

**ACTIVE RESTORATION PRIORITISATION OF INDIGENOUS VEGETATION ON NATURE RESERVES:
SPATIAL ANALYSIS TECHNICAL REPORT**

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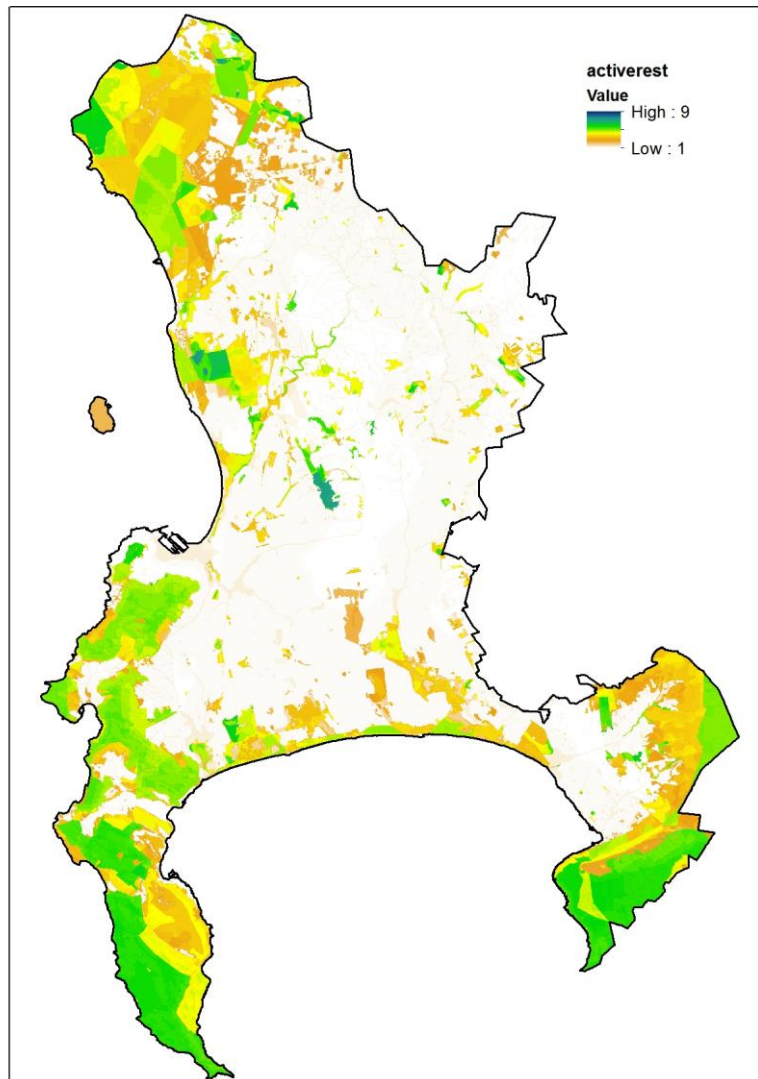


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ACRONYMS

AHP	Analytic Hierarchical Process
BioNet	Biodiversity Network
BMB	Biodiversity Management Branch
CBA	Critical Biodiversity Area
CCT	City of Cape Town
CR	Critically Endangered
DWAF	Department Water Affairs & Forestry
EBA	Ecosystem-based Areas
EN	Endangered
GIS	Geographic Information Systems
NT	Near Threatened
SANBI	South African National Biodiversity Institute
VU	Vulnerable

INTRODUCTION

The aim of this study was to prioritise sites for active restoration of indigenous vegetation in the City of Cape Town's (CCT) nature reserves. It builds on the existing restoration protocol for the Cape Floristic Region (Holmes & Richardson, 1999) and followed the approach used by Mostert (2016). Passive restoration of a site involves the removal of the stressor, commonly invasive alien plants, to allow the indigenous vegetation species to regenerate naturally (Mostert 2016). Active restoration becomes necessary when the indigenous vegetation has been degraded to such an extent that recovery is no longer possible without manual re-introduction of the native plant species by seed or propagated material.

With rapid population growth and development in the city, there is intense competition for land. As the nature reserves are protected by law for the purpose of conservation into the future and because active restoration is an expensive and labour-intensive process, CCT's Biodiversity Management Branch (BMB) must prioritize restoration of degraded areas within the nature reserves and conservation areas. Despite this focus, the analysis was run over the entire remaining extent of indigenous vegetation in order for stakeholders to understand the scale of the need and also to allow for any future changes to protected area boundaries. In addition, owing to the rarity and vulnerability of some of the endemic vegetation types, it could become necessary to actively restore areas outside of the nature reserves while endeavouring to secure these areas for conservation and ecosystem services.

The analysis combined the expertise of the BMB with objective and scientifically-based GIS analysis of the situation on the ground. The results indicate priority sites for active restoration of indigenous vegetation based on expert-led analysis criteria.

STUDY AREA

The extent of the indigenous vegetation remnants within the CCT boundary provided the extent of the study area (Figure 1).

Stakeholder Participation

A workshop of the BMB professional team was held in May 2017 to brainstorm the criteria to be included in the analysis i.e. which factors determine where restoration will have the biggest positive impact. In addition, attendees developed a preliminary weighting of some of the criteria using SuperDecisions Analytical Hierarchical Processing (AHP) software, which is discussed later in this report.

After the first analysis was run, the preliminary results were discussed at the subsequent Flora Management Committee meeting then a second workshop was convened with core staff in November 2017. Attendees approved the rankings, evaluated the preliminary analysis results, and adjusted the criteria and weightings. Attendees included the BMB Branch Manager, and Conservation Services, Invasive Species Management, Nature Reserve Management and GIS staff.

ANALYSIS CRITERIA

In order to guide decision-making as to where to prioritise the active restoration of indigenous vegetation, two key criteria were identified: Biodiversity Importance of the ecosystem (identified by vegetation type) and its contribution to Ecosystem Function. These criteria were broken down into subcriteria and their component inputs (Figure 2).

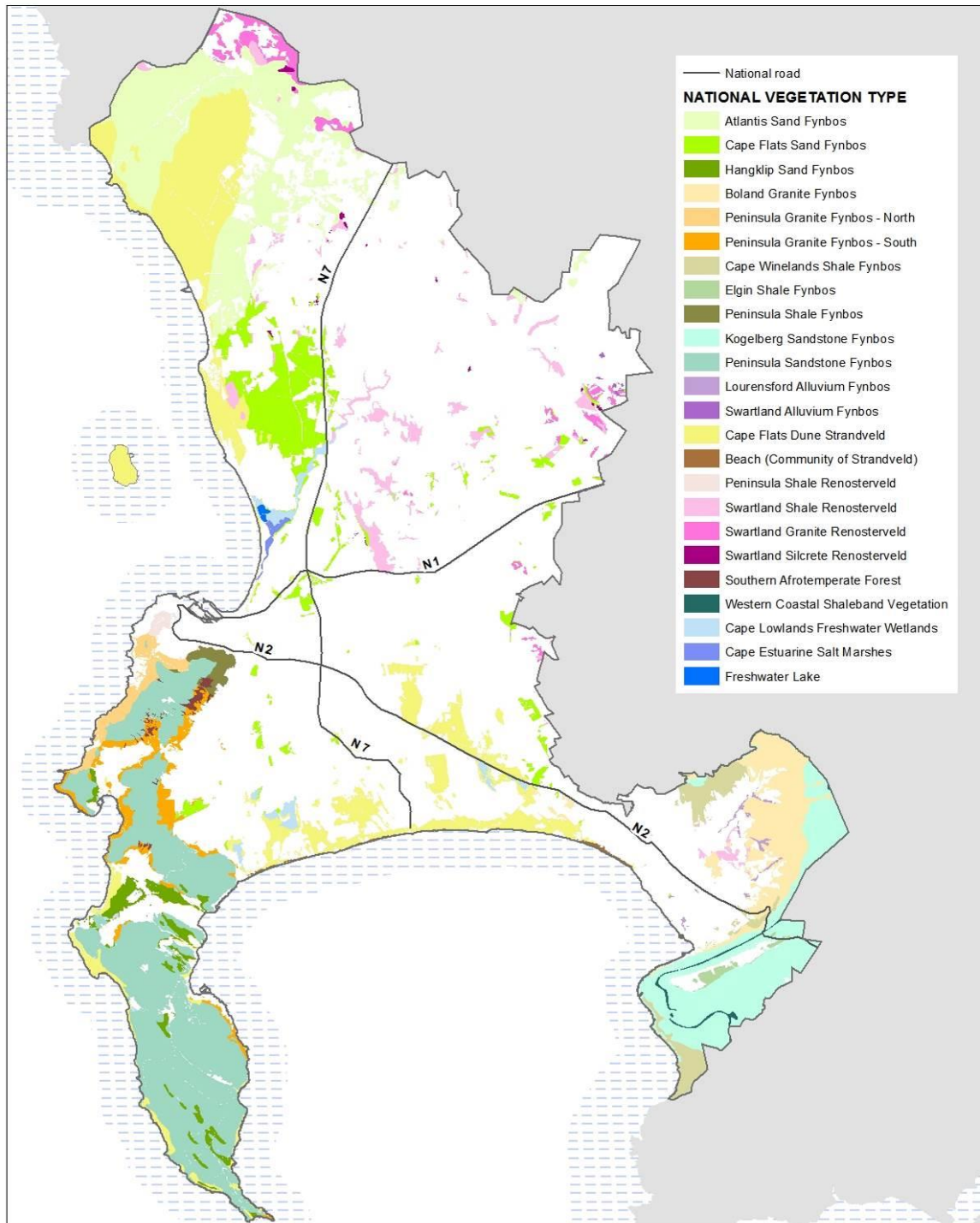


FIGURE 1: STUDY AREA – INDIGENOUS VEGETATION REMNANTS IN THE CITY OF CAPE TOWN



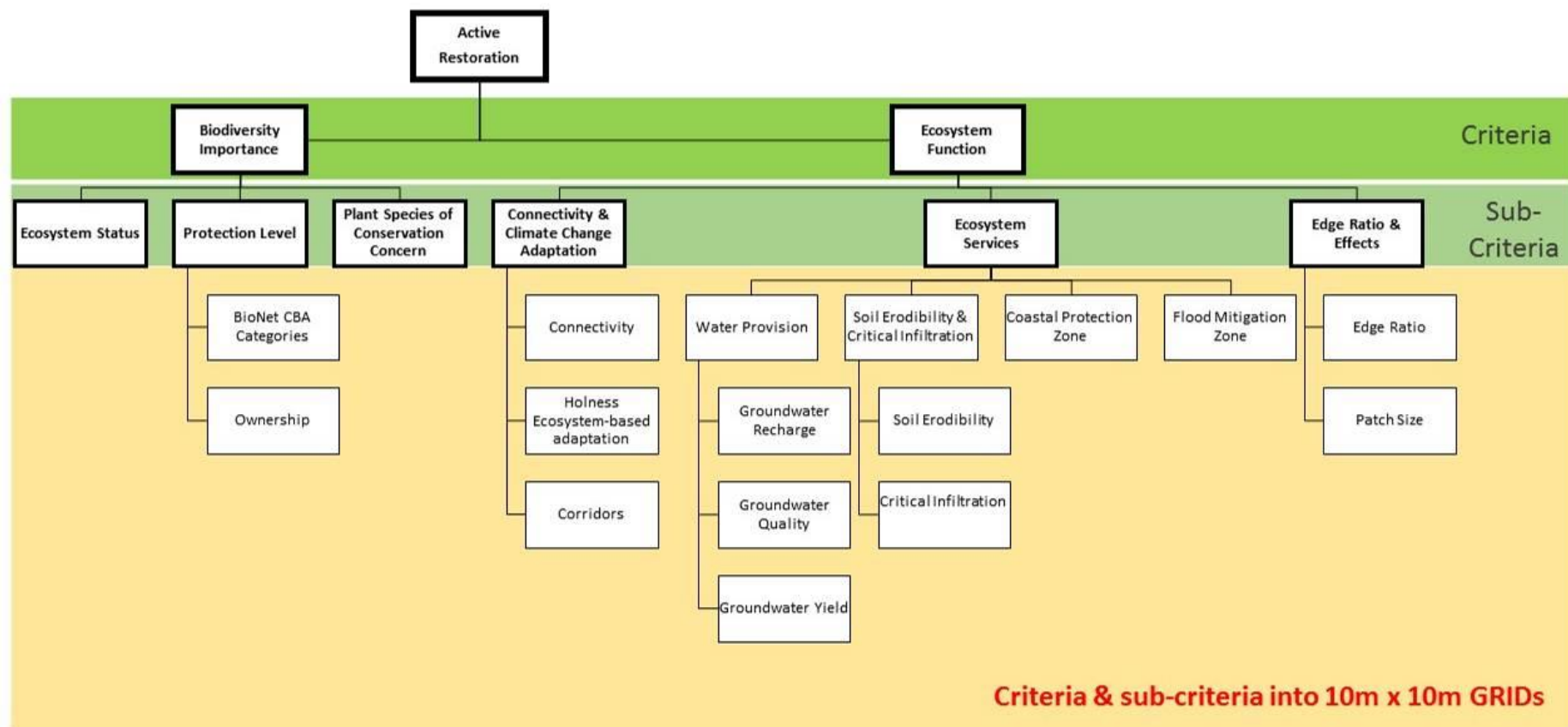


FIGURE 2: ACTIVE RESTORATION PRIORITISATION – CRITERIA & SUBCRITERIA

Analysis criterion: BIODIVERSITY IMPORTANCE

Cape Town harbours a very high concentration of the biodiversity found in the Cape Floristic Region global biodiversity hotspot (Rebelo et al. 2011). For this reason, conservation managers in the city have an international as well as a local responsibility to conserve this biodiversity, a large proportion of which is unique (i.e. endemic). Workshop stakeholders identified biodiversity importance as one of the two main criteria.

The aim of this criterion was to restore indigenous vegetation where it will most contribute towards conserving the rich and endemic biodiversity, including the threatened ecosystems and species. Three subcriteria were identified for their significant role in determining the biodiversity importance of a site: ecosystem threat status of the vegetation type, density of plant species of conservation concern, and level of protection afforded to the site.

Subcriteria of Biodiversity Importance

- SANBI vegetation ecosystem status
 - Vegetation types that are critically endangered under criterion A1 (e.g. in Fynbos those with less than 30% remaining nationally) are the most important to restore.
- Protection level
 - The Terrestrial Biodiversity Network (BioNet) Critical Biodiversity Area (CBA) categories were used to rank the level of protection. These classify the remnant indigenous vegetation based on scientific systematic conservation planning methodology into areas that are protected by proclamation or contractual agreement, areas that are managed for conservation purposes, critical biodiversity areas and ecological support areas.
 - As land ownership dictates whether or not conservation on the site would be supported in the long term, whether the erf was government- or privately-owned was considered significant.
- Plant species of conservation concern
 - Areas with high numbers of threatened plant species in the following categories: critically endangered, endangered, vulnerable and near threatened were prioritised.

Analysis criterion: ECOSYSTEM FUNCTION

Intact natural ecosystems have evolved over time to optimize resource use, and in so doing provide several important ecosystem services (O'Farrell et al 2012). For example, unlike alien vegetation, indigenous plant communities have a positive impact on functioning, providing valuable services such as enhanced infiltration and supply of clean water, buffers against extreme weather events, and micro-climate regulation. In addition, natural areas in the city underpin tourism and recreation, which are of tremendous economic and health benefit to the CCT and its citizens (Mostert 2016). The contribution of indigenous vegetation to healthy ecosystem functioning was divided into three subcriteria: connectivity and climate change adaptation, edge ratio and effects, and ecosystem services.

Subcriteria of Ecosystem Function

- Connectivity & climate change adaptation
 - The Biodiversity Network vegetation remnant corridors were incorporated to prioritise natural passages that allow for gene flow, faunal migration, as well as adaptation to climate change by including gradients (e.g. north-south, altitudinal and links to cooler south-facing slopes).
 - This connectivity factor was further strengthened by prioritising contiguous natural habitat located on a major river network in addition to natural habitat located on the City boundary that connects with natural habitat outside of the city.
 - The Holness' Ecosystem-Based Adaptation areas (EBA) were included to promote terrain that provides a refuge for species in the case of climatic change.
- Ecosystem services
 - Water provision:
 - Restoration of areas that contribute to groundwater recharge were prioritised as recharge is critical to maintain river flows and aquifers in the dry season, both for certain ecosystems, and human use (O'Farrell et al. 2012).

- Restoration of areas that would aid in preserving groundwater quality were prioritised so as to reduce the high costs of purifying polluted water for human consumption (O'Farrell et al. 2012).
 - High groundwater yield areas were further prioritised in order to protect the groundwater supply.
 - Restoration in the flood mitigation zone was prioritised as indigenous vegetation accommodates floodwaters, increases infiltration and dilutes pollution (O'Farrell 2012).
 - Restoration in the coastal protection zone was also prioritised as indigenous vegetation provides a buffer against storm surges by stabilising the dunes.
 - Soil erodibility & critical infiltration
 - Areas of high soil erodibility were prioritised as natural vegetation stabilises the soil and prevents it from being eroded by wind and water and from clogging stormwater systems and rivers (O'Farrell 2012). However, it was taken into account in the methodology that these areas are more expensive to restore and the influence of this input was marginally reduced.
 - Critical infiltration areas, areas of high and most intense rainfall, were prioritised as vegetation plays an important role in absorbing large volumes of rainwater so restoration in these areas reduces flooding and promotes slow release into rivers in the dry season (O'Farrell 2012).
- Edge ratio & effects
 - Small patches of vegetation are more expensive to restore and maintain per hectare so vegetation remnants over 10 ha were prioritised.
 - Compact vegetation remnants have relatively shorter borders and suffer from less degradation; those with an edge ratio ($= \# \text{ area (ha)} / \# \text{ perimeter (m)}$) greater or equal to 0.05 were prioritised.

