | 6 |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |

19. Core area original (ha)



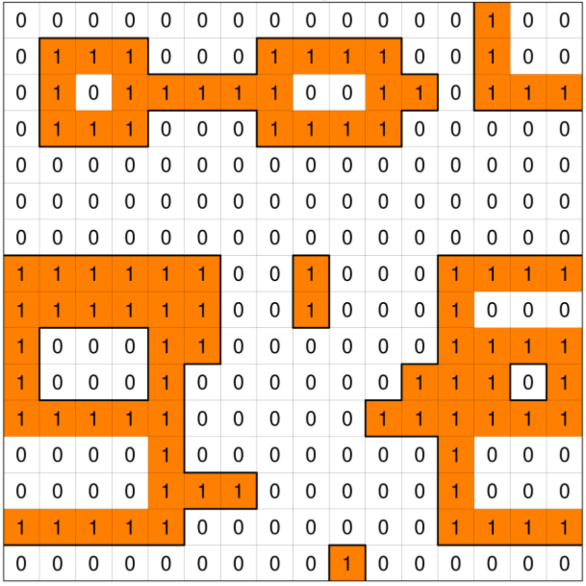
| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | 4 | 4 | 4 |
| | 3 | 3 | 3 | | | | 3 | 3 | 3 | 3 | | | 4 | 4 | 4 |
| | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | 4 | 4 | 4 |
| | 3 | 3 | 3 | | | | 3 | 3 | 3 | 3 | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| 8 | 8 | 8 | 8 | 8 | 8 | | | 0 | | | | 9 | 9 | 9 | 9 |
| 8 | 8 | 8 | 8 | 8 | 8 | | | 0 | | | | 9 | 9 | 9 | 9 |
| 8 | | | | 8 | 8 | | | | | | | 9 | 9 | 9 | 9 |
| 8 | | | | 8 | | | | | | | 9 | 9 | 9 | | 9 |
| 8 | 8 | 8 | 8 | 8 | | | | | | 9 | 9 | 9 | 9 | 9 | 9 |
| 8 | 8 | 8 | 8 | 8 | | | | | | | | 9 | 9 | 9 | 9 |
| 8 | 8 | 8 | 8 | 8 | 8 | 8 | | | | | | 9 | 9 | 9 | 9 |
| 8 | 8 | 8 | 8 | 8 | | | | | | | | 9 | 9 | 9 | 9 |
| | | | | | | | | | 0 | | | | | | |

20. Number of cores



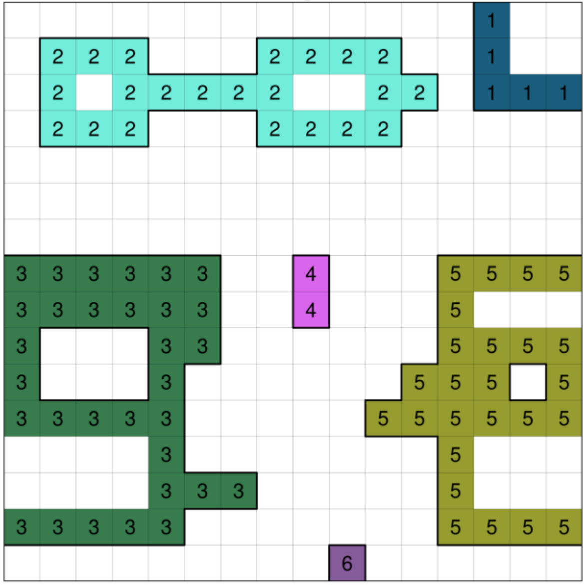
| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | 1 | 1 | 1 |
| | 2 | 2 | 2 | | | | 2 | 2 | 2 | 2 | | | 1 | 1 | 1 |
| | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | 1 | 1 | 1 |
| | 2 | 2 | 2 | | | | 2 | 2 | 2 | 2 | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| 1 | 1 | 1 | 1 | 1 | 1 | | | 0 | | | | 2 | 2 | 2 | 2 |
| 1 | 1 | 1 | 1 | 1 | 1 | | | 0 | | | | 2 | 2 | 2 | 2 |
| 1 | | | | 1 | 1 | | | | | | | 2 | 2 | 2 | 2 |
| 1 | | | | 1 | | | | | | | 2 | 2 | 2 | | 2 |
| 1 | 1 | 1 | 1 | 1 | | | | | | 2 | 2 | 2 | 2 | 2 | 2 |
| 1 | 1 | 1 | 1 | 1 | | | | | | | | 2 | 2 | 2 | 2 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | 2 | 2 | 2 | 2 |
| 1 | 1 | 1 | 1 | 1 | | | | | | | | 2 | 2 | 2 | 2 |
| | | | | | | | | | 0 | | | | | | |

21. Edge



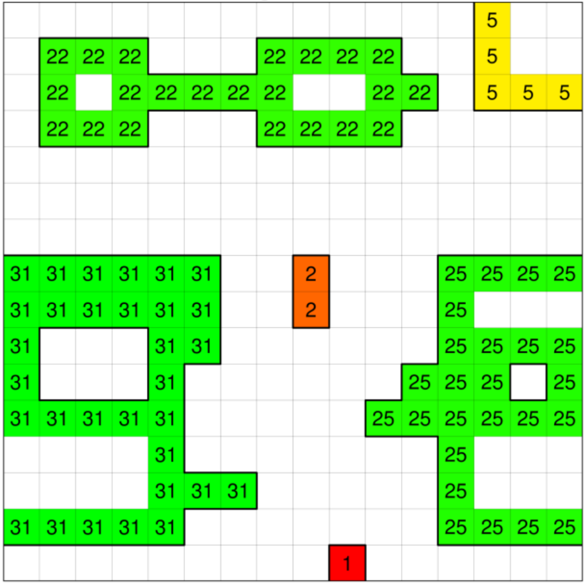
| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 |
| 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |
| 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

22. Edge ID



| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | 1 | | |
| | 2 | 2 | 2 | | | | 2 | 2 | 2 | 2 | | | 1 | | |
| | 2 | | 2 | 2 | 2 | 2 | 2 | | | 2 | 2 | | 1 | 1 | 1 |
| | 2 | 2 | 2 | | | | 2 | 2 | 2 | 2 | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| 3 | 3 | 3 | 3 | 3 | 3 | | | 4 | | | | 5 | 5 | 5 | 5 |
| 3 | 3 | 3 | 3 | 3 | 3 | | | 4 | | | | 5 | | | |
| 3 | | | | 3 | 3 | | | | | | | 5 | 5 | 5 | 5 |
| 3 | | | | 3 | | | | | | | 5 | 5 | 5 | | 5 |
| 3 | 3 | 3 | 3 | 3 | | | | | | 5 | 5 | 5 | 5 | 5 | 5 |
| | | | | 3 | | | | | | | | 5 | | | |
| | | | | 3 | 3 | 3 | | | | | | 5 | | | |
| 3 | 3 | 3 | 3 | 3 | | | | | | | | 5 | 5 | 5 | 5 |
| | | | | | | | | | 6 | | | | | | |

23. Edge area (ha)



| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | 5 | | |
| | 22 | 22 | 22 | | | | 22 | 22 | 22 | 22 | | | 5 | | |
| | 22 | | 22 | 22 | 22 | 22 | 22 | | | 22 | 22 | | 5 | 5 | 5 |
| | 22 | 22 | 22 | | | | 22 | 22 | 22 | 22 | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| 31 | 31 | 31 | 31 | 31 | 31 | | | 2 | | | | 25 | 25 | 25 | 25 |
| 31 | 31 | 31 | 31 | 31 | 31 | | | 2 | | | | 25 | | | |
| 31 | | | | 31 | 31 | | | | | | | 25 | 25 | 25 | 25 |
| 31 | | | | 31 | | | | | | | 25 | 25 | 25 | | 25 |
| 31 | 31 | 31 | 31 | 31 | | | | | | 25 | 25 | 25 | 25 | 25 | 25 |
| | | | | 31 | | | | | | | | 25 | | | |
| | | | | 31 | 31 | 31 | | | | | | 25 | | | |
| 31 | 31 | 31 | 31 | 31 | | | | | | | | 25 | 25 | 25 | 25 |
| | | | | | | | | | 1 | | | | | | |

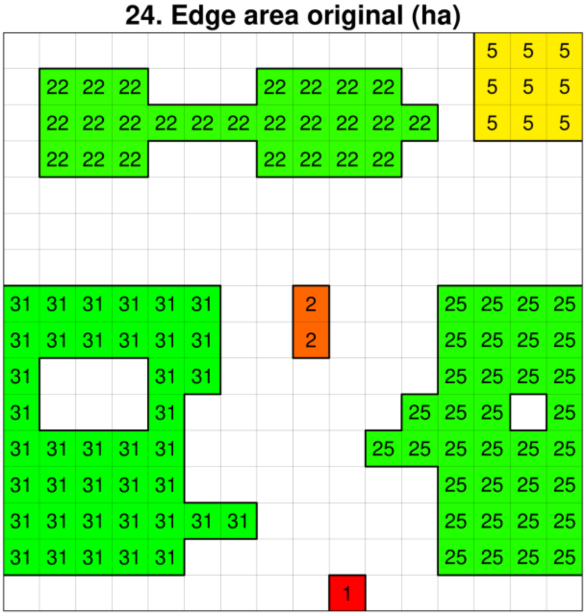
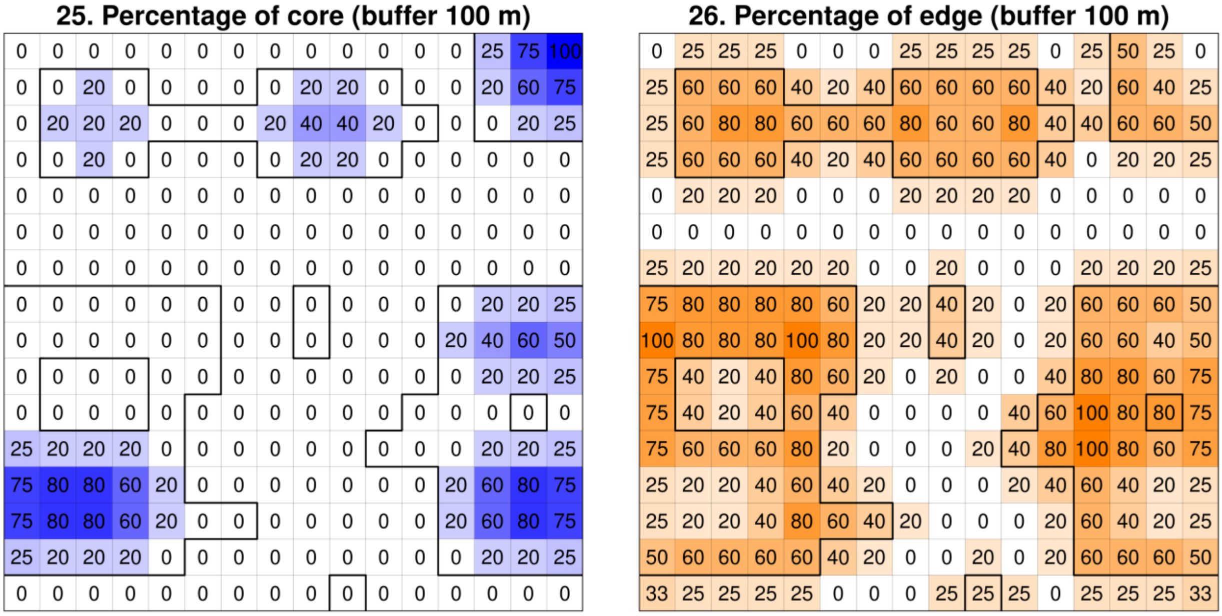

24. Edge area original (ha)

**Figure 12. Edge and core area metrics**. Metric 16: Core is the binary core and not-core. Metric 17: Core ID is the core identification. Metric 18: Core area (ha) is the core area in hectares. Metric 19: Core area original (ha) is the core area for the original fragment in hectares. Metric 20: Number of cores is the number of cores for the original fragment. Metric 21: Edge is the binary edge and not-edge. Metric 22: Edge ID is the edge identification. Metric 23: Edge area (ha) is the edge area in hectares. Metric 24: Edge area original (ha) is the edge area for the original fragment in hectares. Each cell of the toy landscape has 100 m of side length and the edge depth was chosen as 50 m in this illustrative example.

**Percentage of core and edge metrics (Figure 13):** considering a binary habitat map, each cell of the map presents a value of the proportion of core or edge area within a circle window with a given size, centered in the focal cell (amount of core or edge cells/total number of cells in the window). It varies between 0 and 100% (**Metric 25: Percentage of core** and **Metric 26: Percentage of edges**). Edge depths considered: 30 m, 60 m, 120 m, 240 m. Buffer radius represented half the size of a circular window, e.g., for a buffer size of 50 m, the window size was 100 m. Buffer radius used: 50 m, 100 m, 150 m, 200 m, 250 m, 500 m, 750 m, 1000 m, 1500 m, 2000 m, 2500 m.



25. Percentage of core (buffer 100 m)

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 75 | 100 |
| 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 20 | 20 | 0 | 0 | 0 | 20 | 60 | 75 |
| 0 | 20 | 20 | 20 | 0 | 0 | 0 | 20 | 40 | 40 | 20 | 0 | 0 | 0 | 20 | 25 |
| 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 20 | 20 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 20 | 25 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 40 | 60 | 50 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 20 | 25 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 25 | 20 | 20 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 20 | 25 |
| 75 | 80 | 80 | 60 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 60 | 80 | 75 |
| 75 | 80 | 80 | 60 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 60 | 80 | 75 |
| 25 | 20 | 20 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 20 | 25 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

26. Percentage of edge (buffer 100 m)

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 25 | 25 | 25 | 0 | 0 | 0 | 25 | 25 | 25 | 25 | 0 | 25 | 50 | 25 | 0 |
| 25 | 60 | 60 | 60 | 40 | 20 | 40 | 60 | 60 | 60 | 60 | 40 | 20 | 60 | 40 | 25 |
| 25 | 60 | 80 | 80 | 60 | 60 | 60 | 80 | 60 | 60 | 80 | 40 | 40 | 60 | 60 | 50 |
| 25 | 60 | 60 | 60 | 40 | 20 | 40 | 60 | 60 | 60 | 60 | 40 | 0 | 20 | 20 | 25 |
| 0 | 20 | 20 | 20 | 0 | 0 | 0 | 20 | 20 | 20 | 20 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 25 | 20 | 20 | 20 | 20 | 20 | 0 | 0 | 20 | 0 | 0 | 0 | 20 | 20 | 20 | 25 |
| 75 | 80 | 80 | 80 | 80 | 60 | 20 | 20 | 40 | 20 | 0 | 20 | 60 | 60 | 60 | 50 |
| 100 | 80 | 80 | 80 | 100 | 80 | 20 | 20 | 40 | 20 | 0 | 20 | 60 | 60 | 40 | 50 |
| 75 | 40 | 20 | 40 | 80 | 60 | 20 | 0 | 20 | 0 | 0 | 40 | 80 | 80 | 60 | 75 |
| 75 | 40 | 20 | 40 | 60 | 40 | 0 | 0 | 0 | 0 | 40 | 60 | 100 | 80 | 80 | 75 |
| 75 | 60 | 60 | 60 | 80 | 20 | 0 | 0 | 0 | 20 | 40 | 80 | 100 | 80 | 60 | 75 |
| 25 | 20 | 20 | 40 | 60 | 40 | 20 | 0 | 0 | 0 | 20 | 40 | 60 | 40 | 20 | 25 |
| 25 | 20 | 20 | 40 | 80 | 60 | 40 | 20 | 0 | 0 | 0 | 20 | 60 | 40 | 20 | 25 |
| 50 | 60 | 60 | 60 | 60 | 40 | 20 | 0 | 0 | 20 | 0 | 20 | 60 | 60 | 60 | 50 |
| 33 | 25 | 25 | 25 | 25 | 0 | 0 | 0 | 25 | 25 | 25 | 0 | 25 | 25 | 25 | 33 |

**Figure 13. Percentage of core and edge metrics**. Metric 25: Percentage of core and Metric 26: Percentage of edge for a circular window with 100 m size, as an illustrative example in the toy landscape.