ANALYSIS METHODOLOGY

Seventeen critical factors were identified that influence prioritization for active restoration, which is beyond what a person can comfortably assess simultaneously. Thus two approaches were used to simplify the procedure for the stakeholders: Analytic Hierarchy Process (AHP) and GIS suitability modelling. These approaches enable complex multi-criteria decision making.

Analytical Hierarchy Process (AHP)

The AHP is a mathematical theory for decision-making developed by Thomas L. Saaty (Adams WJL & Saaty R 2003). It “involves breaking down a problem into its decision elements, arranging them in a hierarchical structure, making judgements on the relative importance of [the] pairs of elements and synthesising the results.” (Adams WJL & Saaty R 2003). Free and open source software called SuperDecisions is available that allows one to apply the AHP technique to a decision-making exercise. The goal of active restoration and the decision elements (i.e. criteria and subcriteria) were entered into this software as shown in Figure 3.

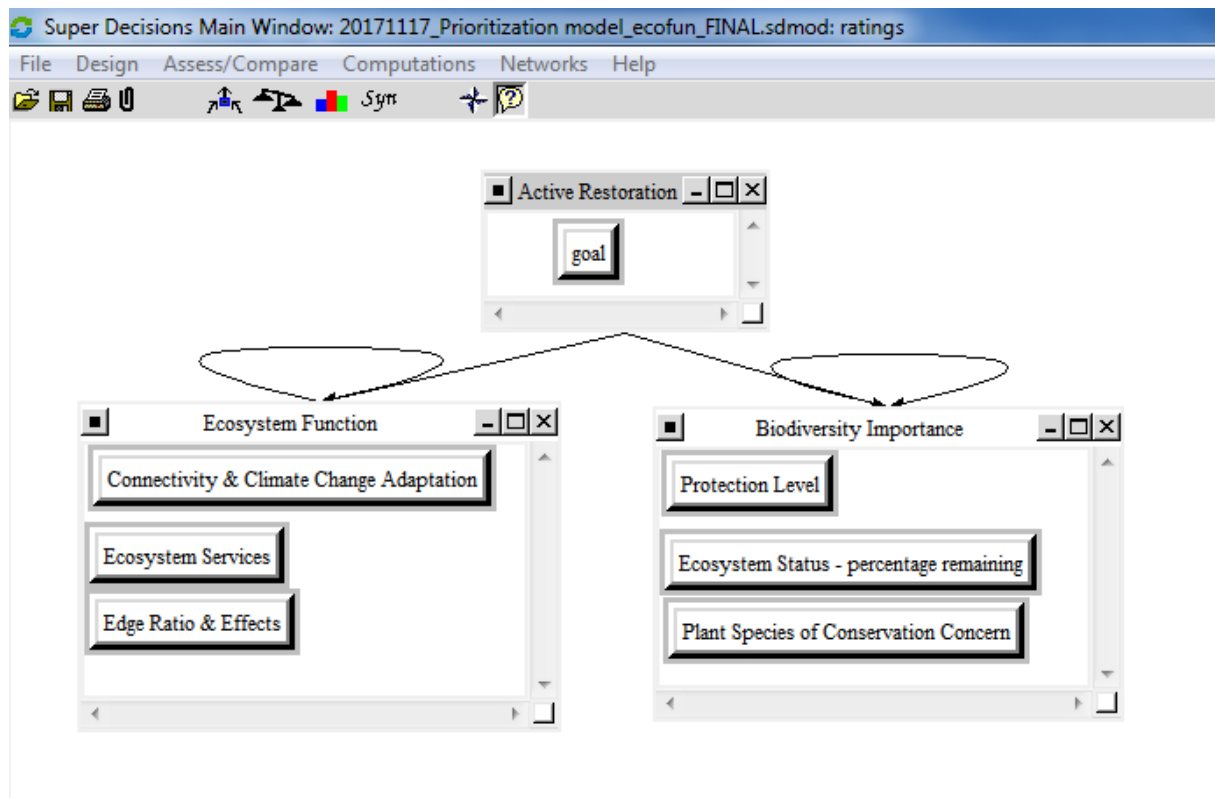


FIGURE 3: GOAL, CRITERIA & SUBCRITERIA IN SUPERDECISIONS SOFTWARE

Calculating relative importance of the active restoration criteria

First, a pairwise comparison was made between the ecosystem function and biodiversity importance criteria towards meeting the goal of active restoration (Figure 4). The stakeholders discussed the relative importance of one against the other on a scale of 1 to ≥ 9.5 . “Experiments have shown that it is cognitively challenging for human beings to decide between more than 9 factors at one time” (Saaty RW 2016). This process was greatly facilitated by the software’s inbuilt description of the relative importance as shown in Table 1 below.

TABLE 1: THE FUNDAMENTAL SCALE FOR MAKING JUDGEMENTS ((ADAMS WJL & SAATY R 2003)

1	Equal
2	Between Equal and Moderate
3	Moderate
4	Between Moderate and Strong
5	Strong
6	Between Strong and Very Strong
7	Very Strong
8	Between Very Strong and Extreme
9	Extreme

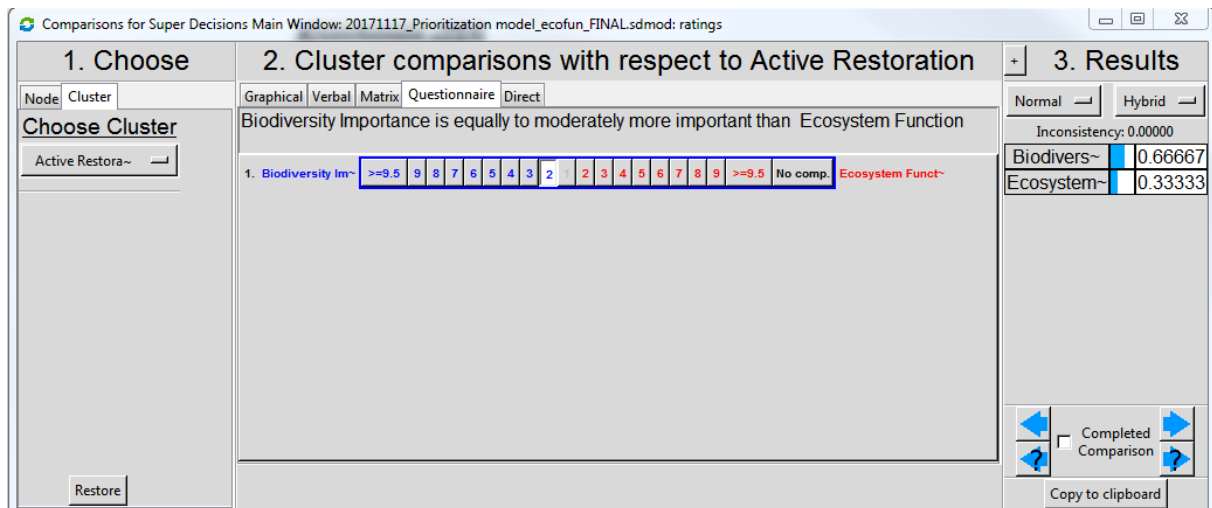


FIGURE 4: PAIRWISE COMPARISON OF ANALYSIS CRITERIA IN SUPER DECISIONS SOFTWARE

The number of 1 to ≥ 9.5 is selected on the side where the criterion is considered strongest.

Stakeholder decision: Biodiversity importance is equally to moderately more important than ecosystem function.

Weightings:

- Biodiversity importance (0.66667)
- Ecosystem function (0.33333)

The software automatically produces the weighting for each criterion based on the decisions made and the weightings together add up to 1.0.

Calculating relative importance of the Biodiversity Importance subcriteria

Next, the stakeholders evaluated the relative importance of the Biodiversity Importance subcriteria by doing pairwise comparisons (Figure 5).

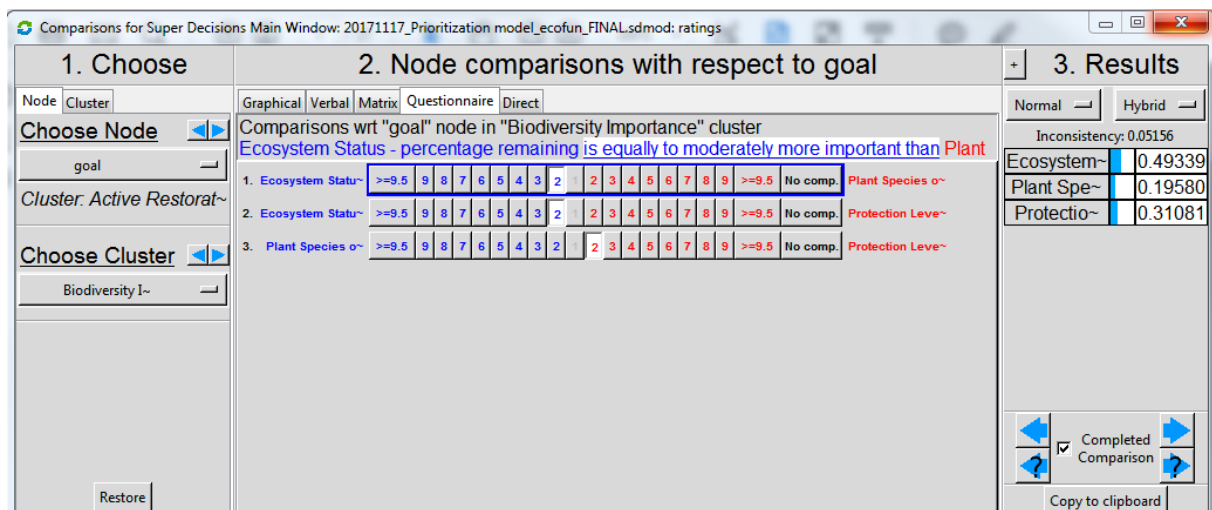


FIGURE 5: PAIRWISE COMPARISON OF BIODIVERSITY IMPORTANCE SUBCRITERIA IN SUPER DECISIONS SOFTWARE

Stakeholder decisions:

- Ecosystem status – percentage remaining is equally to moderately more important than plant species of conservation concern

- Ecosystem status – percentage remaining is equally to moderately more important than protection level
- Protection level is equally to moderately more important than plant species of conservation concern

Weightings:

- Ecosystem status – percentage remaining (0.49339)
- Protection level (0.31081)
- Plant species of conservation concern (0.19580)

Inconsistency index: 0.05156 (see below)

Inconsistency index

The software measures the inconsistency of the decisions made by the group as indicated above. “Since the numeric values are derived from the subjective preferences of individuals, it is impossible to avoid some inconsistencies in the final matrix of judgments.” (Mu E & Pereyra-Rojas M 2017). However, it is necessary to have an inconsistency value of less than 0.10 or the decisions made are considered to be too random (Mu E & Pereyra-Rojas M 2017).

Calculating relative importance of the Ecosystem Function subcriteria

Finally, the stakeholders evaluated the relative importance of the Ecosystem Function subcriteria by doing pairwise comparisons (Figure 6).

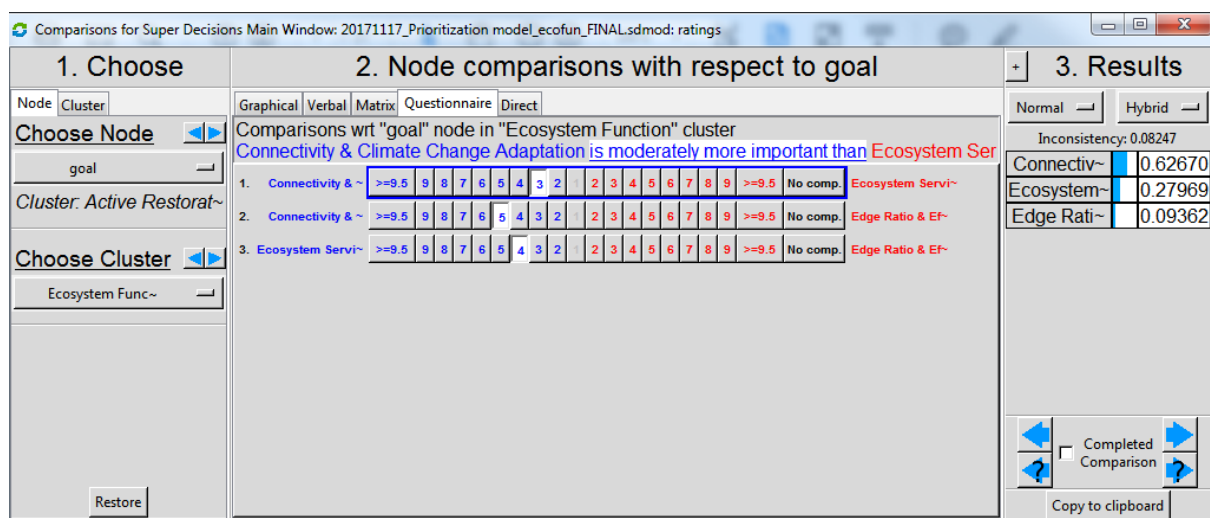


FIGURE 6: PAIRWISE COMPARISON OF ECOSYSTEM FUNCTION SUBCRITERIA IN SUPER DECISIONS SOFTWARE

Stakeholder decisions:

- Connectivity & climate change adaptation is moderately more important than ecosystem services
- Connectivity & climate change adaptation is strongly more important than edge ratio & effects
- Ecosystem services is moderately to strongly more important than edge ratio & effects

Weightings:

- Connectivity & climate change adaptation (0.62670)
- Ecosystem services (0.27969)
- Edge ratio & effects (0.09362)

Inconsistency index: 0.08247.

Suitability Modelling

A suitability model is one in which locations are weighted relative to each other based on given criteria (ESRI 2018). Spatial data layers representing each criterion are classified and each class is given a numeric value that indicates whether it is detrimental or conducive to the desired use (Andris C 2018). The spatial data layers representing the multiple criteria are then combined to form a single output layer that ranks the suitability of each location. Note that only degraded and modified habitat condition areas of the sites prioritised using the suitability modelling method are in fact suitable for active restoration. Near-natural sites should in most situations recover passively and irreversibly modified sites would be the lowest priority owing to high costs.

Processing of the input spatial data layers

Firstly, the complex criteria proposed at the workshop were broken down into their component inputs. This resulted in a total of 17 input layers of spatial information required. The best available data were then sourced (Table 5).

Several input layers were the outputs of the O'Farrell et al (2012) ecosystem services analysis. The nature reserve habitat condition information was captured as a result of an extensive ground-truthing exercise by the Biophysical Specialist and team. Other input layers needed updating or processing first. Each input layer was either clipped or extended to the CCT boundary to ensure uniformity. This GIS work was carried out in ESRI's ArcGIS 10.2.1 with the Spatial Analyst extension and in Python.

The classes of each dataset were then ranked on a scale of 1 to 9, with 1 indicating that the cell has no importance for active restoration and 9 indicating that it is extremely important (Table 2). Natural breaks (Jenks) using 5 classes, also ranked from 1 to 9, were used for quantitative data. In cases where the relevant answer was simply "yes" or "no", the classification was 9 or 1. This standardisation of 1 to 9 allowed for the criteria to be comparable by transforming their values into the same numeric scale (Derak M, Cortina J, Taiqui L 2017). As with the AHP technique, this provided a useful range without going beyond the ability of humans to process the information easily.

TABLE 2: MODELLING THE IMPORTANCE – RANKING 1-9

Value assigned to class of information	Importance for active restoration
1	Not important
2	Between not important and not very important
3	Not very important
4	Between not very important and fairly important
5	Fairly important
6	Between very important and fairly important
7	Very important
8	Between very important and extremely important
9	Extremely important

Each input layer was then converted to a 10 x 10 m grid. This grid cell size is large enough so as not to lose the detail of the data mapped at a finer scale, yet not so small as to unnecessarily prolong the processing time. The value assigned to each class of information in the input layers was transferred to the relevant grid cells. See Table 6 for the input combination grids with their rankings and Figure 12 to Figure 35 for maps of these.

Processing of input combination grids

Some of these input grids were then combined with other input grids or combination grids to spatially represent more complex inputs. In order to retain their ranking of 1 to 9, the numeric value of each cell in the grids was divided by the number of input grids being combined. These inputs were seen to be of equal importance and were thus not weighted.

- Protection level = ((BioNet CBA category + land ownership) /2)
- Connectivity & climate change = ((BioNet corridors + ecosystem-based adaptation areas + remnant/river connectivity) /3)
- Water provision = ((groundwater quality + groundwater yield + groundwater recharge) /3)
- Soil erodibility & critical infiltration = ((soil erodibility + critical infiltration) /2)

- Ecosystem services = ((water provision + flood mitigation zone + coastal protection zone + soil erodibility & critical infiltration) /4)
- Edge ratio & effects = ((BioNet edge ratio + BioNet patch size) /2)

Weighting of the subcriteria

The weightings developed with SuperDecisions at the workshops were then applied to the subcriteria to model their relative importance. These weighted calculations are shown below:

- Biodiversity Importance = ((vegetation ecosystem status * 0.49339) + (protection level * 0.19580) + (plant species of conservation concern * 0.31081)) = 1.0.
- Ecosystem Function = ((connectivity & climate change adaptation * 0.62670) + (ecosystem services * 0.27969) + (edge ratio & effects * 0.09362)) = 1.0.