**Perimeter metrics (Figure 14)**: considering a binary habitat map, the perimeter is the number of cells sides of a fragment facing the matrix, including any internal holes, in meters (**Metric 27: Perimeter**). Perimeter-area ratio is the ratio between fragment perimeter and fragment area, without a measurement unit (**Metric 28: Perimeter-area ratio**). This is a simple measure of shape complexity, the higher its value, the greater the complexity of the fragment shape. A limitation in using this metric as a shape complexity index is that it varies with the area of the fragment. For example, holding shape constant, an increase in fragment area will cause a decrease in the perimeter-area ratio. Edge depths considered: 30 m. Non-habitat cells were assigned with NULL values.

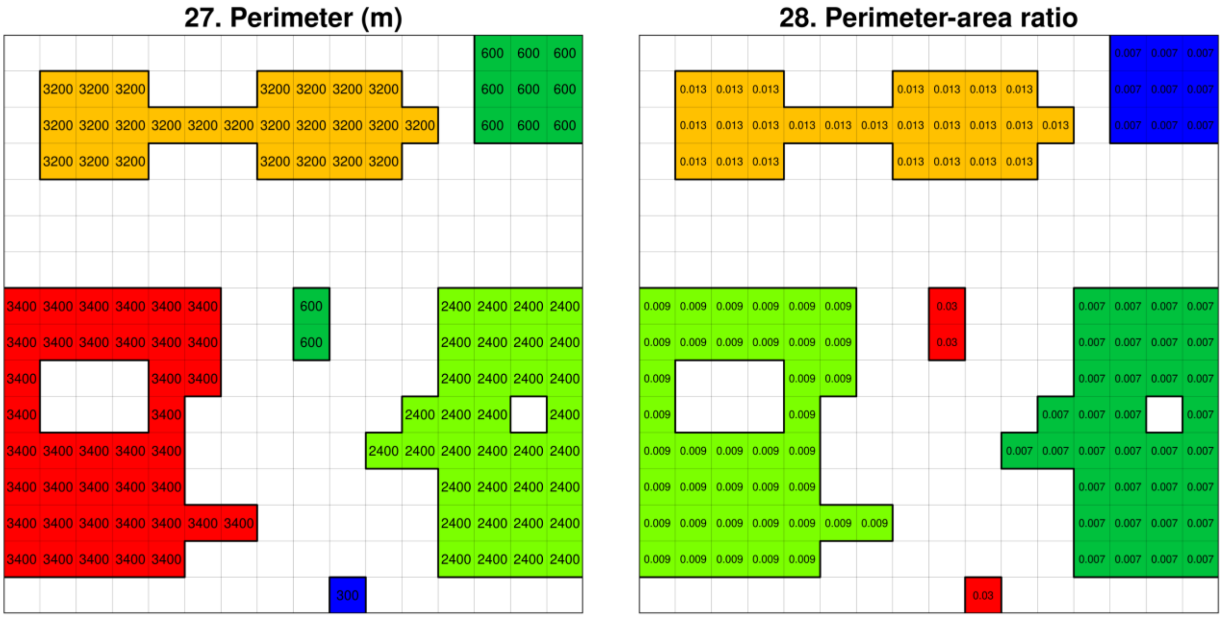
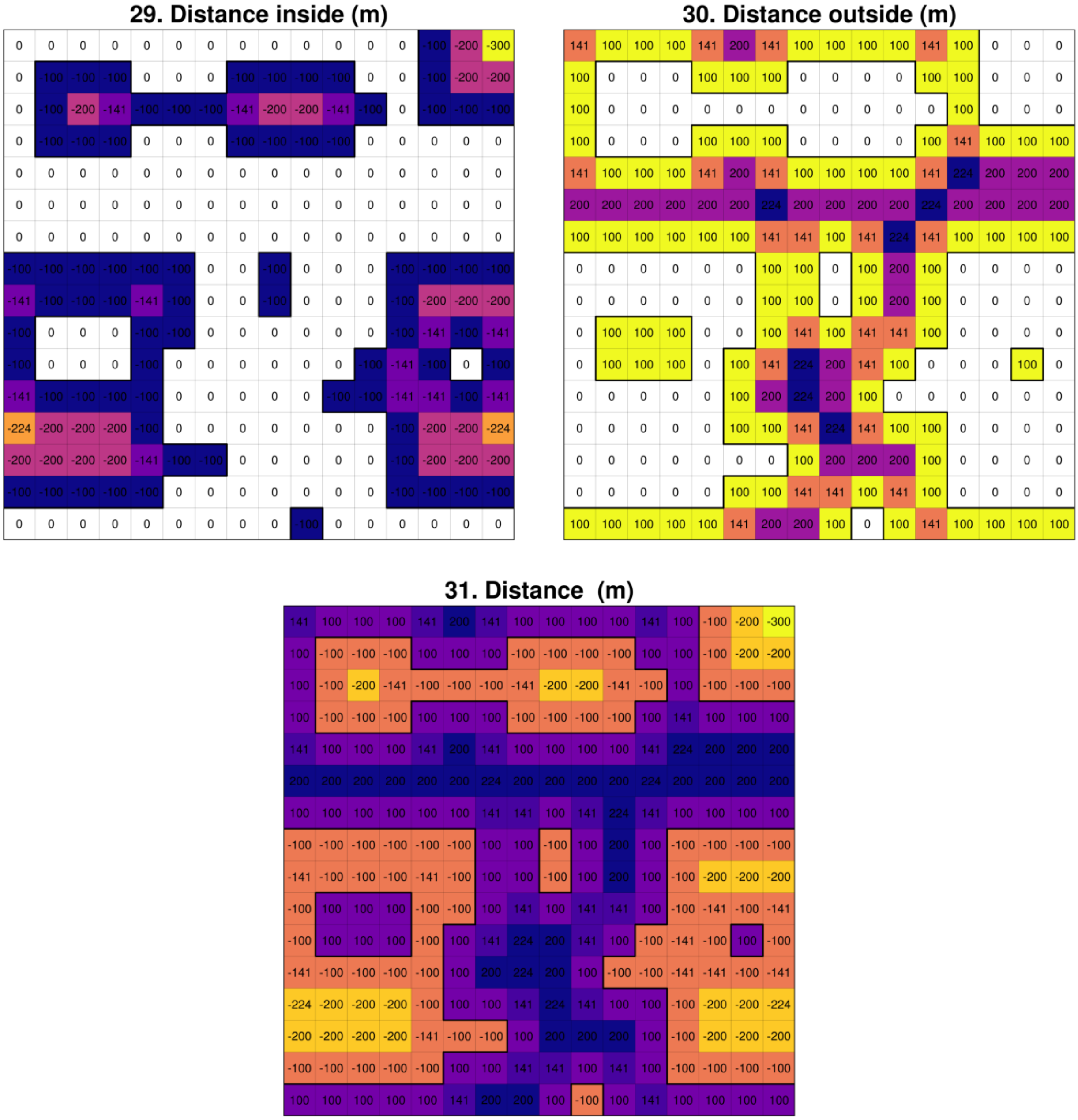


**Figure 14. Perimeter metrics.** Metric 27: Perimeter (m) is the number of pixel sides of a fragment facing the matrix. Metric 28: Perimeter-area ratio is a shape complexity metric.

**Distance metrics (Figure 15)**: considering a binary habitat map, these metrics are based on maps of Euclidean distance inside and outside from habitat edges, in meters. Each cell outside habitat (matrix, non-habitat) was given a positive value equal to the distance to the nearest habitat cell edge (**Metric 29: Distance outside**). Cells inside habitat were given a negative value, corresponding to the distance to the nearest edge with matrix cells (**Metric 30: Distance inside**). Inside and outside distances were combined in a metric by summing outside and inside distance metrics, only for FV and NV (**Metric 31: Distance**).