Despite the fact that three subcriteria were combined to form each criterion, the ranking of the grid cells remained 0 to 9 as the 3 subcriteria weightings add up to 1.0. Please see Table 3 for an example of this and for the influence of the weightings on a calculated grid cell value. This grid cell location is not considered to be a priority for active restoration in terms of ecosystem status. However, because the location is within a protected area and because there are at least 10-20 plant species of conservation concern on site, this increases the calculated importance of the site for restoration.

TABLE 3: INFLUENCE OF WEIGHTINGS ON A GRID CELL

Criterion	Sum of Weighted Subcriteria Grid Cell Values	Weighting of each subcriteria Grid Cell Value	Subcriteria	Weighting	Subcriteria Grid Cell Value (Class rank description)
Biodiversity Importance	5.10723	3 * 0.49339 = 1.48017	Ecosystem Status	0.49339	3 (>=30% vegetation type remaining nationally)
		9 * 0.1958 = 1.7622	Protection Level	0.1958	9 (Protected Area)
		6 * 0.31081 = 1.86486	Plant Species of conservation Concern	0.31081	6 (>= 10 to 20 Red List plant species)
	Total	5.10723		1.0	

Generation of the active restoration prioritization layer

The weighted biodiversity importance and ecosystem function criteria grids were combined to create the final prioritized output that indicates where BMB need to focus their active restoration operations.

Active restoration = ((biodiversity importance * 0.66667) + (ecosystem function * 0.33333))

Post- analysis filters

The following criteria were used as post-analysis filters:

- Boundaries of nature reserves
 - The prioritisation was done irrespective of habitat condition: habitat condition was not an input into the analysis but only used as a post-analysis filter.
 - This filter was first used to extract only those prioritised areas that fall within nature reserve boundaries. These areas are proclaimed and managed for conservation purposes and restoration is therefore sustainable in the long term as staff are on location and there is greater likelihood of dedicated budget.
- Habitat condition

- This filter was used to extract only those prioritised areas that fall within nature reserve boundaries that are of degraded or modified habitat condition. Near-natural areas have potential to passively restore under appropriate veld management and the more modified areas generally require more intensive and expensive interventions to achieve successful restoration. In general therefore, “degraded/fair” habitat condition areas will be those generating optimal benefit from active restoration. However, in some situations modified/poor areas should also be included in this subset, especially where there is a mosaic of condition classes. Please see Table 7 for detail on the nature reserve habitat condition categories.
- Restoration potential of ecosystem type
 - This filter categorised the prioritisation results into Strandveld (including Beach), Fynbos and Renosterveld vegetation types. Strandveld is more resilient than Fynbos and Renosterveld with higher self-recovery potential after disturbance. Degraded areas of Strandveld could therefore be left to regenerate naturally where embedded within higher condition areas, and modified areas rather prioritized for active restoration.

Once the methodology had been agreed upon, most of the GIS data processing was automated. Models were built to generate each of the input grids from input layers in ModelBuilder and Python used to create the combination and weighted grids and the standard maps. Python and ModelBuilder dramatically reduced the time-consuming, repetitive work. Automation also results in standardisation of the output over the years so that results are comparable.

Analysis issues

The next time this analysis is run, research should be done prior to starting on grid cell size. Using a fine scale grid cell size for this analysis meant that the information contained by smaller polygons was retained and included. However, where the boundary of one criterion overlapped with another, slivers were formed and these had artificially high scores. As a result, the maximum grid score value could not be relied upon and instead the average grid score value per reserve and vegetation type was used to interpret the results. As these slivers were very small in size and in number, their influence on the overall mean grid score could be ignored. Using Blaauwberg Nature Reserve as the trial area – an area that had slivers in the current analysis – it would be worth investigating whether running the analysis with a larger grid cell size would reduce this problem.

RESULTS OF THE SPATIAL ANALYSIS

The analysis prioritisation results are depicted as follows: Figure 7 shows results across all indigenous vegetation areas, Figure 8 shows the subset for all vegetation remnants of degraded and modified habitat condition, and Figure 9 –, shows the results for all vegetation areas within the nature reserve boundaries only. See Table 4 for the top 40 priority sites for active restoration in 2018/9 based on the mean calculated per nature reserve per vegetation type (any habitat condition). The final priorities for 2018/9 active restoration were based on whether there was an existing restoration project at the reserve, how highly the reserve was prioritised in the analysis and whether a restoration plan was in place (excluding Working for Wetlands projects) – see Table 9 which is a more detailed version of Table 4.

The mean was used in preference to the maximum as the maximum was occasionally highest for slivers – those unwanted polygons resulting from multiple layer intersections - and thus was misleading. The mean values were calculated from the raster output with its uniform grid cell sizes. The area of degraded and modified habitat condition vegetation per nature reserve is included with the rankings in Table 4 to indicate the extent of active restoration needed.

For the purposes of prioritising initial clearance of alien vegetation, the active restoration prioritisation output will be overlaid with the Invasive Species Unit's own prioritisation of their proposed initial clearing sites. The latter are being prioritised on a scale of 1 to 3, with 1 being their highest priority. Where sites prioritized for initial alien clearance also need active restoration (i.e. those with modified and poor habitat condition classes, see Figure 8), discussion between the Invasive Species Unit and the Conservation Services Unit will be required to re-assess and potentially modify the outputs from the active restoration prioritization study for the upcoming year. This step either may be done as an expert review process, or in GIS whereby the datasets may be combined to generate an overall priority score on a scale of 1 to 9. In future, it will be important to plan several years in advance in order for the Invasive Species Unit to synchronise their work with active restoration projects. This will greatly increase the likelihood for success of both the alien clearing, through suppressing alien regrowth and secondary invasions, and the active restoration outcomes.

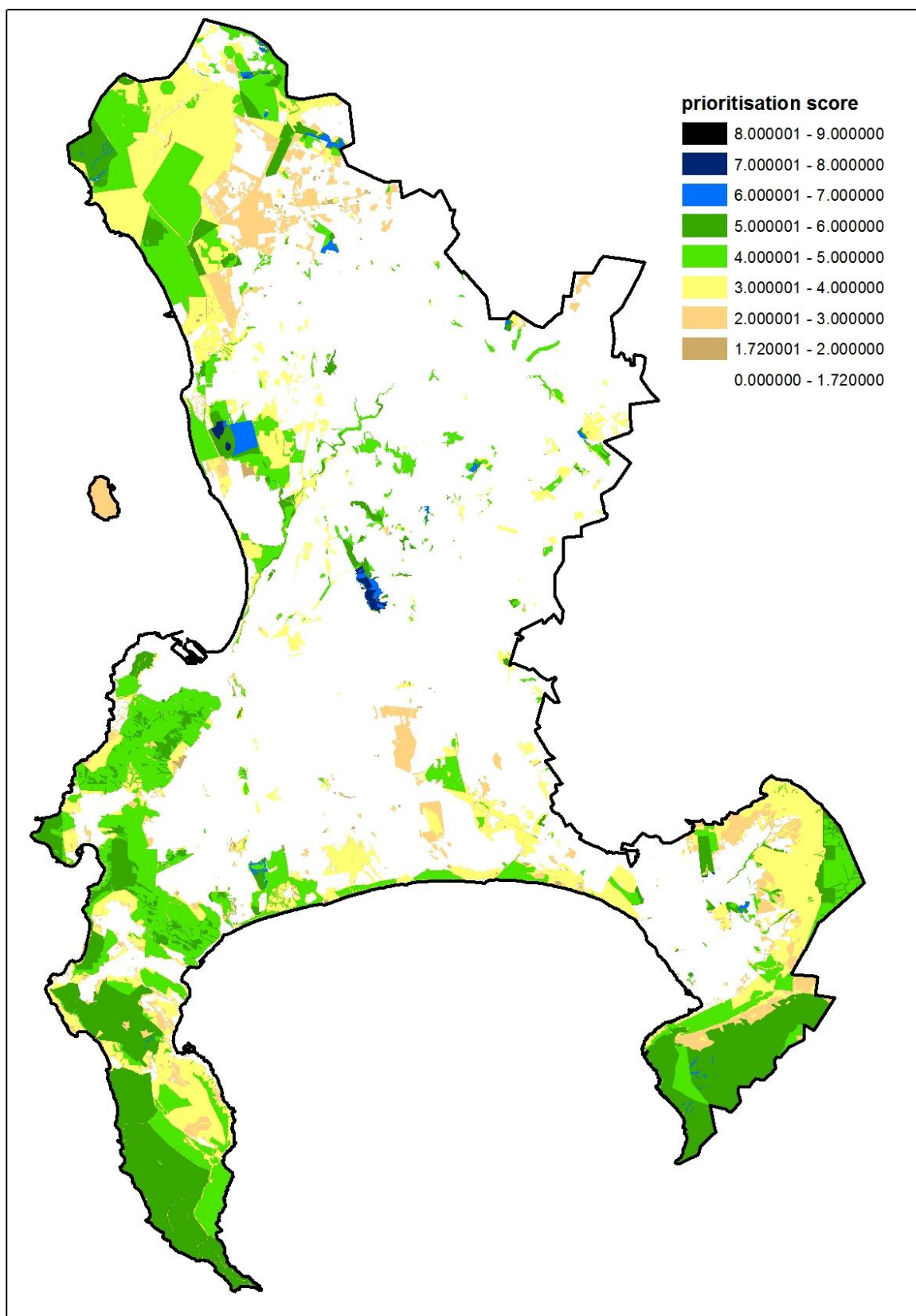


FIGURE 7: ACTIVE RESTORATION PRIORITISATION ANALYSIS RESULTS FOR ALL VEGETATION REMNANTS ACROSS THE CAPE TOWN METRO

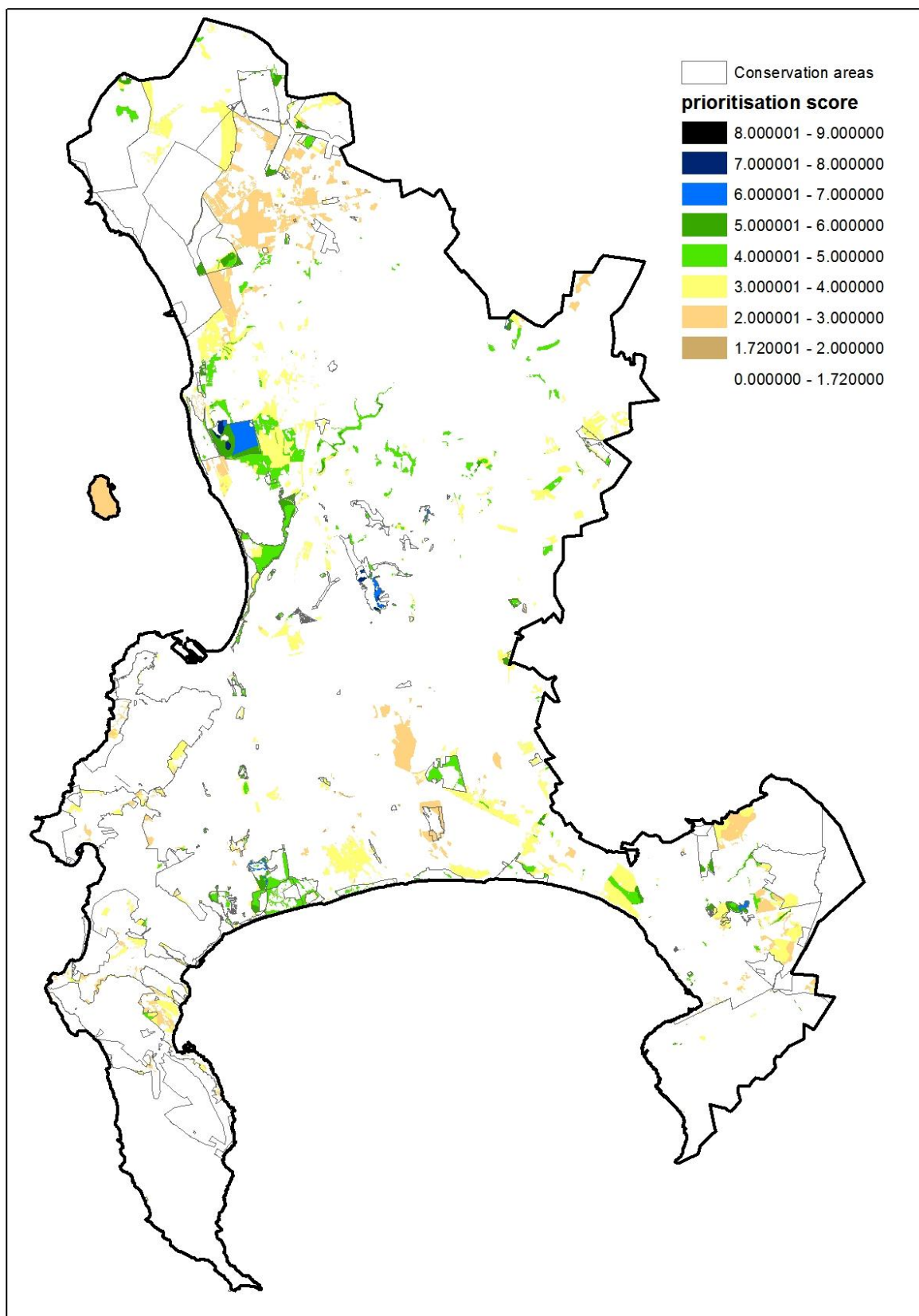


FIGURE 8: ACTIVE RESTORATION PRIORITISATION ANALYSIS RESULTS - SUBSET OF VEGETATION REMNANTS OF DEGRADED AND MODIFIED HABITAT CONDITION

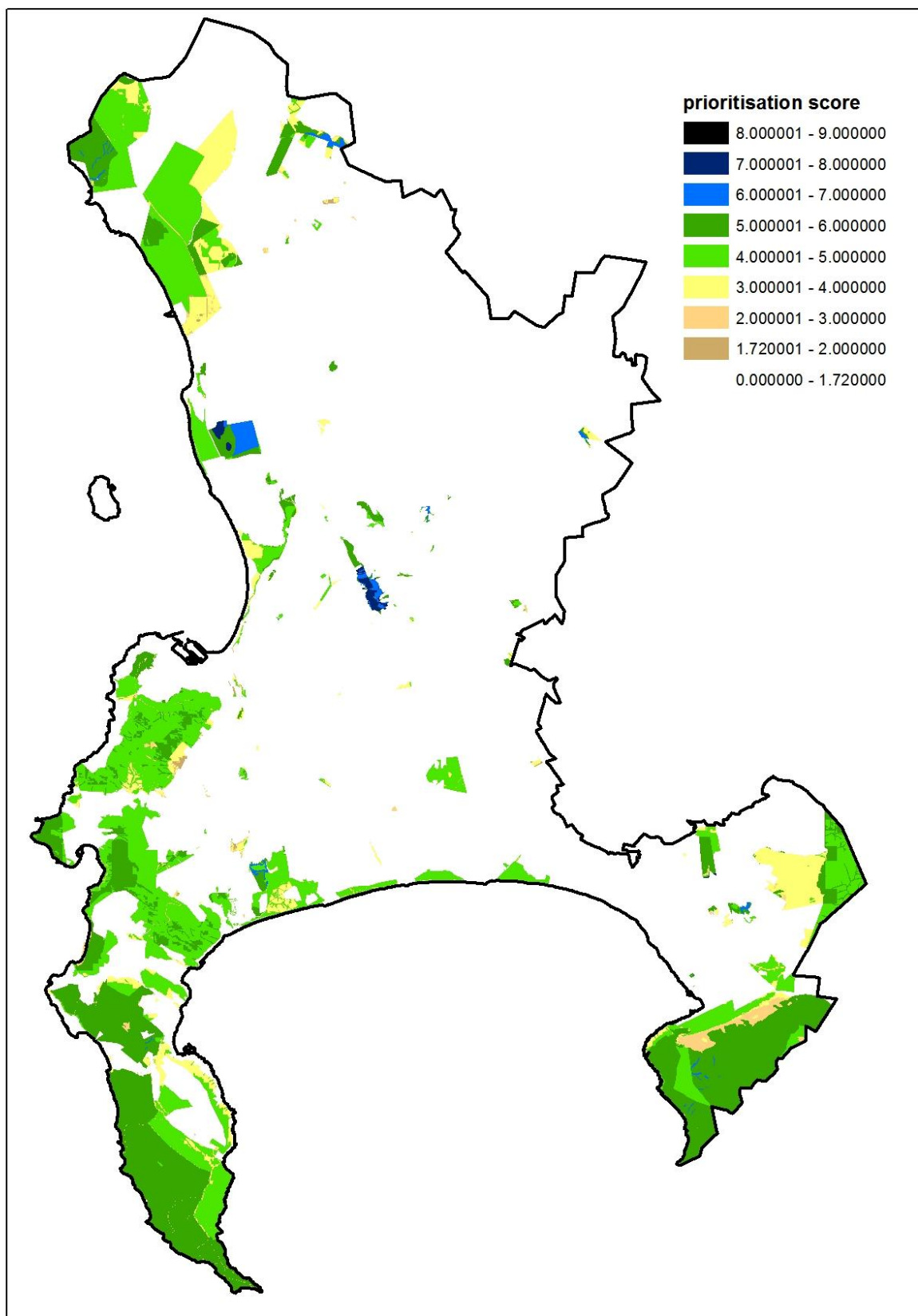


FIGURE 9: ACTIVE RESTORATION PRIORITISATION ANALYSIS RESULTS - SUBSET OF NATURE RESERVES ONLY

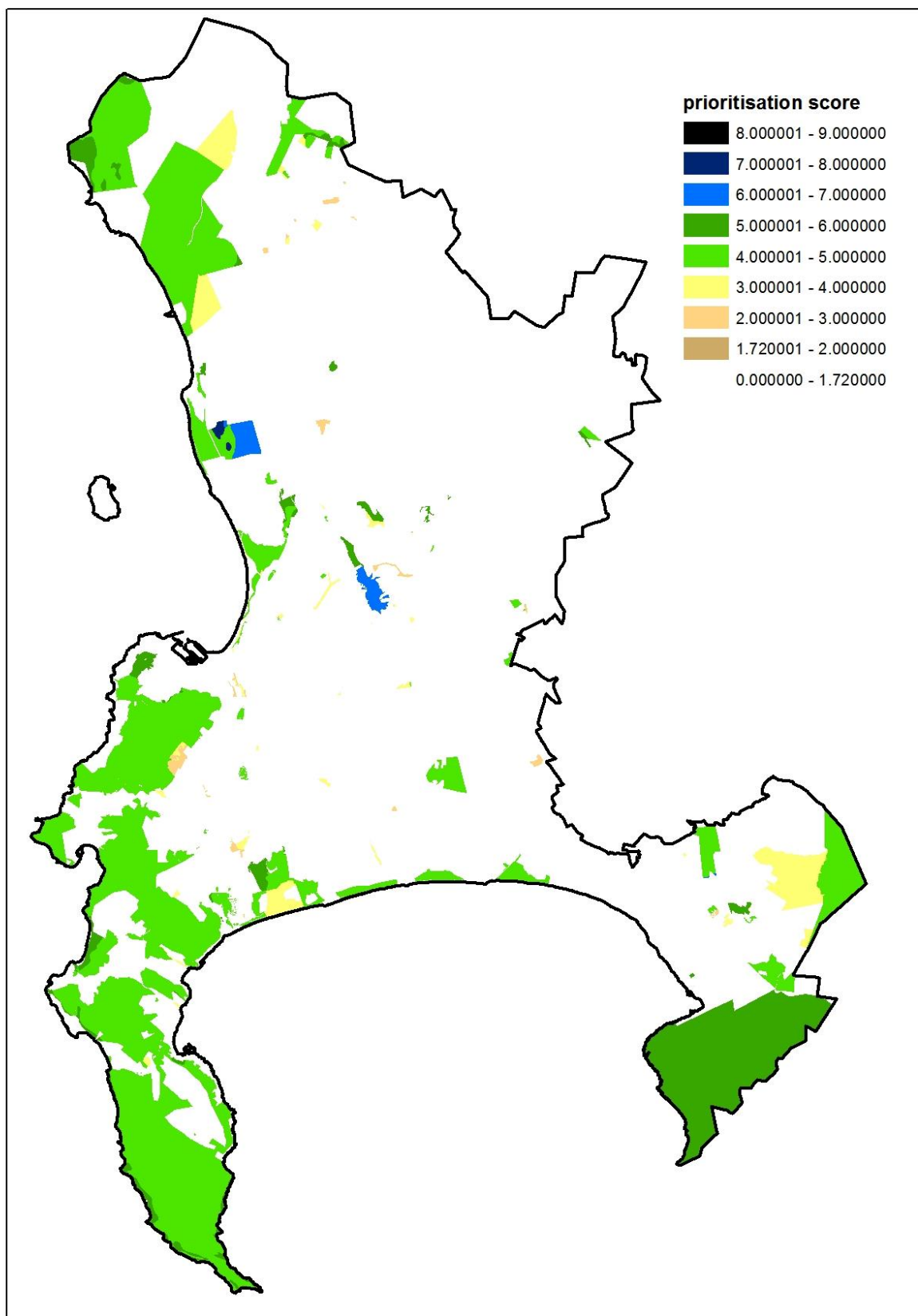


FIGURE 10: MEAN ACTIVE RESTORATION PRIORITISATION SCORE PER MAJOR VEGETATION TYPE PER NATURE RESERVE

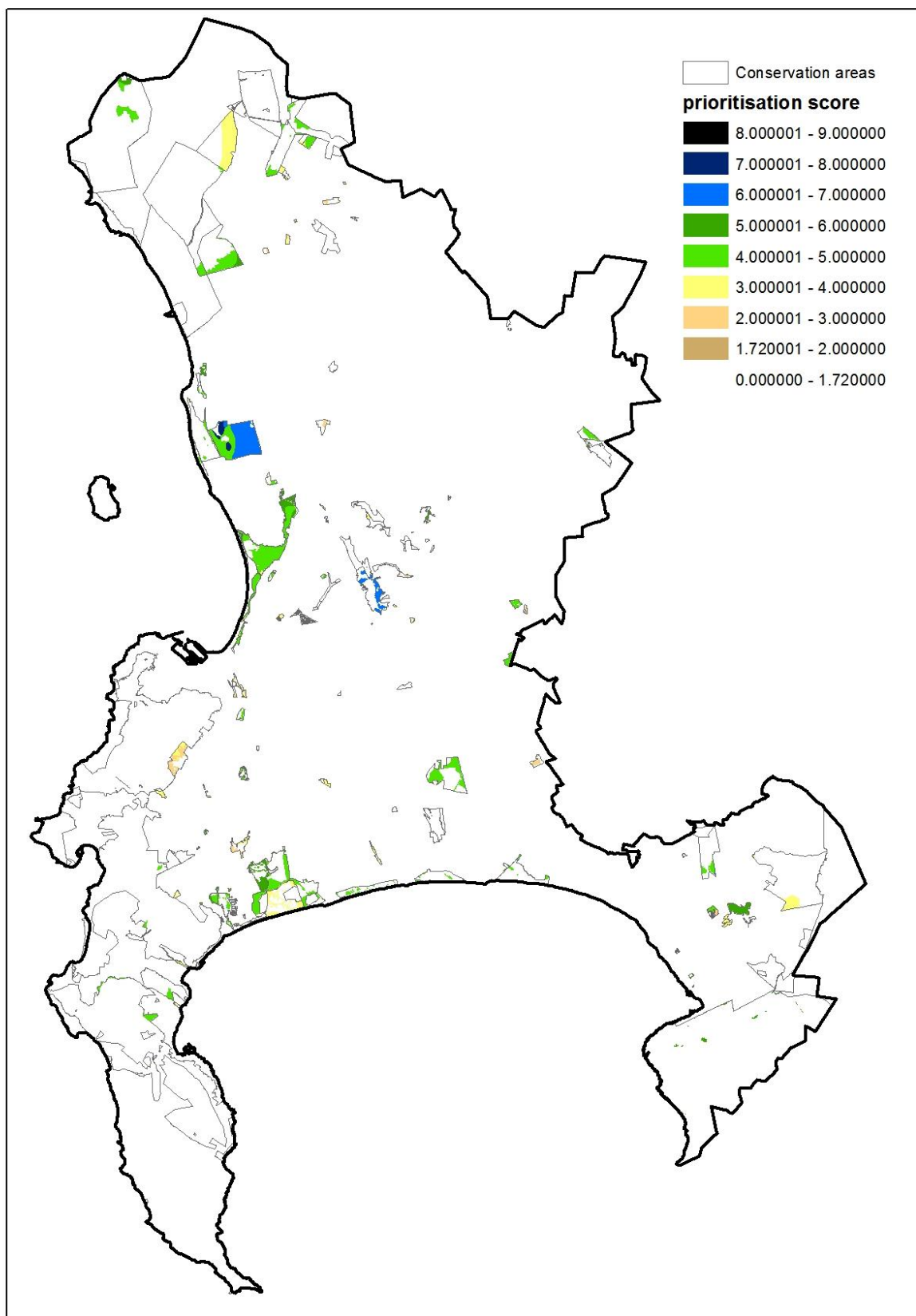


FIGURE 11: MEAN ACTIVE RESTORATION PRIORITISATION SCORE PER MAJOR VEGETATION TYPE PER NATURE RESERVE - SUBSET OF AREAS OF VEGETATION OF DEGRADED AND MODIFIED HABITAT CONDITION

TABLE 4: TOP 40 ACTIVE RESTORATION PRIORITY SITES WITH MEAN SCORES PER VEGETATION TYPE

* Sites listed in decreasing order of prioritization according to overall mean score (any vegetation type, any habitat condition) – see Table 8. Likely projects highlighted in yellow (For the full restoration planning table, please see Table 9)..

** Mean score per vegetation type (any habitat condition).

*** Total hectares of vegetation of degraded and modified habitat condition.

Protected Area name*	Mean prioritisation score**	Mean prioritisation score**	Mean prioritisation score**	Total degraded + modified (ha)***
	Fynbos	Renosterveld	Strandveld	
Blaauwberg	6.215	7.279	4.827	870.42
Helderberg	4.967	6.996		53.84
Tygerberg	5.570	6.973		131.73
Coastal Corridor (West Coast)	4.703	5.959	5.679	166.75
Dassenberg	4.228	5.959		66.72
False Bay - Rondevlei section	5.891		5.758	130.52
Uitkamp Wetland		5.808		19.12
Botterblom		5.643		0
Table Mountain	4.940	5.503	5.159	126.46
Sonop	4.706	5.472		0
Harmony Flats	5.444			4.68
Joostenberg Kloof	4.031	5.404		51.65
Klein Dassenberg	4.947	5.392		57.41
Capaia Wines		5.443		0
Mellish		5.285		0
Table Bay - Fynbos Corridor	5.221			210.08
False Bay - Zeekoevlei section	5.187		4.478	156.33
Melkbos	5.165		4.216	37.42
Table Bay - Rivergate section	5.150			11.74
Tygerberg Hill	2.685	5.120		0
Zandvlei Estuary	5.036		4.621	88.58
Steenbras	5.034		3.766	59.79
Witzands Aquifer	4.976		4.440	54.37
Durbanville	4.058	4.974		0.96
Bracken	4.964			34.73
Table Bay - Milnerton Race Course section	4.863			9.53
Haasendal	4.847	3.901		37.06
Hottentots-Holland	4.778			0.84
Table Mountain - Tokai Park section	4.765			0.1
Fraai Uitsig	3.733	4.756		59.19
Wolfgat			4.755	49.28
Macassar Dunes			4.706	27.9
Sandown	4.700			13.71
Kenilworth Race Course	4.697			18.48
Highberry Wine Estate	4.061	4.684		0
Bothasig Fynbos	4.652			6.62
Aurora Park		4.575		0
Nirvana	4.557			0.23
False Bay - Pelican Park section			4.546	91.67
False Bay - Slangetjebos section			4.540	106.72

Critical factors towards active restoration success

The Flora Management Committee discussed the results in March 2018. They noted that implementation of an active restoration prioritisation programme has to be aligned with fire management, invasive species management and available resources, including the Restoration Facility, (Biodiversity Management Branch 2018). They also noted that some of the areas prioritised are not practical to restore. Considerations are listed below.

- The work to rehabilitate an area typically takes place after a prescribed burn as this creates suitable conditions for indigenous seedling recruitment. Post-fire age of veld therefore determines the timing of interventions (Biodiversity Management Branch 2018).
- Active restoration should ideally be done by seed to optimize the number of species and genetic diversity re-introduced. However, some species (particularly obligate resprouters) may need to be propagated in the Restoration Facility at least one year ahead of the planned restoration if they produce fewer seeds and do not germinate easily.
- Local seeds representing the required growth forms must be readily available to restore recently-cleared areas that are prioritised for active restoration (Biodiversity Management Branch 2018).
- Community support is a factor and stakeholders who have established relationships with local communities (e.g. Friend's groups) may be interested in volunteering a restoration project for (Mostert 2016).
- Degree of interest/support by the reserve manager is also a factor (Biodiversity Management Branch 2018).
- Decisions would need to be supported by an on-site expert assessment.
- The restoration plans prepared for the nature reserves have a list of suggested species in the appendices (Biodiversity Management Branch 2018).
- Active restoration is only possible at an invaded site if there's alien vegetation clearing budget (Biodiversity Management Branch 2018).
- Reliable, punctual data capture and reporting on fires, invasive species programmes, required restoration plant species etc. is required in order to create successful integrated reserve plans.
- Recently eland and hartebeest were introduced to Blaauwberg Nature Reserve, which was identified as one of the locations where active restoration would be most meaningful to implement. Data on the impact of these large ungulates on vegetation are not yet available and it may be necessary to relocate them to allow for actively restored areas to establish sufficiently and to be resilient (Biodiversity Management Branch 2018).

CONCLUSION

The analysis reduced a very complex situation that involves many overlapping considerations into one spatial layer ranked 1 to 9. The highest ranked areas indicate where active restoration would achieve the greatest gains in terms of conserving biodiversity and in terms of protecting ecosystem services. The methodology used succeeds in increasing the objectivity and transparency of active restoration-related decision-making, allows for justification of decisions made, allows for evaluation of multiple criteria and can easily cover a very large spatial extent. The models and scripts that have been developed can be re-run annually with radically-reduced processing time to provide the BMB with annual prioritisation updates. Further analysis needs to be done to align these results with the alien vegetation clearing and fire management plans.

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APPENDIX

TABLE 5: DATA SOURCES

Criteria	Data	Content	Source	Version	Format
Biodiversity Importance	Terrestrial Biodiversity Network (BioNet)	Prioritised remnants of indigenous vegetation in City of Cape Town per Critical Biodiversity Area category	City of Cape Town	Apr-2018	Polygon shapefile mapped at varying scales historically and ground-truthed in 2008 but constantly being refined to a scale of 1:2000 and updated.
	Indigenous Vegetation Remnants	Indigenous vegetation remnants per national vegetation type	City of Cape Town	Apr-2018	Polygon shapefile originally mapped at National scale 1:50 000 but refined at a scale of 1:2000 in areas by CCT & SANBI
	2011 Ecosystem Status	SANBI 2011 Ecosystem Status: % of national vegetation type remaining nationally	South African National Biodiversity Institute (SANBI)	2011	Attribute table
	Property Ownership of nature reserves & conservation areas	Private vs. government ownership of nature reserves & conservation areas	CCT	Nov-2017	Attribute table
	CREW Red List plant species	Indigenous plant species locations (Red List: Critically Endangered, Endangered, Vulnerable & Near Threatened)	Custodians of Rare and Endangered Wildflowers (CREW), SANBI	Nov-2015	Centroid coordinates (point taken to be accurate within a radius of 10m)
	Protea Atlas Project species	Indigenous plant species locations (Red List: Critically Endangered, Endangered, Vulnerable & Near Threatened)	Protea Atlas Project, SANBI	Sep-2011	Centroid coordinates (point taken to be accurate within a radius of 250m)
	SaSflora Red List plant species	Indigenous plant species locations (Red List: Critically Endangered, Endangered, Vulnerable & Near Threatened)	Barrie Low - Coastec	Sep-2011	Centroid coordinates (point taken to be accurate within a radius of 250m)
	CCT Red List species	Indigenous plant species locations (Red List: Critically Endangered, Endangered, Vulnerable & Near Threatened)	Biodiversity Management Branch	Nov-2015	Centroid coordinates (accurate to within 10m)

Criteria	Data	Content	Source	Version	Format
Ecosystem Function	Connectivity	Contiguous indigenous vegetation remnants or those connected by the city's major river network	CCT	Nov-2018	Polygon shapefile derived from BioNet.
	Expert Corridors in Terrestrial Biodiversity Network (BioNet)	Attribute identifying whether remnant is part of an essential BioNet corridor (expert opinion)	City of Cape Town	Apr-2018	Attribute in BioNet polygon shapefile

	Ecosystem-Based Adaptation (EBA) layer	Remaining vegetation areas in RSA indicating importance for climate change resilience	Holness, SANBI	Nov-2011	Raster grid (m x m grid cell)
	BioNet Edge Ratio	BioNet indigenous vegetation remnant: (area/perimeter)*100	CCT	Apr-2018	Polygon shapefile derived from BioNet.
	Groundwater recharge	Ecosystem services classification of national groundwater recharge potential data	O'Farrell (base data from: Department of Water Affairs & Forestry (DWA) 2005 data)	2012	Polygon shapefile
	Groundwater quality	Ecosystem services classification of groundwater conductivity values (mS/m)	O'Farrell (base data from: CCT 2002 data)	2012	Polygon shapefile
	Groundwater yield	Ecosystem services classification of groundwater borehole yield data in litres per second	O'Farrell (base data from: CCT 2002 data)	2012	Polygon shapefile
	Coastal protection zone	Area seaward of the CCT Coastal Edge within which certain land uses may be restricted	CCT	Jan-2015	Polygon shapefile
	Flood mitigation zone	Ecosystem services classification of national 1:500,000 rivers within CCT extent buffered to 50m	O'Farrell (base data from: DLA-CDSM 2007 data)	2012	Polygon shapefile
		Ecosystem services classification of national 1:50 000 rivers within CCT extent buffered to 32m	O'Farrell (base data from: DLA-CDSM 2007 data)	2012	
		Ecosystem services classification of 1:500,000 wetlands	O'Farrell (base data from: Nel et al 2011 data)	2012	
		Ecosystem services classification of flood prone areas buffered to 50m	O'Farrell (base data from: CCT 2012 data)	2012	
	Soil erodibility	Ecosystem services classification based on soil type erodibility factor (K)	O'Farrell (base data from: Schulze & Horan 2007 data)	2012	Polygon shapefile
	Critical infiltration zone	Ecosystem services classification of areas of high and most intense rainfall (800 mm and above)	O'Farrell (base data from Schulze 2007)	2012	Polygon shapefile