29. Distance inside (m)

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -100 | -200 | -300 |
| 0 | -100 | -100 | -100 | 0 | 0 | 0 | -100 | -100 | -100 | -100 | 0 | 0 | -100 | -200 | -200 |
| 0 | -100 | -200 | -141 | -100 | -100 | -100 | -141 | -200 | -200 | -141 | -100 | 0 | -100 | -100 | -100 |
| 0 | -100 | -100 | -100 | 0 | 0 | 0 | -100 | -100 | -100 | -100 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| -100 | -100 | -100 | -100 | -100 | -100 | 0 | 0 | -100 | 0 | 0 | 0 | -100 | -100 | -100 | -100 |
| -141 | -100 | -100 | -100 | -141 | -100 | 0 | 0 | -100 | 0 | 0 | 0 | -100 | -200 | -200 | -200 |
| -100 | 0 | 0 | 0 | -100 | -100 | 0 | 0 | 0 | 0 | 0 | 0 | -100 | -141 | -100 | -141 |
| -100 | 0 | 0 | 0 | -100 | 0 | 0 | 0 | 0 | 0 | 0 | -100 | -141 | -100 | 0 | -100 |
| -141 | -100 | -100 | -100 | -100 | 0 | 0 | 0 | 0 | 0 | -100 | -100 | -141 | -141 | -100 | -141 |
| -224 | -200 | -200 | -200 | -100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -100 | -200 | -200 | -224 |
| -200 | -200 | -200 | -200 | -141 | -100 | -100 | 0 | 0 | 0 | 0 | 0 | -100 | -200 | -200 | -200 |
| -100 | -100 | -100 | -100 | -100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -100 | -100 | -100 | -100 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -100 | 0 | 0 | 0 | 0 | 0 | 0 |

30. Distance outside (m)

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 141 | 100 | 100 | 100 | 141 | 200 | 141 | 100 | 100 | 100 | 100 | 141 | 100 | 0 | 0 | 0 |
| 100 | 0 | 0 | 0 | 100 | 100 | 100 | 0 | 0 | 0 | 0 | 100 | 100 | 0 | 0 | 0 |
| 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 0 | 0 | 0 |
| 100 | 0 | 0 | 0 | 100 | 100 | 100 | 0 | 0 | 0 | 0 | 100 | 141 | 100 | 100 | 100 |
| 141 | 100 | 100 | 100 | 141 | 200 | 141 | 100 | 100 | 100 | 100 | 141 | 224 | 200 | 200 | 200 |
| 200 | 200 | 200 | 200 | 200 | 200 | 224 | 200 | 200 | 200 | 200 | 224 | 200 | 200 | 200 | 200 |
| 100 | 100 | 100 | 100 | 100 | 100 | 141 | 141 | 100 | 141 | 224 | 141 | 100 | 100 | 100 | 100 |
| 0 | 0 | 0 | 0 | 0 | 0 | 100 | 100 | 0 | 100 | 200 | 100 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 100 | 100 | 0 | 100 | 200 | 100 | 0 | 0 | 0 | 0 |
| 0 | 100 | 100 | 100 | 0 | 0 | 100 | 141 | 100 | 141 | 141 | 100 | 0 | 0 | 0 | 0 |
| 0 | 100 | 100 | 100 | 0 | 100 | 141 | 224 | 200 | 141 | 100 | 0 | 0 | 0 | 100 | 0 |
| 0 | 0 | 0 | 0 | 0 | 100 | 200 | 224 | 200 | 100 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 100 | 100 | 141 | 224 | 141 | 100 | 100 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 200 | 200 | 200 | 100 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 100 | 100 | 141 | 141 | 100 | 141 | 100 | 0 | 0 | 0 | 0 |
| 100 | 100 | 100 | 100 | 100 | 141 | 200 | 200 | 100 | 0 | 100 | 141 | 100 | 100 | 100 | 100 |

31. Distance (m)

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 141 | 100 | 100 | 100 | 141 | 200 | 141 | 100 | 100 | 100 | 100 | 141 | 100 | -100 | -200 | -300 |
| 100 | -100 | -100 | -100 | 100 | 100 | 100 | -100 | -100 | -100 | -100 | 100 | 100 | -100 | -200 | -200 |
| 100 | -100 | -200 | -141 | -100 | -100 | -100 | -141 | -200 | -200 | -141 | -100 | 100 | -100 | -100 | -100 |
| 100 | -100 | -100 | -100 | 100 | 100 | 100 | -100 | -100 | -100 | -100 | 100 | 141 | 100 | 100 | 100 |
| 141 | 100 | 100 | 100 | 141 | 200 | 141 | 100 | 100 | 100 | 100 | 141 | 224 | 200 | 200 | 200 |
| 200 | 200 | 200 | 200 | 200 | 200 | 224 | 200 | 200 | 200 | 200 | 224 | 200 | 200 | 200 | 200 |
| 100 | 100 | 100 | 100 | 100 | 100 | 141 | 141 | 100 | 141 | 224 | 141 | 100 | 100 | 100 | 100 |
| -100 | -100 | -100 | -100 | -100 | -100 | 100 | 100 | -100 | 100 | 200 | 100 | -100 | -100 | -100 | -100 |
| -141 | -100 | -100 | -100 | -141 | -100 | 100 | 100 | -100 | 100 | 200 | 100 | -100 | -200 | -200 | -200 |
| -100 | 100 | 100 | 100 | -100 | -100 | 100 | 141 | 100 | 141 | 141 | 100 | -100 | -141 | -100 | -141 |
| -100 | 100 | 100 | 100 | -100 | 100 | 141 | 224 | 200 | 141 | 100 | -100 | -141 | -100 | 100 | -100 |
| -141 | -100 | -100 | -100 | -100 | 100 | 200 | 224 | 200 | 100 | -100 | -100 | -141 | -141 | -100 | -141 |
| -224 | -200 | -200 | -200 | -100 | 100 | 100 | 141 | 224 | 141 | 100 | 100 | -100 | -200 | -200 | -224 |
| -200 | -200 | -200 | -200 | -141 | -100 | -100 | 100 | 200 | 200 | 200 | 100 | -100 | -200 | -200 | -200 |
| -100 | -100 | -100 | -100 | -100 | 100 | 100 | 141 | 141 | 100 | 141 | 100 | -100 | -100 | -100 | -100 |
| 100 | 100 | 100 | 100 | 100 | 141 | 200 | 200 | 100 | -100 | 100 | 141 | 100 | 100 | 100 | 100 |

**Figure 15. Distance metrics**. Metric 29: Distance inside (m) is the distance inside from habitat with negative values. Metric 30: Distance outside (m) is the outside distance from habitat with positive values. Metric 31: Distance (m) is the distance to habitat (FV and NV only) resulting from summing Distance inside (m) and Distance outside (m).

**Structural connectivity metrics (Figure 16)**: considering a binary habitat map, these metrics represent the area of habitat structurally connected to a patch, considering corridors, branches and possibly other patches (if the corridor connects these patches). In practice, it is calculated as the difference between the fragment area and the patch area. When a patch has no corridors or branches, its structural connectivity equals zero (i.e., it is not structurally connected to any other habitat). Each patch cell is assigned a structural connectivity value (**Metric 32: Structural connectivity**). The structural connected area was calculated from the original fragment, where the structural connectivity of the patches was associated with the fragment (**Metric 33: Connected structural area**). The definition of structural connectivity depends on what is considered patch, corridor and branch, so this metric depends on the edge depth value considered. For the AF the depth of the chosen edge was 30 m. The unit used to calculate the area was hectares. Non-habitat cells were assigned with NULL values.