Filter	Biodiversity Network habitat condition	Ground-truthed habitat condition of the CCT Biodiversity Network	CCT	Apr-2018	Polygon shapefile mapped at a maximum of 1:2000
Filter	Indigenous Vegetation Remnants	Indigenous vegetation remnants per national vegetation type	City of Cape Town	Apr-2018	Polygon shapefile originally mapped at National scale 1:50 000 but refined at a scale of 1:2000 in areas by CCT & SANBI

TABLE 6: INPUT GRIDS & THEIR RANKINGS

INPUT GRIDS	ATTRIBUTE	GRID VALUE (1 to 9)
City extent	CCT	1
Ecosystem Status (% remaining nationally)*	<10%	9
Vegecostat**	>= 10% & <30%	6
	>=30	3
Biodiversity Network (BioNet) CBA categories	Protected: IP	9
Bionetcba**	Protected: NIP	9
	Conservation Area	8
	CBA 1A	6
	CBA 1B	6
	CBA 1C	6
	CBA 1D	6
	CBA 1E	6
	CBA 2	6
	ESA	5
	Other Natural Area	4
Ownership	Government	9
ownership**	Private	2
Plant Species CRENVUNT	high >=20	9
plantspecies**	med =>10-20	6
(No. of Red List: CR, EN, VU, NT)	low <10	3
Connectivity	Connected remnant	9
connect**	Isolated remnant	1
(if contiguous natural habitat on major river network)		
BioNet corridors	Yes	9
corridors**	No	1
Holness EBA (Natural Breaks (Jenks) 5 classes))	0-5	1
eba_**	5-15	3
(gradients: more likely refuge for spp if climate change)	15-30	5
	30-40	7
	40-60	9
Edge ratio	high (>=0.05)	9
bnedgeratio**	low (< 0.05)	3
bn edge ratio		
a small reserve may not be able to maintain any active restoration gains		
because of negative edge effects; ((area/perimeter)*100)		

*Name of subcriteria
 **Name of GIS grid

Patch size	> 10 ha	9
bnpatchsize**	≤ 10 ha	3
all contiguous natural habitat on the BioNet can be considered as part of a patch		
Groundwater recharge (Natural Breaks (Jenks) 5 classes))	19-70	1
gwrecharge**	71-136	3
(DWA national groundwater resource assessment 2005)	137-230	5
	231-404	7
	405-810	9
Groundwater Quality	>520	9
gwquality**	370-520	7
(groundwater conductivity values (mS/m))	150-370	5
	70-150	3
	<70	1
Groundwater Yield	0.0-0.1	1
(groundwater borehole yield litres/s)	0.1-0.5	3
gwyield**	0.5-2.0	5
	2.0-5.0	7
	>5.0	9
Coastal Protection Zone (doesn't include all PAs)	Yes	9
coastal**	No	1
Flood Mitigation Zone	Yes	9
floodmit**	No	1
Soil Erodibility (rather than Soil Retention)	0-0.33	3
soilerod**	0.33-0.45	3
(erodibility factor K)	0.45-0.53	4
	0.53-0.61	5
	0.61-0.70	6
Critical Infiltration (Natural Breaks (Jenks) 5 classes))	0-880	2
critinfil**	881-1000	3
(areas of high & most intense rainfall)	1001-1138	5
	1139-1389	7
	1390-2086	9
Biodiversity Network Habitat Condition	Degraded (Fair)	9
bnhabcond**	Modified/Reed bed (Poor)	5
	Irreversibly modified	1
	Natural (Good)	2
	Near-natural (Good)	2