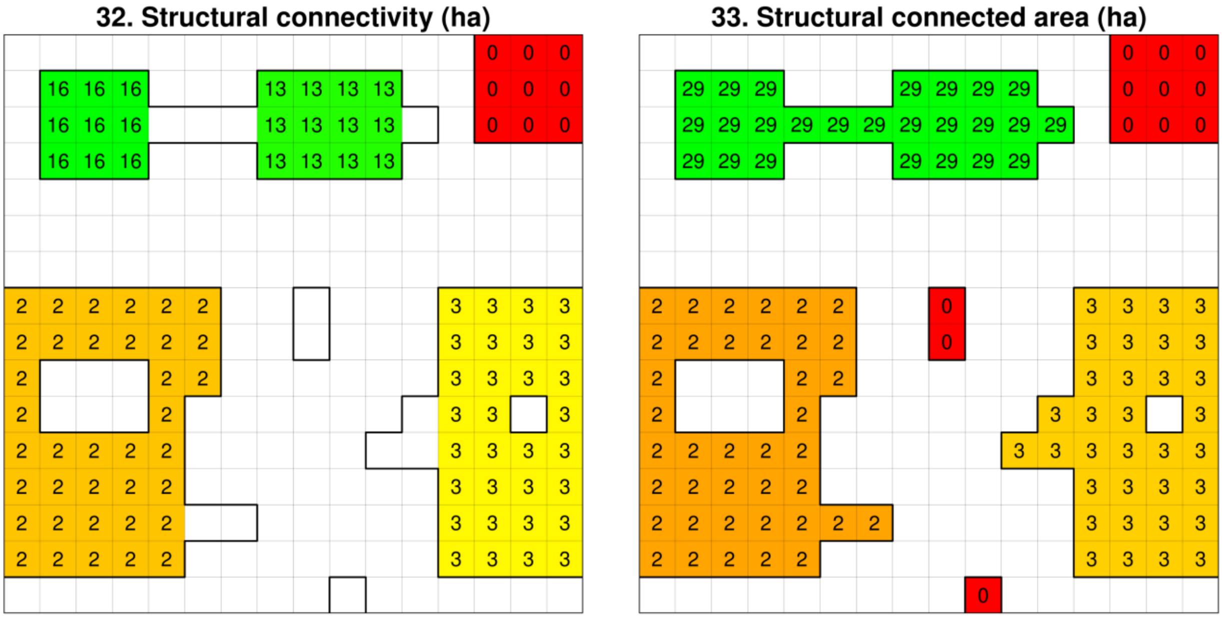
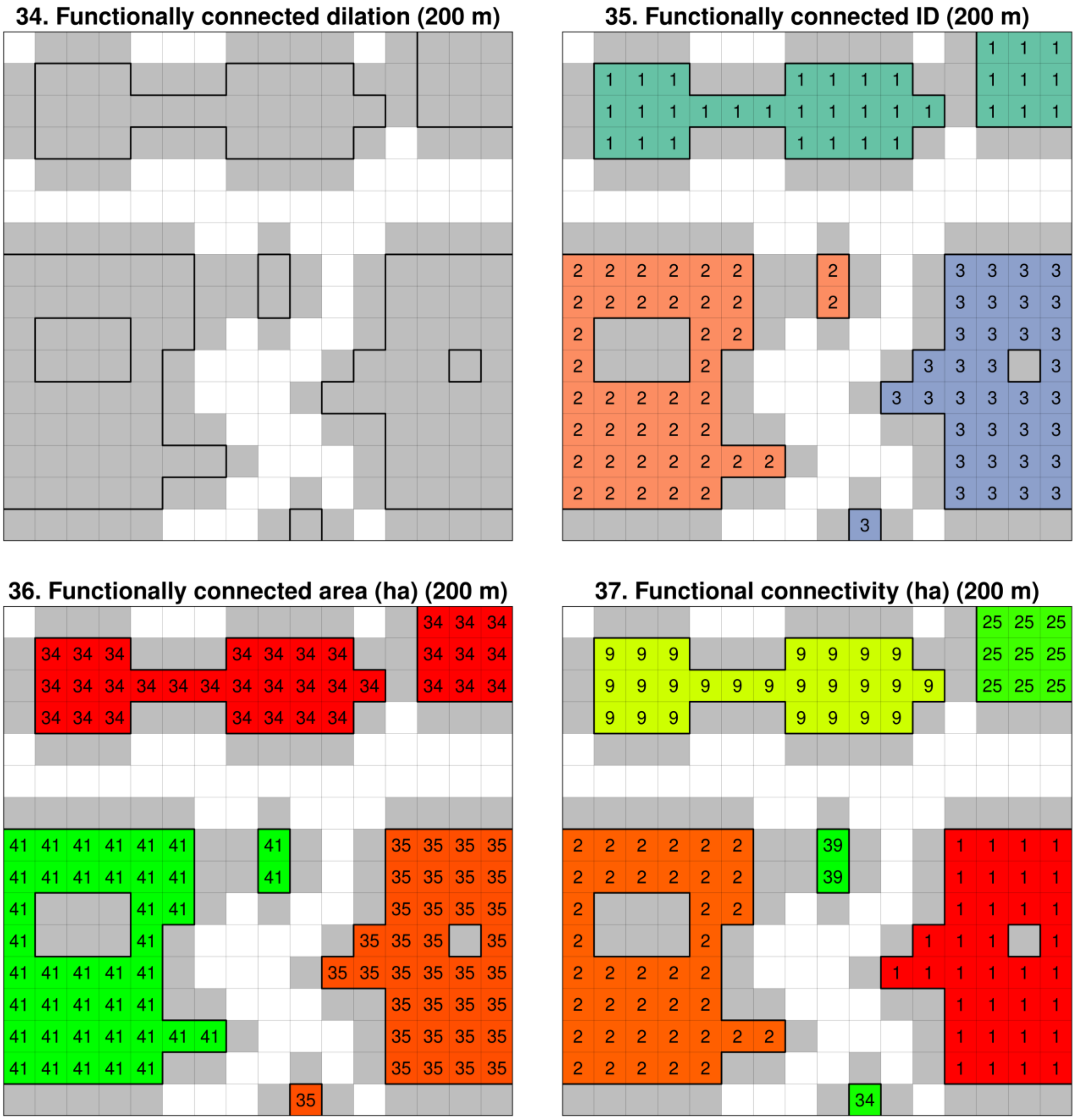


**Figure 16. Structural connectivity metrics.** Metric 32: Structural connectivity (ha) is the area of habitat structurally connected to a patch only for patches in hectares. Metric 33: Structural connected area (ha) is the area of structurally connected habitat to fragments in hectares.

**Functional connectivity metrics (Figure 17)**: considering a binary habitat map, these metrics represent the habitat area functionally linked to a fragment, considering the ability of an organism to cross non-habitat gaps (gap-crossing value). First, the fragments are expanded/dilated by half the value of the organism's gap-crossing capacity (e.g., if an organism crosses 200 m, the fragments will be dilated by 100 m along their entire perimeter) (**Metric 34: Functionally connected dilation**). Then, the fragments that are at the shortest distance from the gap-crossing are grouped, receiving the same ID (**Metric 35: Functionally connected ID**). Then, the area of these fragments with the same ID was summed (**Metric 36: Functionally connected area**). Finally, to obtain the functional connectivity, the difference between the functionally connected area and the fragment area was calculated, representing how much habitat is accessible from a habitat fragment for an organism with a given gap-crossing ability, excluding the area of the very same fragment (**Metric 37: Functional**

**connectivity**). Crossing capacities considered for the AF: 60 m, 120 m, 180 m, 240 m, 300 m, 600 m. The unit used to calculate the area was hectares. Non-habitat cells were assigned with NULL values.



34. Functionally connected dilation (200 m)

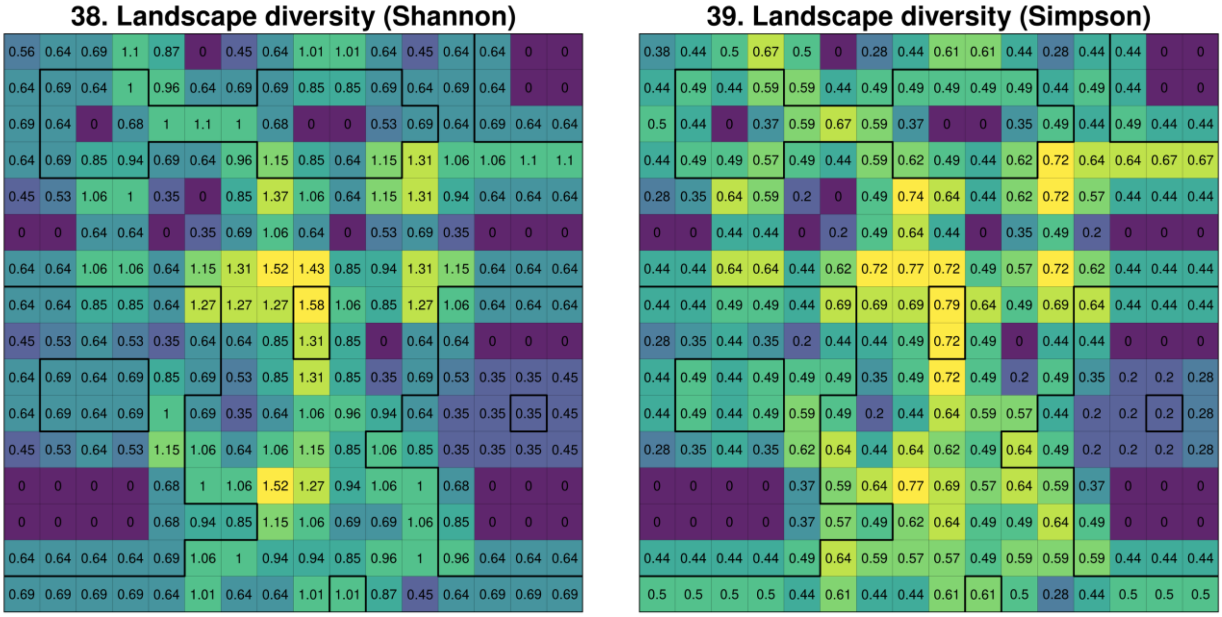
35. Functionally connected ID (200 m)

36. Functionally connected area (ha) (200 m)

37. Functional connectivity (ha) (200 m)

**Figure 17. Functional connectivity metrics**. Metric 34: Functionally connected dilation (200 m) is the dilation of fragments for gap-crossing of 100 m (gray pixels). Metric 35: Functionally connected ID (200 m) is the functionally connected area identification. Metric 36: Functionally connected area (ha) is the fragment area connected in hectares. Metric 37: Functional connectivity (ha) (200 m) is the functional connectivity in hectares.

**Landscape diversity metrics (Figure 18):** considering a multi-class map, each cell of the map presented a value of the diversity of LULC classes within a square window with a given size, centered in the focal cell. Diversity (Shannon and Simpson) indices consider the number of classes in each class cell within the window of analysis. Shannon's diversity values are positive values and vary between 0 and infinity (**Metric 38: Landscape diversity (Shannon)**) and Simpson's diversity values vary between 0 and 1 (**Metric 39: Landscape diversity (Simpson)**). Buffer radius represented half the size of a square window, e.g., for a buffer size of 50 m, the window size was 100 m. Buffer radii used: 50 m, 100 m, 150 m, 200 m, 250 m, 500 m, 750 m, 1000 m, 1500 m and 2000 m. Due to computational limitations, we were unable to calculate landscape diversity metrics for the 2,500 m buffer radius.



38. Landscape diversity (Shannon)

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.56 | 0.64 | 0.69 | 1.1 | 0.87 | 0 | 0.45 | 0.64 | 1.01 | 1.01 | 0.64 | 0.45 | 0.64 | 0.64 | 0 | 0 |
| 0.64 | 0.69 | 0.64 | 1 | 0.96 | 0.64 | 0.69 | 0.69 | 0.85 | 0.85 | 0.69 | 0.64 | 0.69 | 0.64 | 0 | 0 |
| 0.69 | 0.64 | 0 | 0.68 | 1 | 1.1 | 1 | 0.68 | 0 | 0 | 0.53 | 0.69 | 0.64 | 0.69 | 0.64 | 0.64 |
| 0.64 | 0.69 | 0.85 | 0.94 | 0.69 | 0.64 | 0.96 | 1.15 | 0.85 | 0.64 | 1.15 | 1.31 | 1.06 | 1.06 | 1.1 | 1.1 |
| 0.45 | 0.53 | 1.06 | 1 | 0.35 | 0 | 0.85 | 1.37 | 1.06 | 0.64 | 1.15 | 1.31 | 0.94 | 0.64 | 0.64 | 0.64 |
| 0 | 0 | 0.64 | 0.64 | 0 | 0.35 | 0.69 | 1.06 | 0.64 | 0 | 0.53 | 0.69 | 0.35 | 0 | 0 | 0 |
| 0.64 | 0.64 | 1.06 | 1.06 | 0.64 | 1.15 | 1.31 | 1.52 | 1.43 | 0.85 | 0.94 | 1.31 | 1.15 | 0.64 | 0.64 | 0.64 |
| 0.64 | 0.64 | 0.85 | 0.85 | 0.64 | 1.27 | 1.27 | 1.27 | 1.58 | 1.06 | 0.85 | 1.27 | 1.06 | 0.64 | 0.64 | 0.64 |
| 0.45 | 0.53 | 0.64 | 0.53 | 0.35 | 0.64 | 0.64 | 0.85 | 1.31 | 0.85 | 0 | 0.64 | 0.64 | 0 | 0 | 0 |
| 0.64 | 0.69 | 0.64 | 0.69 | 0.85 | 0.69 | 0.53 | 0.85 | 1.31 | 0.85 | 0.35 | 0.69 | 0.53 | 0.35 | 0.35 | 0.45 |
| 0.64 | 0.69 | 0.64 | 0.69 | 1 | 0.69 | 0.35 | 0.64 | 1.06 | 0.96 | 0.94 | 0.64 | 0.35 | 0.35 | 0.35 | 0.45 |
| 0.45 | 0.53 | 0.64 | 0.53 | 1.15 | 1.06 | 0.64 | 1.06 | 1.15 | 0.85 | 1.06 | 0.85 | 0.35 | 0.35 | 0.35 | 0.45 |
| 0 | 0 | 0 | 0 | 0.68 | 1 | 1.06 | 1.52 | 1.27 | 0.94 | 1.06 | 1 | 0.68 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0.68 | 0.94 | 0.85 | 1.15 | 1.06 | 0.69 | 0.69 | 1.06 | 0.85 | 0 | 0 | 0 |
| 0.64 | 0.64 | 0.64 | 0.64 | 0.69 | 1.06 | 1 | 0.94 | 0.94 | 0.85 | 0.96 | 1 | 0.96 | 0.64 | 0.64 | 0.64 |
| 0.69 | 0.69 | 0.69 | 0.69 | 0.64 | 1.01 | 0.64 | 0.64 | 1.01 | 1.01 | 0.87 | 0.45 | 0.64 | 0.69 | 0.69 | 0.69 |