FIGURES - Analysis Input Grids

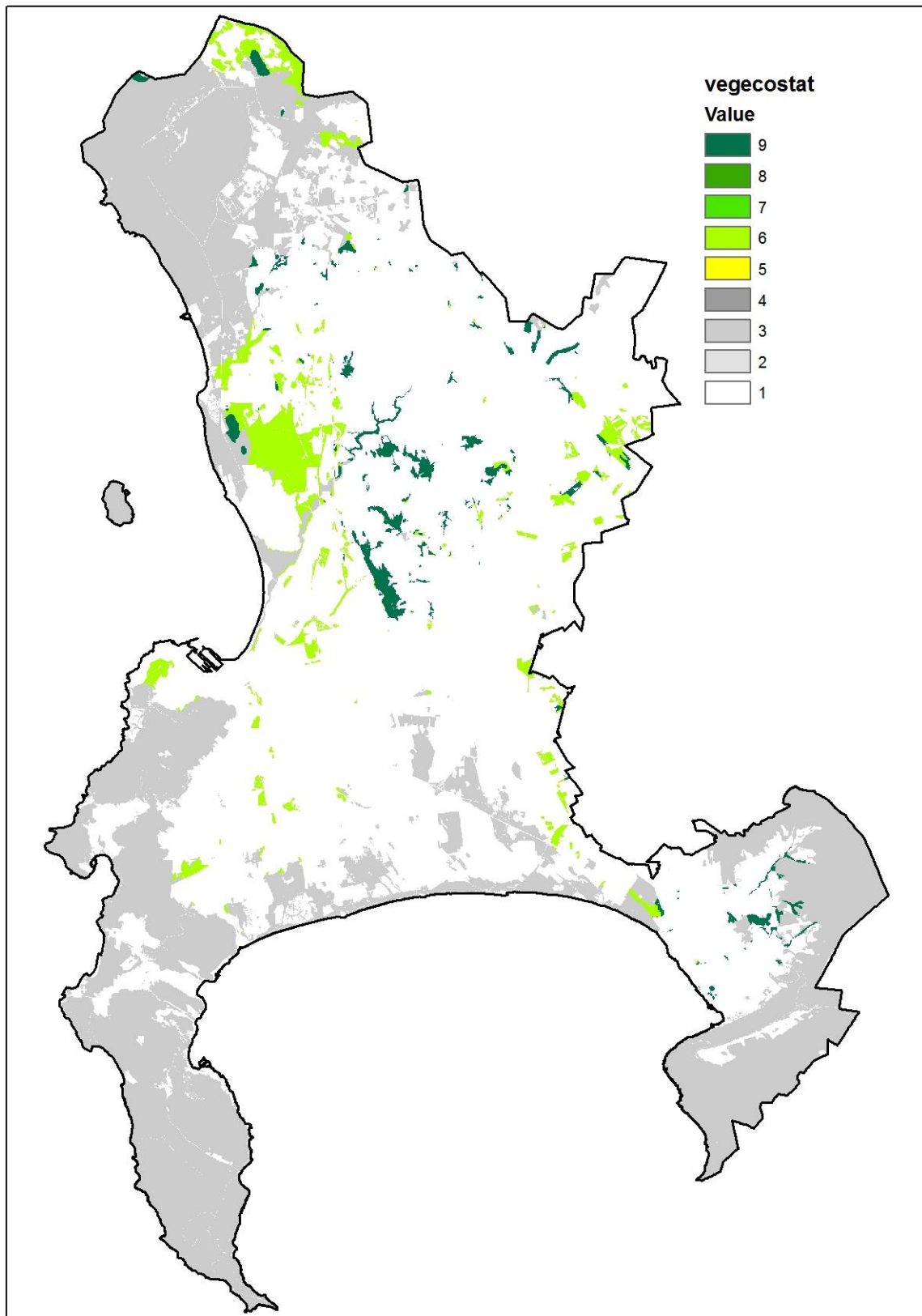


FIGURE 12: VEGETATION ECOSYSTEM STATUS

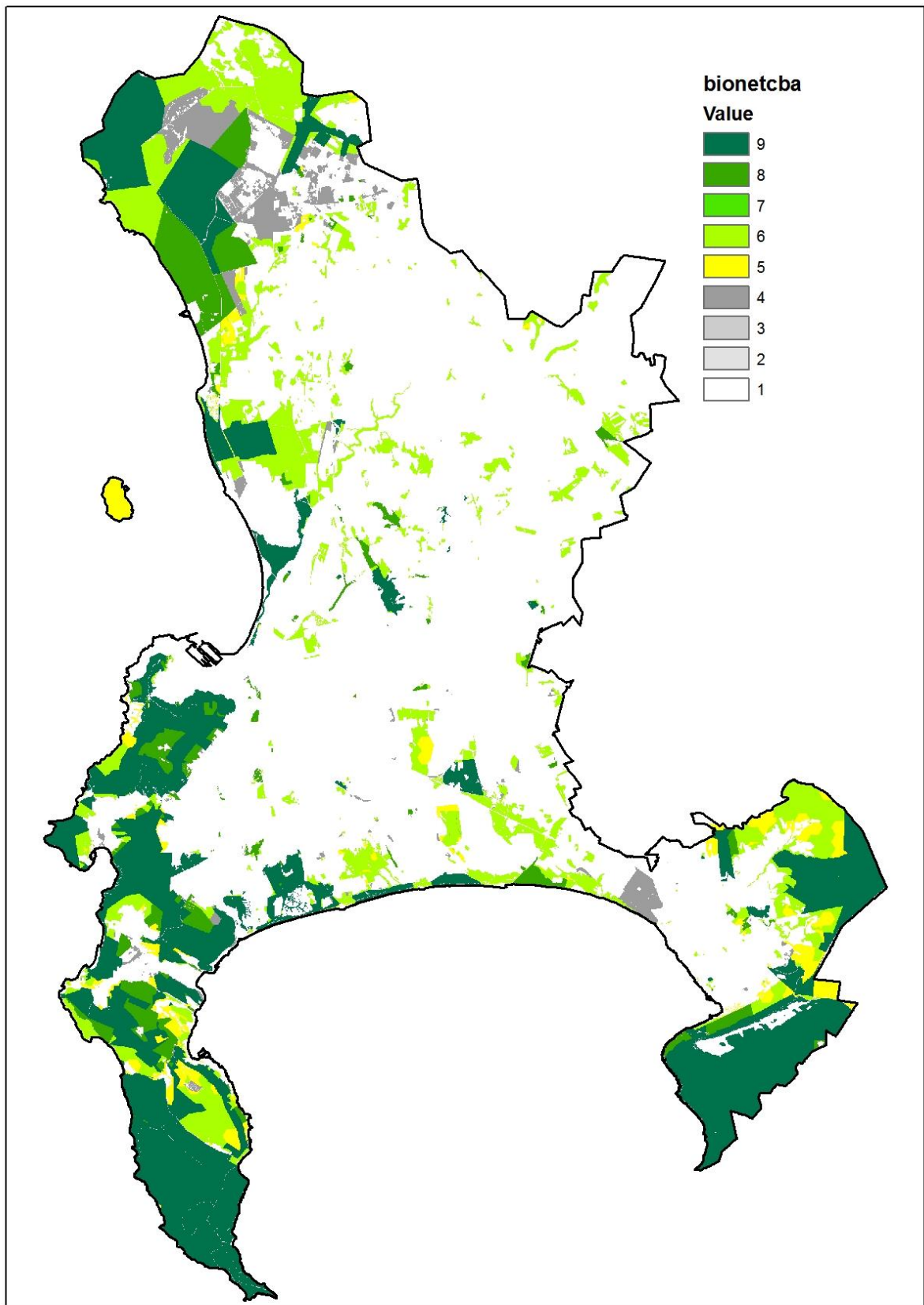


FIGURE 13: BIONET CBA CATEGORIES

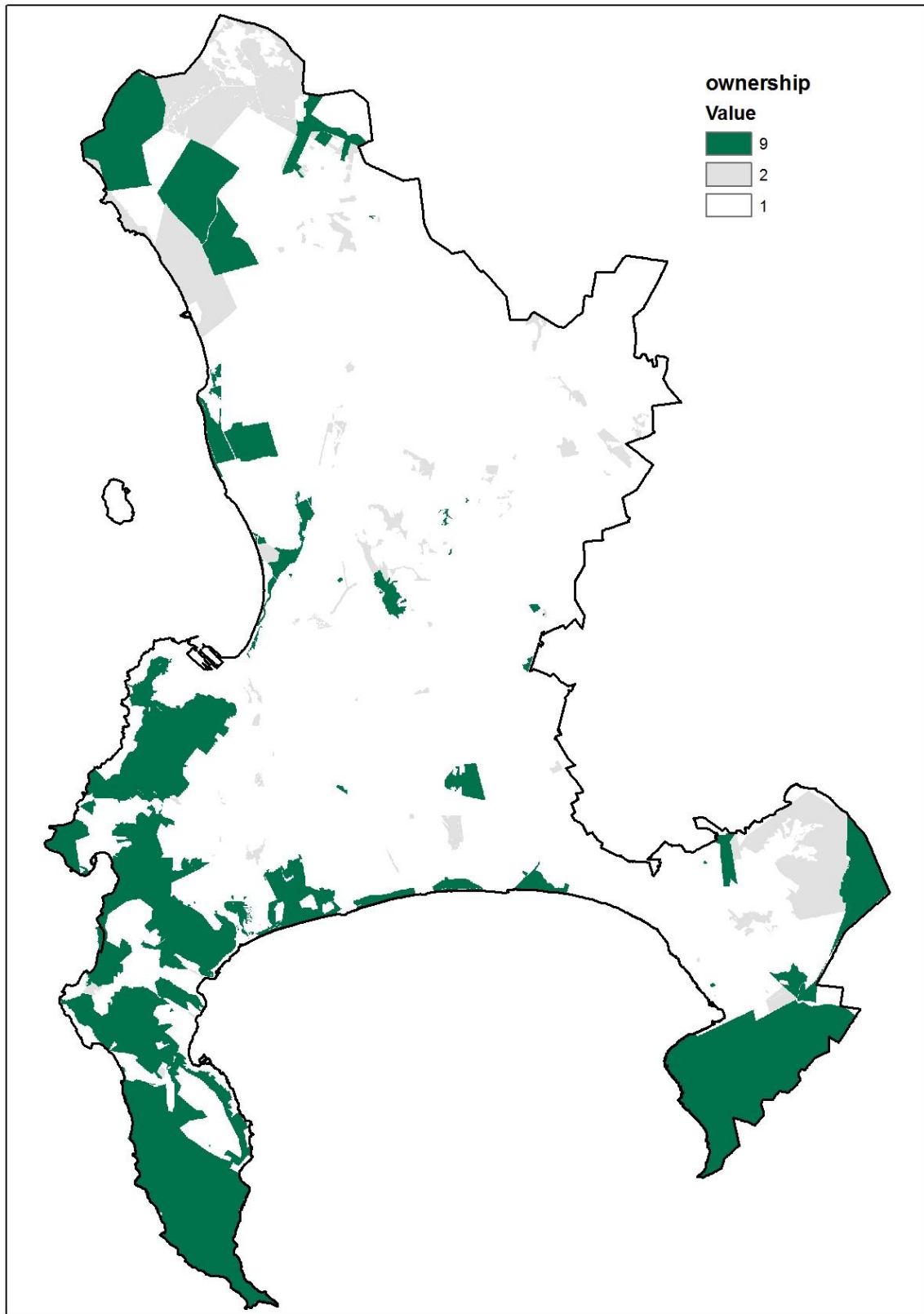


FIGURE 14: OWNERSHIP

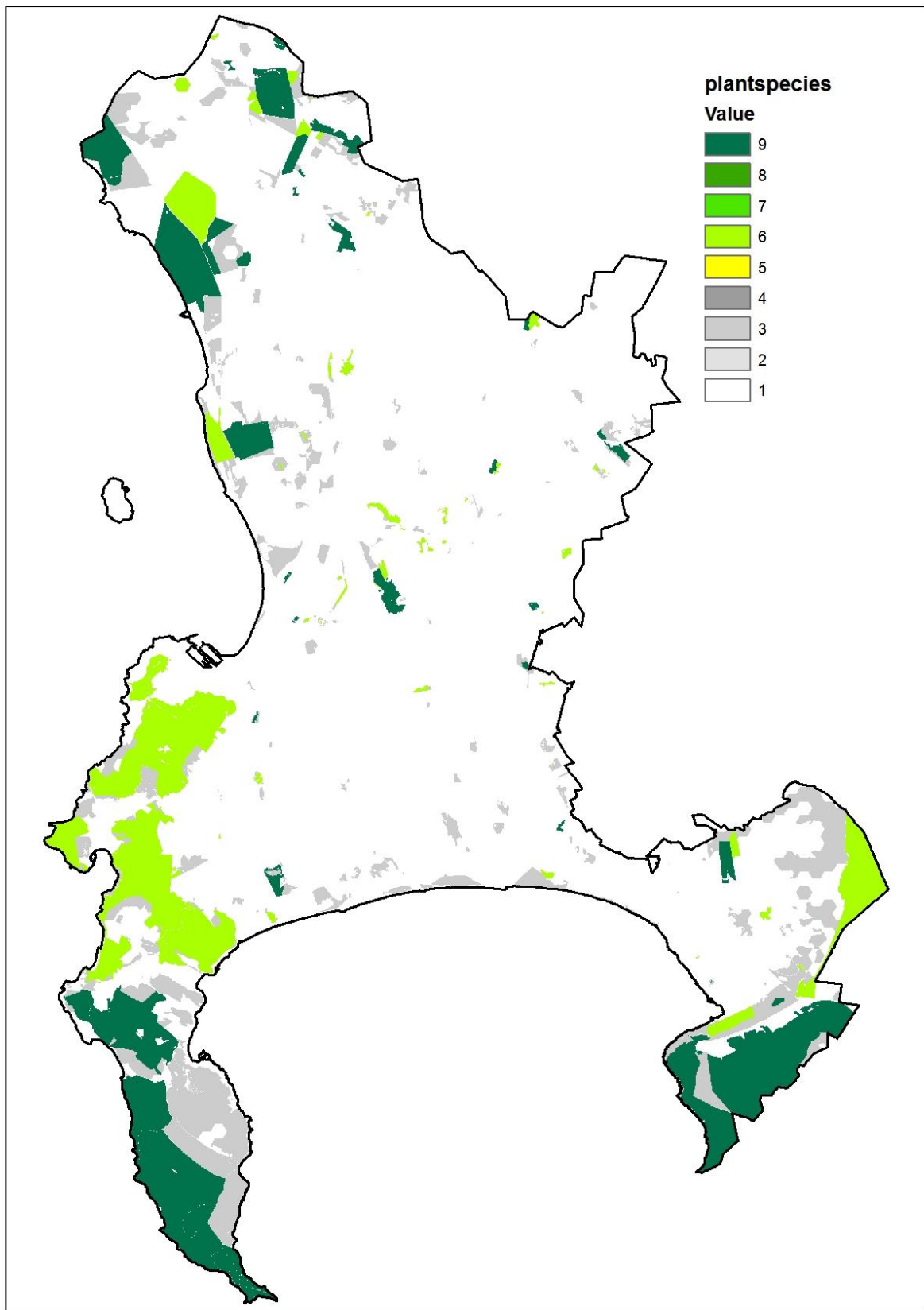


FIGURE 15: PLANT SPECIES OF CONSERVATION CONCERN

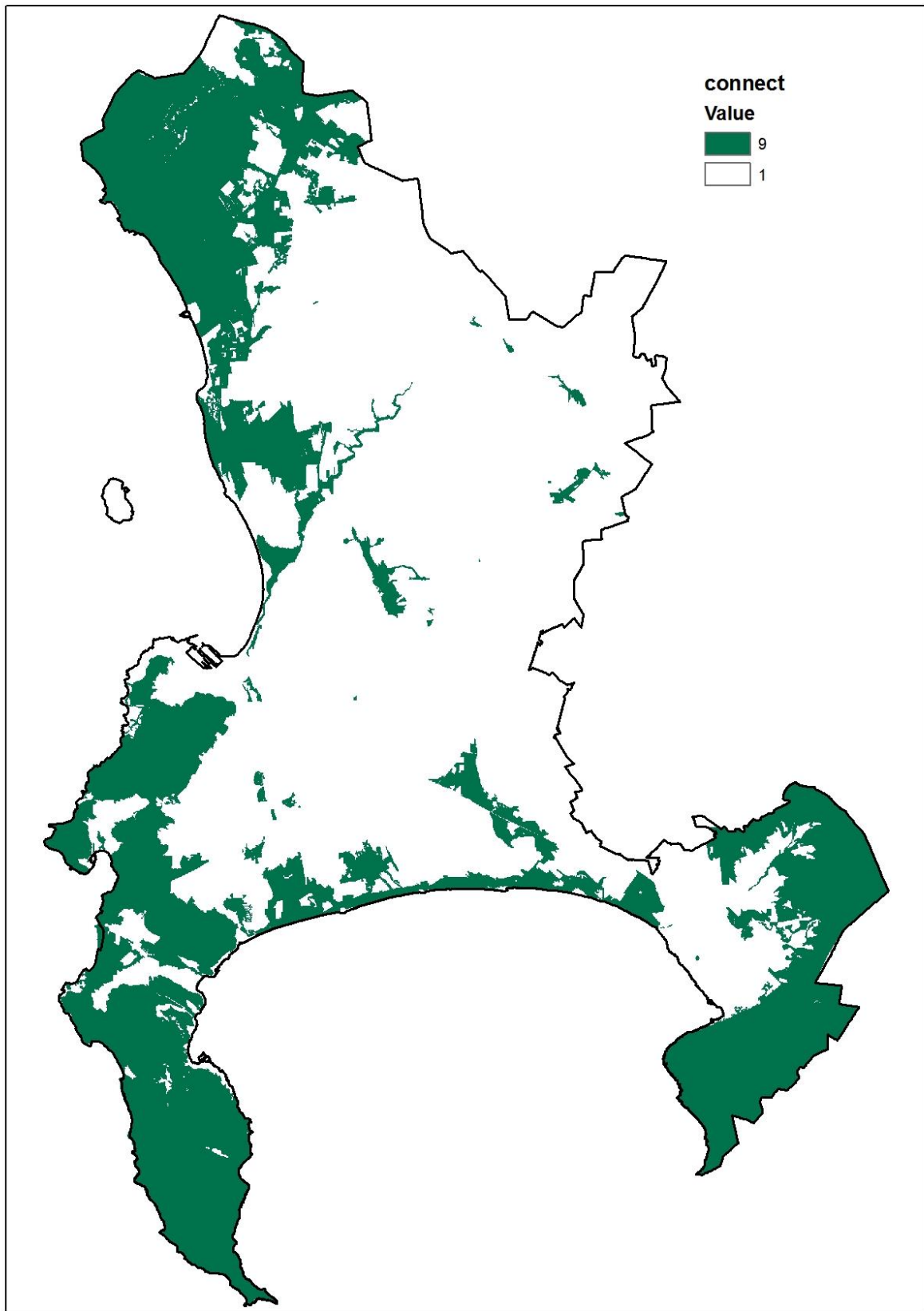


FIGURE 16: CONNECTIVITY

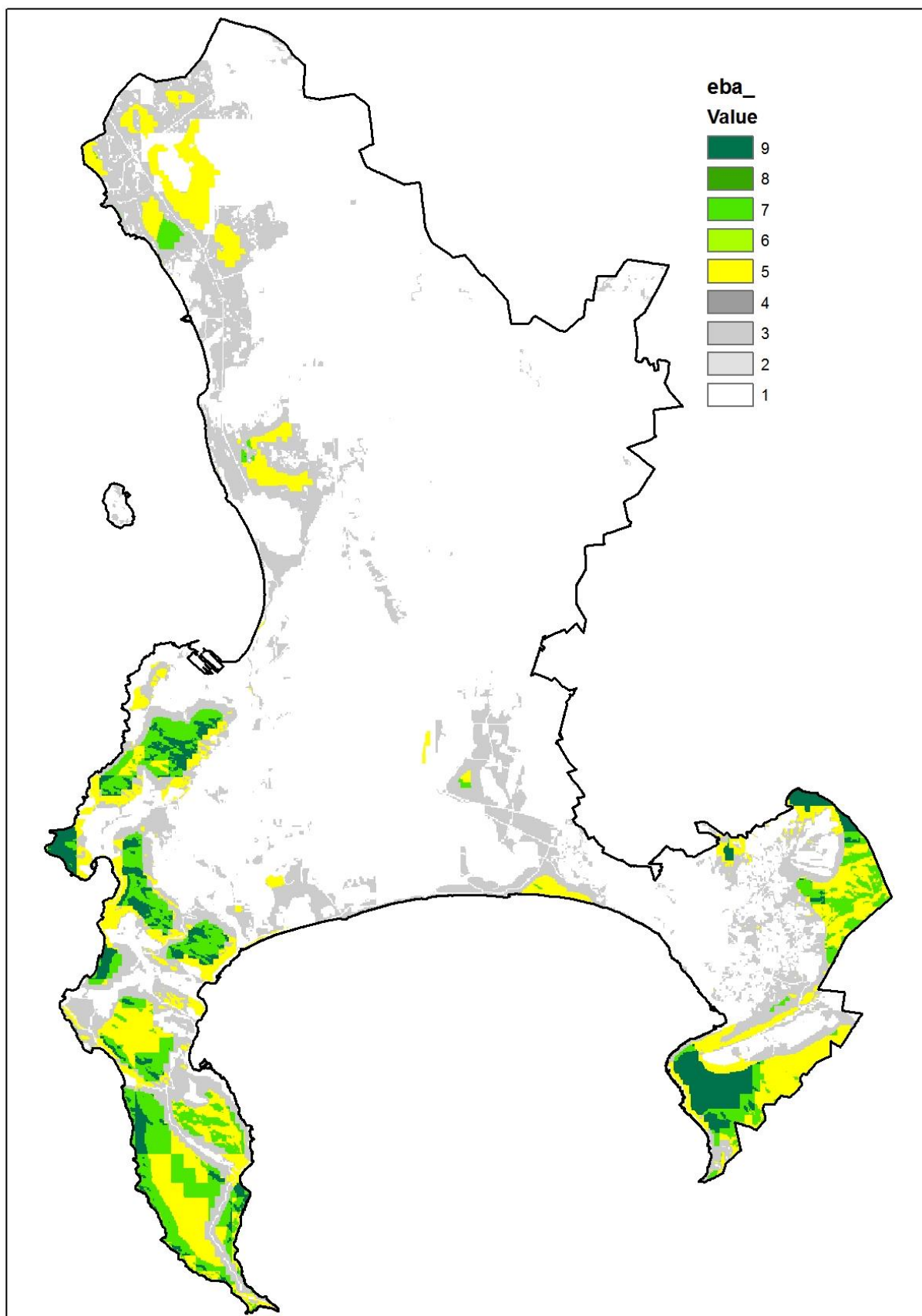