39. Landscape diversity (Simpson)

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.38 | 0.44 | 0.5 | 0.67 | 0.5 | 0 | 0.28 | 0.44 | 0.61 | 0.61 | 0.44 | 0.28 | 0.44 | 0.44 | 0 | 0 |
| 0.44 | 0.49 | 0.44 | 0.59 | 0.59 | 0.44 | 0.49 | 0.49 | 0.49 | 0.49 | 0.49 | 0.44 | 0.49 | 0.44 | 0 | 0 |
| 0.5 | 0.44 | 0 | 0.37 | 0.59 | 0.67 | 0.59 | 0.37 | 0 | 0 | 0.35 | 0.49 | 0.44 | 0.49 | 0.44 | 0.44 |
| 0.44 | 0.49 | 0.49 | 0.57 | 0.49 | 0.44 | 0.59 | 0.62 | 0.49 | 0.44 | 0.62 | 0.72 | 0.64 | 0.64 | 0.67 | 0.67 |
| 0.28 | 0.35 | 0.64 | 0.59 | 0.2 | 0 | 0.49 | 0.74 | 0.64 | 0.44 | 0.62 | 0.72 | 0.57 | 0.44 | 0.44 | 0.44 |
| 0 | 0 | 0.44 | 0.44 | 0 | 0.2 | 0.49 | 0.64 | 0.44 | 0 | 0.35 | 0.49 | 0.2 | 0 | 0 | 0 |
| 0.44 | 0.44 | 0.64 | 0.64 | 0.44 | 0.62 | 0.72 | 0.77 | 0.72 | 0.49 | 0.57 | 0.72 | 0.62 | 0.44 | 0.44 | 0.44 |
| 0.44 | 0.44 | 0.49 | 0.49 | 0.44 | 0.69 | 0.69 | 0.69 | 0.79 | 0.64 | 0.49 | 0.69 | 0.64 | 0.44 | 0.44 | 0.44 |
| 0.28 | 0.35 | 0.44 | 0.35 | 0.2 | 0.44 | 0.44 | 0.49 | 0.72 | 0.49 | 0 | 0.44 | 0.44 | 0 | 0 | 0 |
| 0.44 | 0.49 | 0.44 | 0.49 | 0.49 | 0.49 | 0.35 | 0.49 | 0.72 | 0.49 | 0.2 | 0.49 | 0.35 | 0.2 | 0.2 | 0.28 |
| 0.44 | 0.49 | 0.44 | 0.49 | 0.59 | 0.49 | 0.2 | 0.44 | 0.64 | 0.59 | 0.57 | 0.44 | 0.2 | 0.2 | 0.2 | 0.28 |
| 0.28 | 0.35 | 0.44 | 0.35 | 0.62 | 0.64 | 0.44 | 0.64 | 0.62 | 0.49 | 0.64 | 0.49 | 0.2 | 0.2 | 0.2 | 0.28 |
| 0 | 0 | 0 | 0 | 0.37 | 0.59 | 0.64 | 0.77 | 0.69 | 0.57 | 0.64 | 0.59 | 0.37 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0.37 | 0.57 | 0.49 | 0.62 | 0.64 | 0.49 | 0.49 | 0.64 | 0.49 | 0 | 0 | 0 |
| 0.44 | 0.44 | 0.44 | 0.44 | 0.49 | 0.64 | 0.59 | 0.57 | 0.57 | 0.49 | 0.59 | 0.59 | 0.59 | 0.44 | 0.44 | 0.44 |
| 0.5 | 0.5 | 0.5 | 0.5 | 0.44 | 0.61 | 0.44 | 0.44 | 0.61 | 0.61 | 0.5 | 0.28 | 0.44 | 0.5 | 0.5 | 0.5 |

**Figure 18. Landscape diversity metrics**. Metric 38: Landscape diversity (Shannon) and Metric 39: Landscape diversity (Simpson) indices for a square window with 100 m size, in the illustrative example for the toy landscape.

*Topographic metrics*

We calculated six metrics of topography using a Digital Elevation Model (DEM) map from FABDEM v1.2 (Hawker et al. 2022) (Table 4). We used two GRASS GIS modules: *r.slope.aspect* and *r.geomorphon*.

**Table 4. Topographic metrics description.**

| Metric | Short description | Values | Reference |
|---|---|---|---|
| 1. Elevation | Digital representation of elevations (or height) in meters through Digital | Meters | Hawker et al. (2022) |

|  |  |  |  |
|---|---|---|---|
|  | Elevation Model (DEM). |  |  |
| 2. Slope | Inclination from the horizontal stated in degrees | Degrees (0º to 90º) | Hawker et al. (2022) |
| 3. Aspect | Direction that slopes are facing counterclockwise from East in degrees: 90 degrees is North, 180 is West, 270 is South, 360 is East | Degrees (0º to 360º) | Hawker et al. (2022) |
| 4. Profile curvature | Curvature in the direction of steepest slope in 1/meters. A curvature of 0.05 corresponds to a radius of curvature of 20 meters and positive and negative values represent convex and concave forms, respectively | Units | Hawker et al. (2022) |
| 5. Tangential curvature | Curvature in the direction of the contour tangent in 1/meters. A curvature of 0.05 corresponds to a radius of curvature of 20 meters and positive and negative values represent convex and concave forms, respectively | Units | Hawker et al. (2022) |
| 6. Geomorphon | Classification and mapping of landform elements from a DEM based on the principle of pattern recognition (geomorphon) | Classes: flat (1), peak (2), ridge (3), shoulder (4), spur (5), slope (6), hollow (7), footslope (8), valley (9), pit (10) | Jasiewicz and Stepinski (2013) |

*Hydrologic metrics*

We calculated four hydrologic metrics using a Digital Elevation Model (DEM) map from FABDEM v1.2 (Hawker et al. 2022) (Table 5). Due to the large extension, we first calculated these metrics for hydrologic smaller basins using the HydroBASINS level 5 (Lehner and Grill 2013); after that we merged the results into single maps for the four metrics. We used two GRASS GIS modules to calculate the potential streams and springs: *r.watershed* and *r.stream.extract*, both with threshold = 100. With the potential streams and strings done, we deleted the lines and points, respectively, that overlap with masses of water from HydroLAKES (Messager et al. 2016) and official masses of water from three countries: Brazil (Instituto Brasileiro de Geografia e Estatística – IBGE; IBGE, 2021), Argentina (Instituto Geográfico Nacional – IGN; IGN, 2023) and Paraguay (Instituto Nacional de Estadística – INE; INE, 2023). Stream Euclidean distance was generated using *r.grow.distance*

GRASS GIS module with metric = euclidean, and spring kernel was generated using *v.kernel* module with radius varying (50 m, 100 m, 150 m, 200 m, 250 m, 500 m, 750 m, 1000 m, 1500 m, 2000 m, 2500 m) and kernel = gaussian.

**Table 5. Hydrologic metrics description.**

| Metric | Short description | Values | Scale (buffer radius in meters) | Reference |
|---|---|---|---|---|
| 1. Stream | Potential streams generated from DEM | 0 and 1 | None | Holmgren (1994) |
| 2. Stream distance | Euclidean distance from potential streams generated from DEM | Meters | None | Holmgren (1994) |
| 3. Spring | Potential springs generated from DEM | 0 and 1 | None | Holmgren (1994) |
| 4. Spring density | Density (kernel) of potential springs generated from DEM | Units | 50, 100, 150, 200, 250, 500, 750, 1000, 1500, 2000, 2500 | Okabe et al. (2009) |

*Anthropogenic metrics*

We calculated 12 anthropogenic metrics represented by Euclidean distances outside (positive values) from roads, railways, protected areas, indigenous territories and the grouped classes categories: pasture, temporary crop, perennial crop, forest plantation, urban areas, mining and water (Table 1; Figure 2b). These metrics represented the approximation of human impact at the landscape scale. We used the *r.grow.distance* GRASS GIS module with metric = euclidean.

**Table 3. Anthropogenic metrics description.**

| Metric | Short description | Values | Reference |
|---|---|---|---|
| 1. Distance from roads | Euclidean distance from roads | Meters | Ribeiro et al. (2009) |
| 2. Distance from railways | Euclidean distance from railways | Meters | Ribeiro et al. (2009) |
| 3. Distance from roads and railways | Euclidean distance from roads and railways | Meters | Ribeiro et al. (2009) |
| 4. Distance from protected areas | Euclidean distance from protected areas | Meters | Ribeiro et al. (2009) |

| | | | |
|---|---|---|---|
| 5. Distance from indigenous territories | Euclidean distance from indigenous territories | Meters | Ribeiro et al. (2009) |
| 6. Distance from the forest plantation | Euclidean distance from forest plantation | Meters | Ribeiro et al. (2009) |
| 7. Distance from the pasture | Euclidean distance from pasture | Meters | Ribeiro et al. (2009) |
| 8. Distance from the temporary crop | Euclidean distance from temporary crop | Meters | Ribeiro et al. (2009) |
| 9. Distance from the perennial crop | Euclidean distance from perennial crop | Meters | Ribeiro et al. (2009) |
| 10. Distance from the urban areas | Euclidean distance from urban areas | Meters | Ribeiro et al. (2009) |
| 11. Distance from the mining | Euclidean distance from mining | Meters | Ribeiro et al. (2009) |
| 12. Distance from the water | Euclidean distance from water (lakes and rivers) | Meters | Ribeiro et al. (2009) |

*Software*

All the landscape, topographic, hydrologic and anthropogenic metrics were processed using GRASS GIS 8.3 (Neteler et al. 2012) and R language 4.3 (R Core Team, 2023) with the aid of the *rgrass* package (Bivand, 2023). All landscape metrics were calculated using custom functions based on *LSMetrics* and translated to R (https://github.com/LEEClab/LS_METRICS; Niebuhr et al. *in prep.*).