FIGURE 17: ECOSYSTEM-BASED ADAPTATION

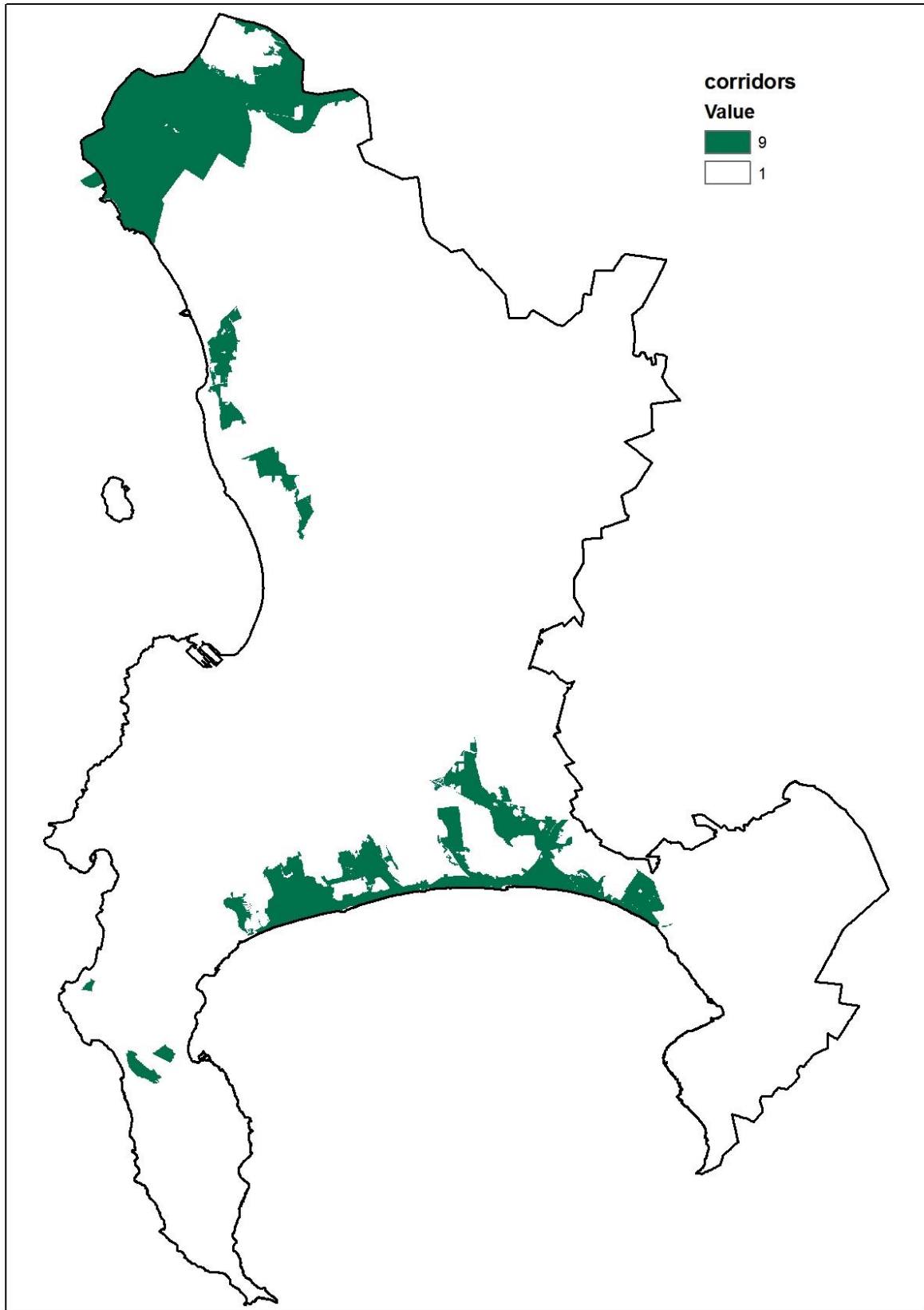


FIGURE 18: CORRIDORS

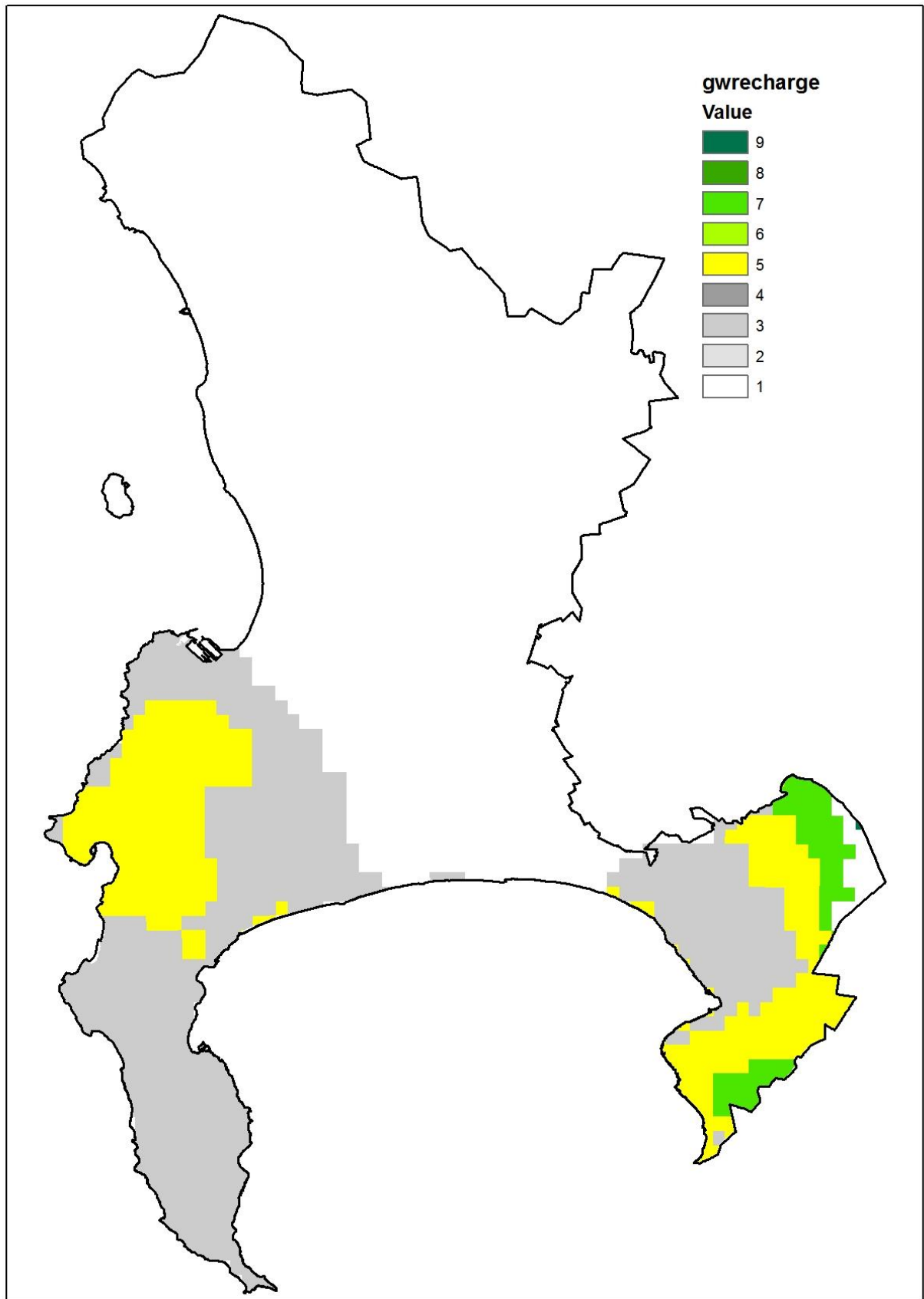


FIGURE 19: GROUNDWATER RECHARGE

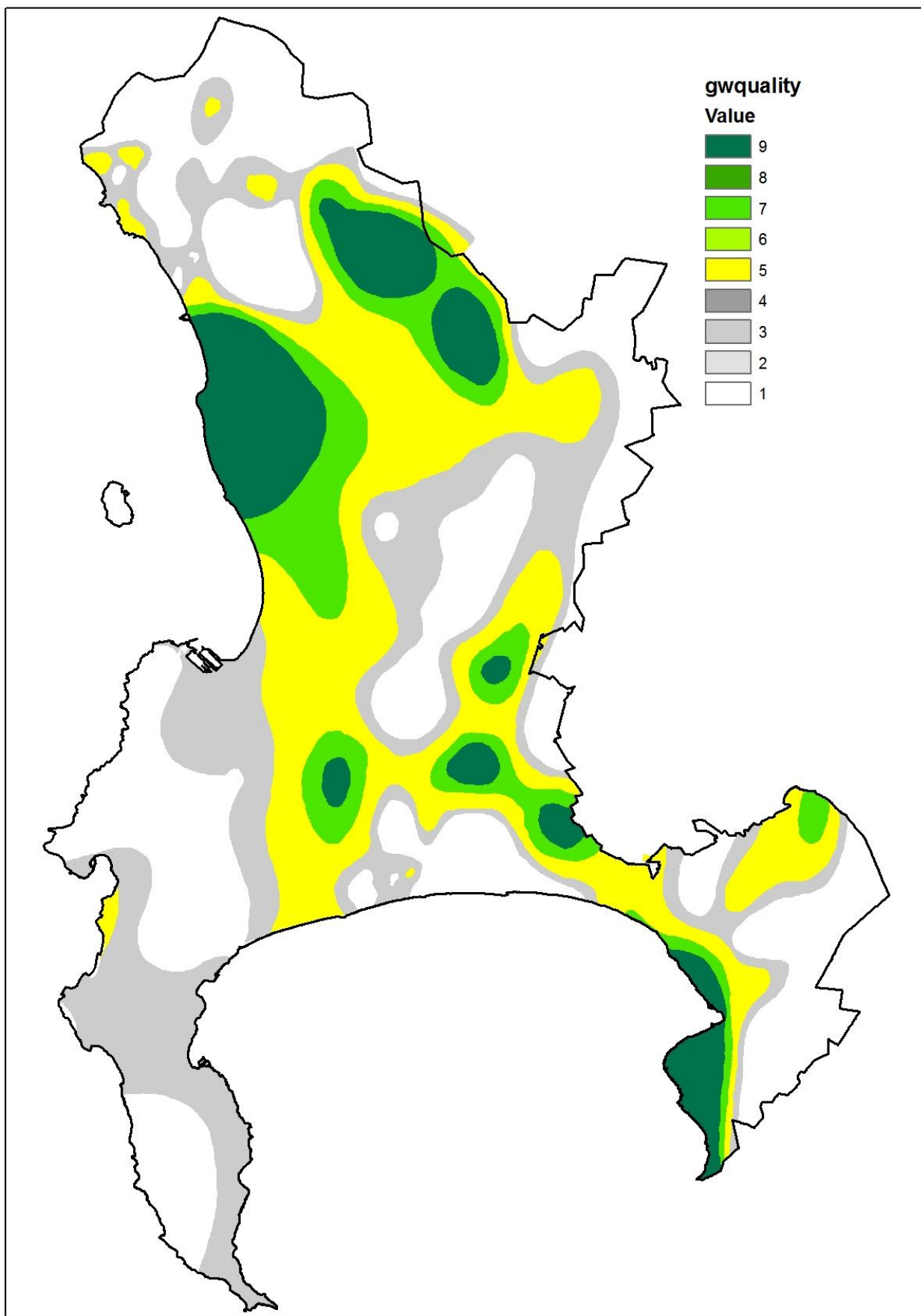


FIGURE 20: GROUNDWATER QUALITY

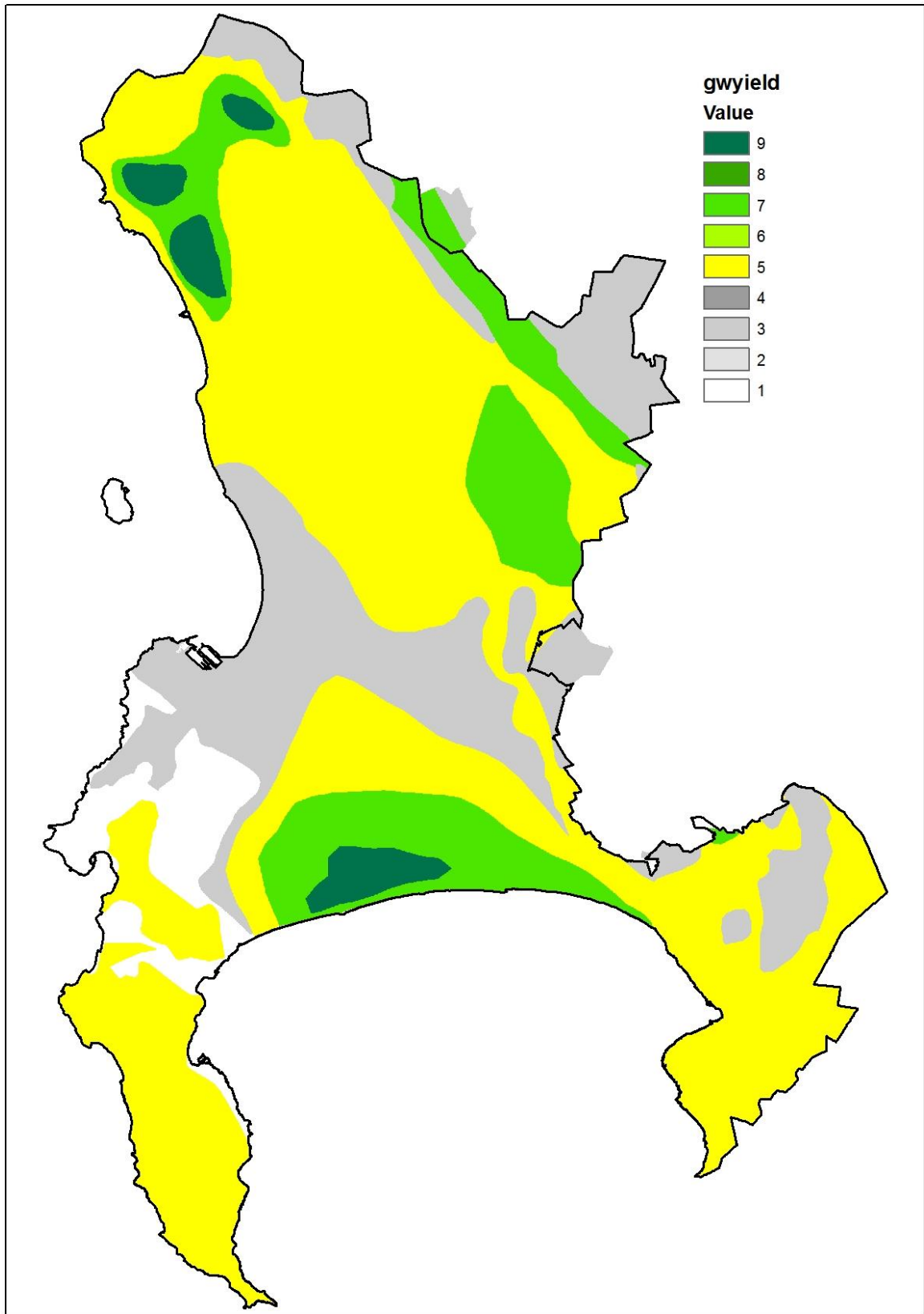


FIGURE 21: GROUNDWATER YIELD

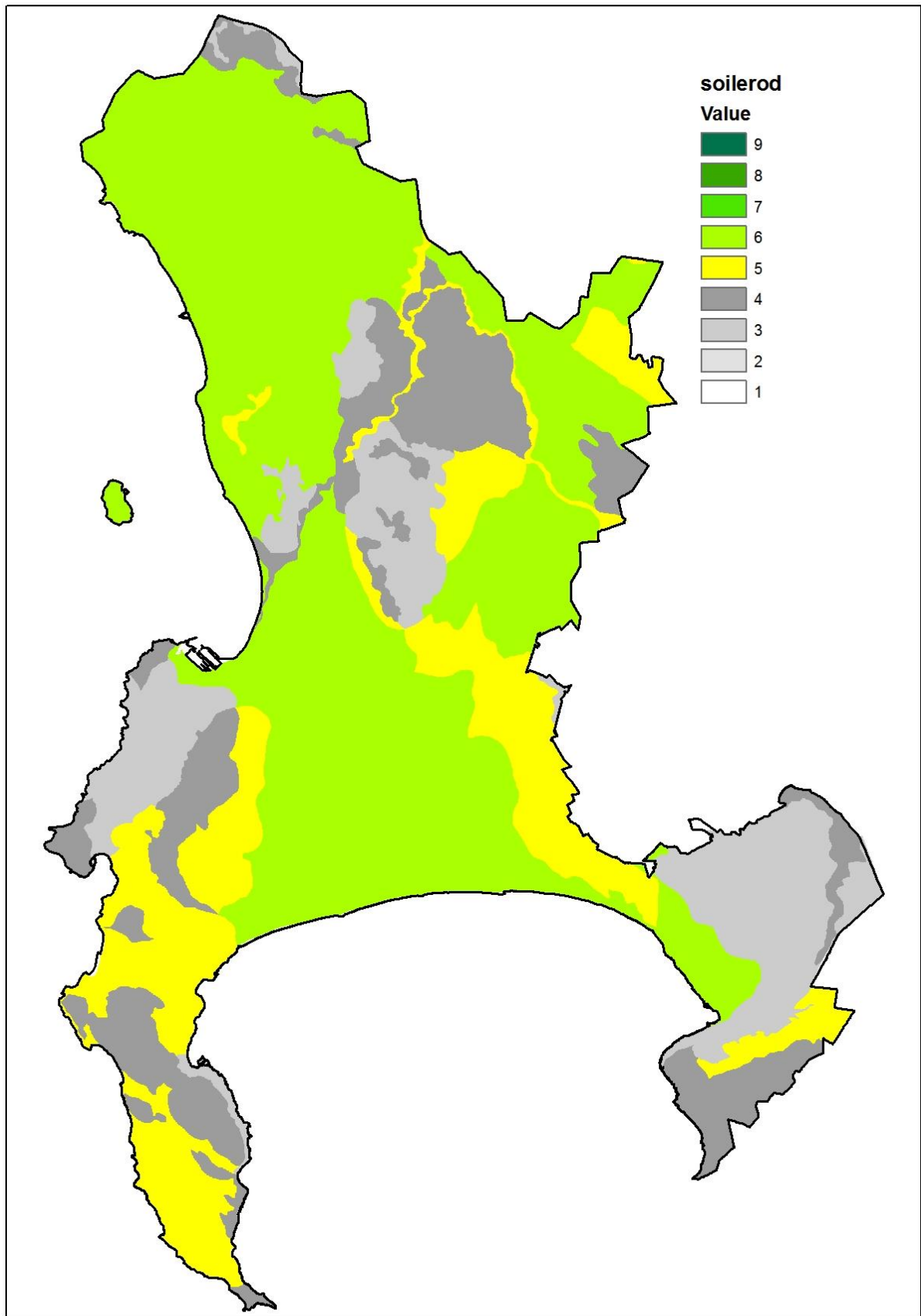


FIGURE 22: SOIL ERODIBILITY