### 4. Project personnel

None.

## Class III. Data set status and accessibility

### A. Status

### 1. Latest update

November 2023.

### 2. Latest archive date

November 2023.

### 3. Metadata status

Last updated in November 2023, version submitted.

### 4. Data verification

Last updated in November 2023, version submitted.

## B. Accessibility

### 1. Storage location and medium

The original ATLANTIC SPATIAL data set can be accessed as supporting information to this Data Paper publication in Ecology. Updated versions and additional information are available at the Open Science Framework (OSF) (https://doi.org/10.17605/OSF.IO/AJUMC) and code at GitHub (https://github.com/mauriciovancine/ATLANTIC-SPATIAL). We also created the R package *atlanticr* (https://mauriciovancine.github.io/atlanticr) which, in addition to facilitating access to other data papers from the Atlantic series, provides a table with all metrics and their information "atlantic_spatial" and a function to download rasters "atlantic_spatial_download()".

### 2. Contact persons

Maurício Humberto Vancine (mauricio.vancine@gmail.com), Bernardo Brandão Niebuhr (bernardo_brandaum@yahoo.com.br) or Milton Cezar Ribeiro (miltinho.astronauta@gmail.com).

### 3. Copyright restrictions

CC BY-NC 4.0: Creative Commons Attribution-Non-Commercial 4.0 International.

### 4. Proprietary restrictions

#### a. Release date

None.

#### b. Citation

Please, cite this data paper when the data are used in publications or teaching events.

#### c. Disclaimer(s)

None.

### 5. Costs

None.

## Class IV. Data structural descriptors

The data set contains 1003 files. ATLANTIC_SPATIAL.csv contains a table describing the vector and raster files. The AF delimitation vector is available as Geopackage (.gpkg). The 500 rasters are available as GeoTiff (.tif) and TFW files (.tfw). ATLANTIC_SPATIAL.zip contains all rasters in a single compressed file with GeoTiff (.tif) and TFW (.tfw) files.

### A. Data set file

**1. Identity**: ATLANTIC_SPATIAL.csv

**2. Size**: 20 columns and 502 rows records, including header row, 231 KB.

**3. Format and storage mode**: comma-separated values (.csv).

**4. Header information**: See column descriptions in section B.

**5. Alphanumeric attributes**: Mixed.

**6. Special characters/fields**: None.

**7. Authentication procedures**: None.

**1. Identity**: ATLANTIC_SPATIAL.zip

**2. Size**: 232 GB.

**3. Format and storage mode**: compressed file (.zip).

**4. Header information**: None.

**5. Alphanumeric attributes**: None.

**6. Special characters/fields**: None.

**7. Authentication procedures**: None.

### B. Variable information

**1) Table 1**. **Information in the ATLANTIC SPATIAL data set**. Description of the fields related with the study site of the ATLANTIC_SPATIAL.csv.

| Variable identify | Variable description | Levels | Example |
|---|---|---|---|
| **id** | Identification code for each metric | 001-502 | 006 |
| **metric** | Metric name | Detailed name of metric in text format | atlantic_spatial_forest_vegetation_fragment_area |

| | | | |
|---|---|---|---|
| **metric_group** | Group of metrics | anthropogenic, hydrologic, landscape, topographic | landscape |
| **metric_type** | Detailed description of metric types | Detailed description of metric types in text format | fragment_area |
| **metric_description** | Detailed description of metrics | Detailed description of metrics in text format | forest vegetation fragment area |
| **value** | Metric values | Detailed metrics values in text and number formats | 0.09 to infinity |
| **value_description** | Detailed description of metric values | Detailed description of metric values in text format | area |
| **unit** | Unit of metrics | 1/meters, angles in degrees, binary, categorical, discrete, hectares, meters, meters/hectares, proportion, unit, unitary | hectares |
| **lulc_class** | Land use and land cover class | forest_plantation, forest_vegetation, mining, multiple, natural_vegetation, pasture, perennial_crop, temporary_crop, urban_areas, water | forest_vegetation |
| **edge_depth_m** | Edge depth for different metrics in meters. Edge depth is the minimum distance at which cells are classified as edges, those that are further away are classified as cores | 30-240 | NA |

| | | | |
|---|---|---|---|
| **gap_crossing_m** | Gap-crossing for different metrics in meters. Gap-crossing considers the ability of an organism to cross non-habitat gaps, characterizing the distance to functional connectivity | 60-600 | NA |
| **scale_buffer_radius_m** | Scale for different metrics in meters. Scale is the radius of the buffer to which the moving window is rotated to impute the effect of different scales on landscape metrics | 50-10,000 | NA |
| **resolution** | Raster pixel width and height. | 30 | 30 |
| **file_name** | Metrics file name | Multiple metrics name files | 006_atlantic_spatial_forest_vegetation_fragment_area.tif |
| **link_drive_tif** | Link to the .tif file on Google Drive | Multiple links | https://drive.google.com/file/d/14yxqKSNlLVgzONtpTozGhPje4yxeVDcU |
| **link_drive_tfw** | Link to the .tfw file on Google Drive | Multiple links | https://drive.google.com/file/d/1G7vjuQ-sfm-4E2InIkm2NlcET7PzJG4a |
| **link_drive_gpkg** | Link to the .gpkg file on Google Drive | Multiple links | https://drive.google.com/file/d/1P1NH14zW_OVLHG_jbnCuqhxSVBkkDL64 |
| **link_osf_tif** | Link to the .tif file on Open Science Framework (OSF) | Multiple links | https://osf.io/download/6p9ub/ |
| **link_osf_tfw** | Link to the .tfw file on Open Science Framework (OSF) | Multiple links | https://osf.io/download/kvtcq |
| **link_osf_gpkg** | Link to the .gpkg file on Open Science Framework (OSF) | Multiple links | https://osf.io/download/b2t6h/ |

### C. Data anomalies

If no information is available, this was indicated by “NA”.

## Class V. Supplemental descriptors

### A. Data acquisition

#### 1. Data forms or acquisition methods

None.

#### 2. Location of completed data forms

None.

#### 3. Data entry verification procedures

None.

### B. Quality assurance/quality control procedures

None.

### C. Related materials

None.

### D. Computer programs and data-processing algorithms

None.

### E. Archiving

#### 1. Archival procedures

#### 2. Redundant archival sites

### F. Publications and results

Vancine et al. (2023) used part of this data set to describe the spatiotemporal landscape structure of AF.

## G. History of data set usage

### 1. Data request history

None.

### 2. Data set updates history

None.

### 3. Review history

None.

### 4. Question and comments from secondary users

None.

## CRediT authorship contribution statement

**MHV**: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Visualization, Writing— original draft, Writing—review and editing. **BBN**: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Visualization, Writing— original draft, Writing—review and editing. **RLM**: Conceptualization, Data curation, Investigation, Software, Writing—review and editing. **JEFO**: Conceptualization, Data curation, Writing—review and editing. **VT**: Data curation, Conceptualization, Writing—review and editing. **RB**: Data curation, Writing—review and editing. **RSCA**: Data curation, Writing—review and editing. **EMZ**: Data curation, Writing—review and editing. **VCS**: Data curation, Writing—review and editing. **JGRG**: Conceptualization, Data curation, Writing—review and editing. **CHG**: Data curation, Methodology, Software, Writing—review and editing. **MG**: Writing—review and editing. **MCR**: Conceptualization, Data curation, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Writing— original draft, Writing—review and editing.

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