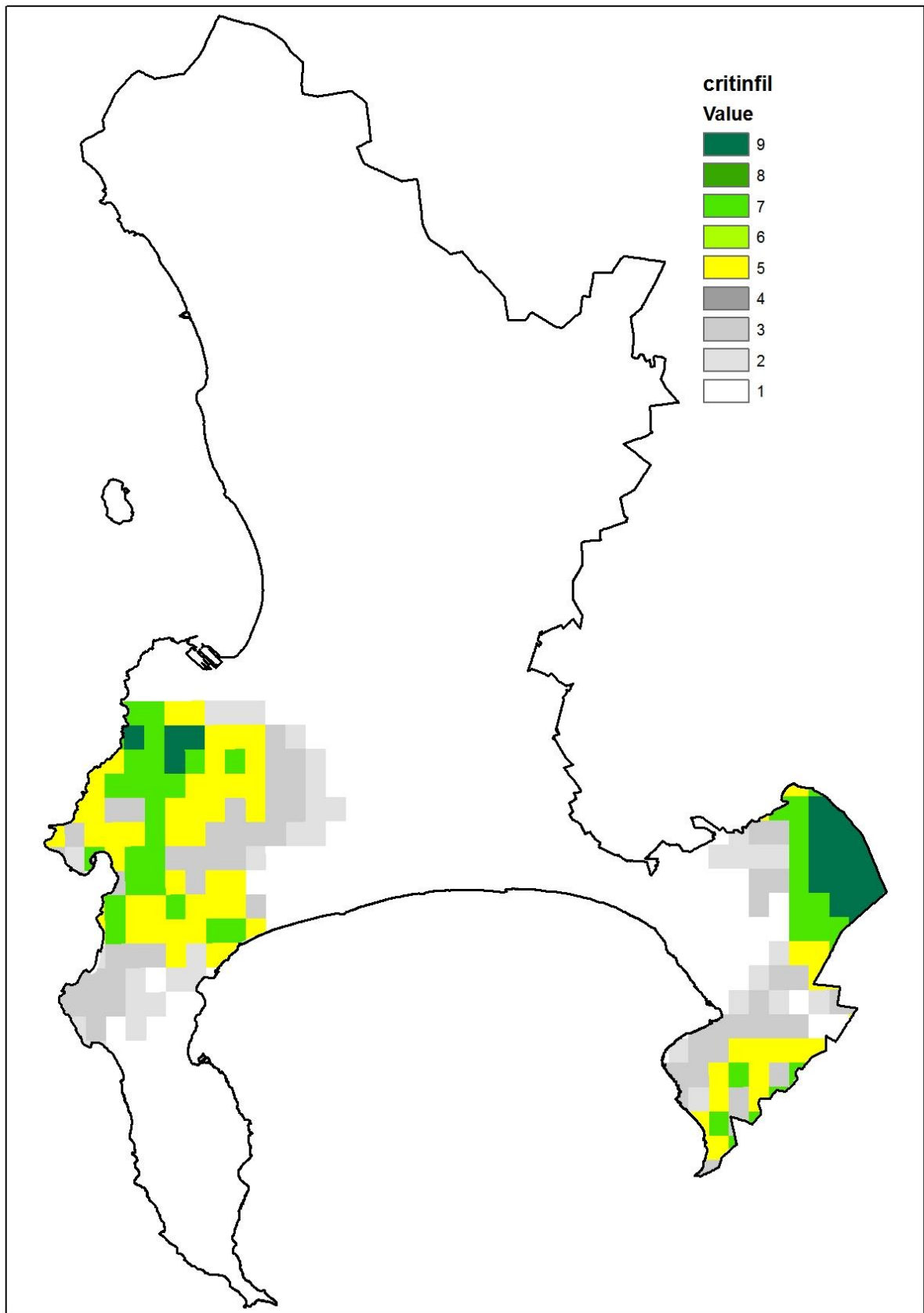


FIGURE 23: CRITICAL INFILTRATION

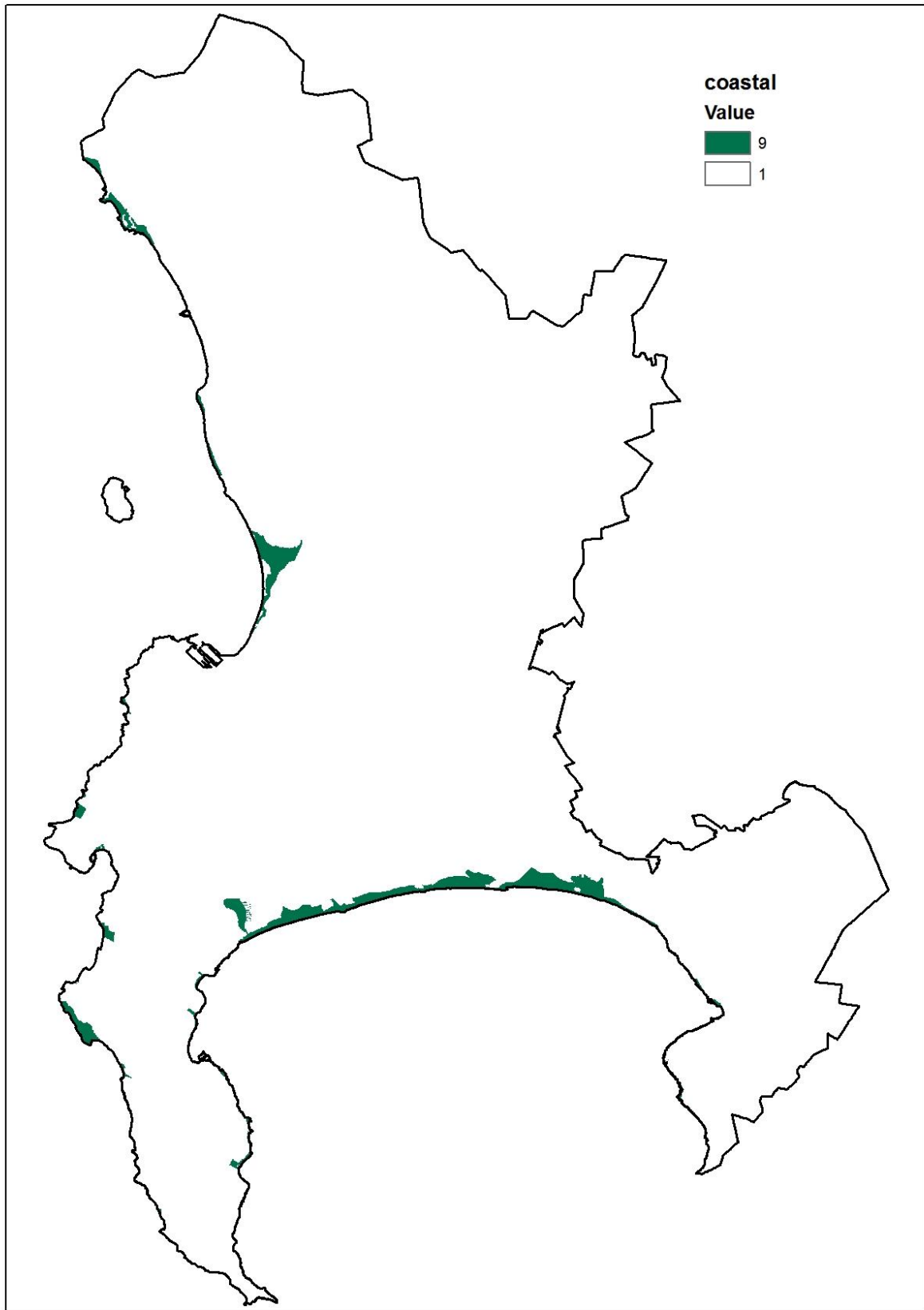


FIGURE 24: COASTAL EDGE

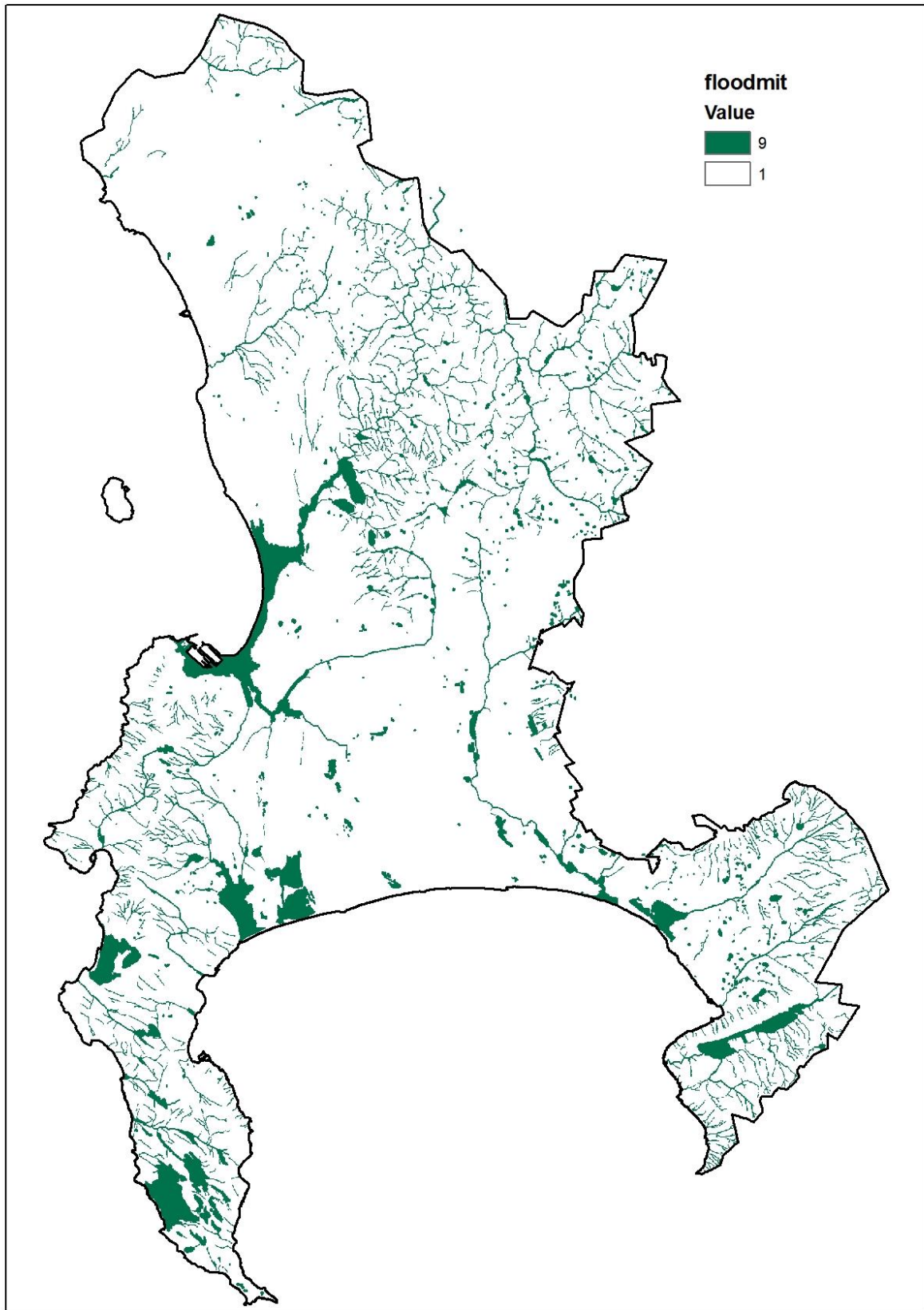


FIGURE 25: FLOOD MITIGATION

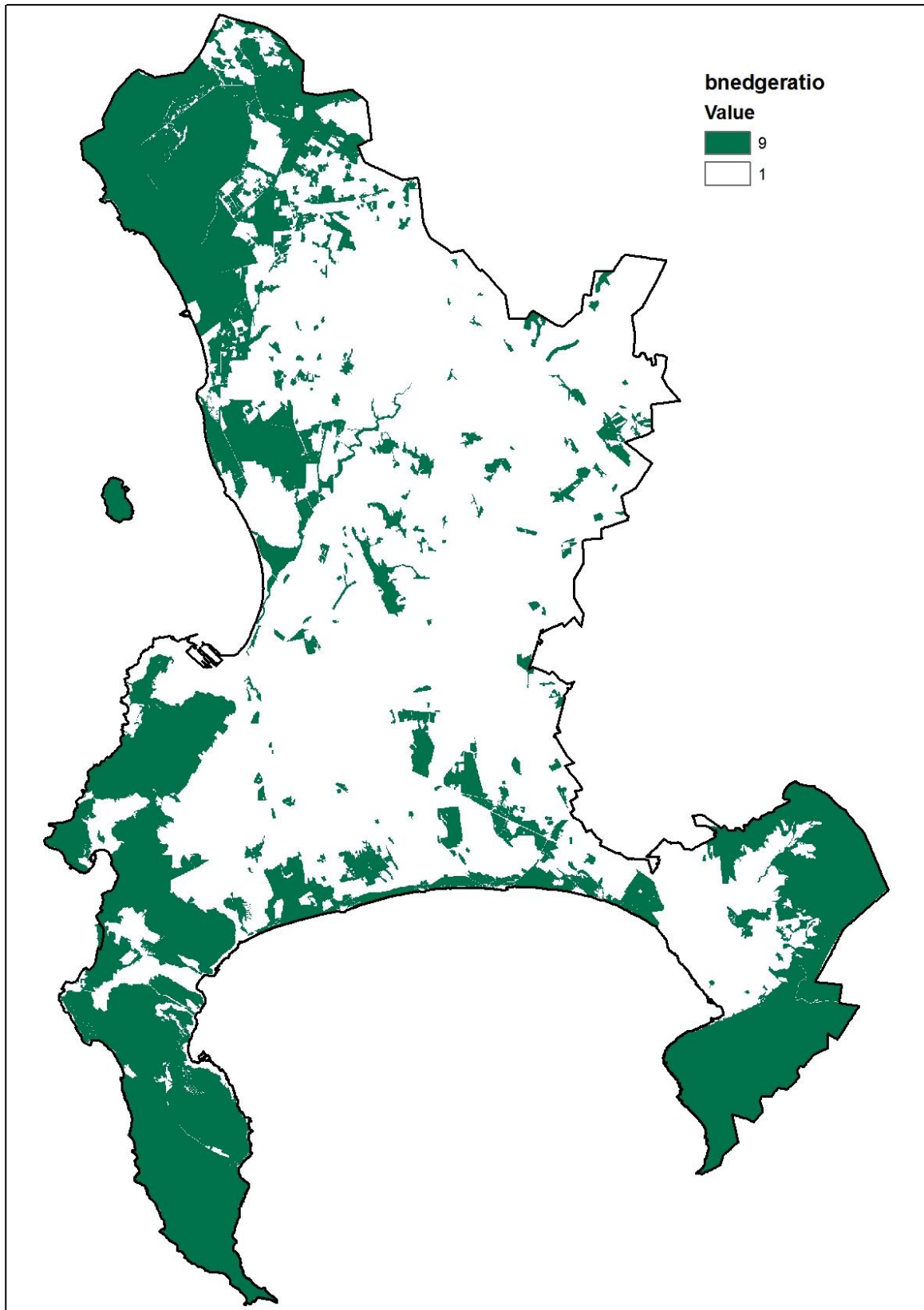


FIGURE 26: EDGE RATIO

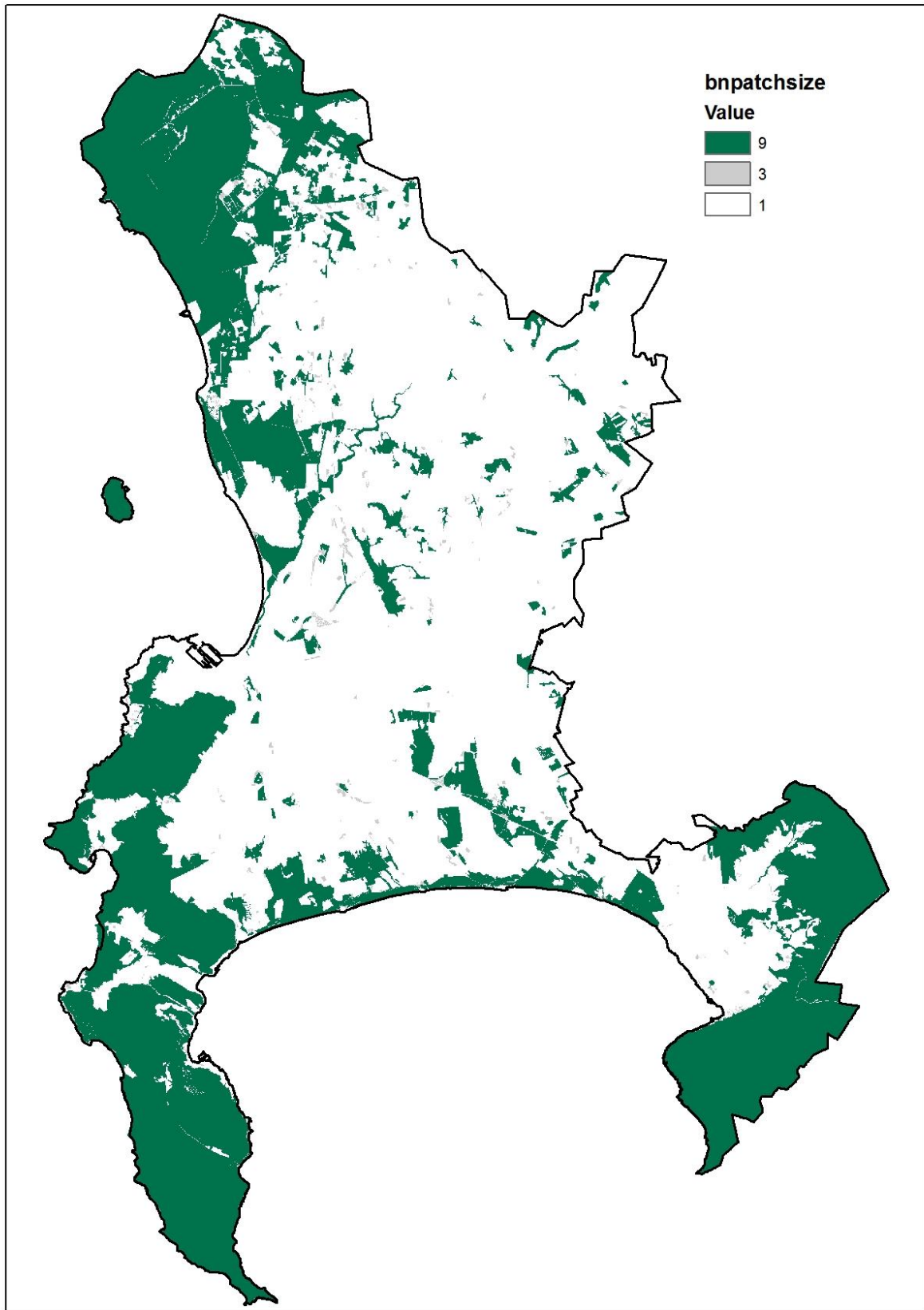


FIGURE 27: PATCH SIZE

Figures - Analysis Subcriteria Grids

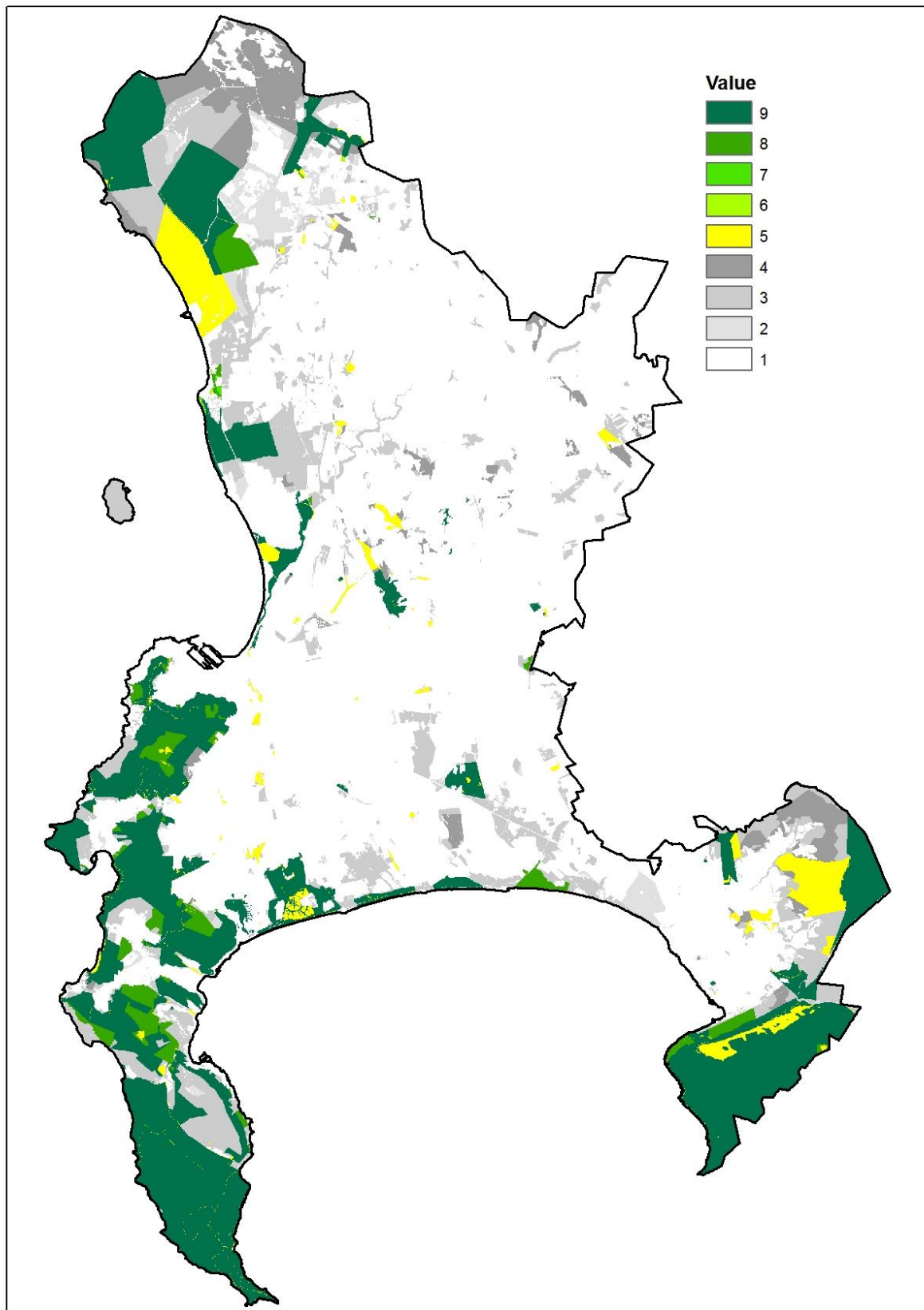


FIGURE 28: PROTECTION LEVEL

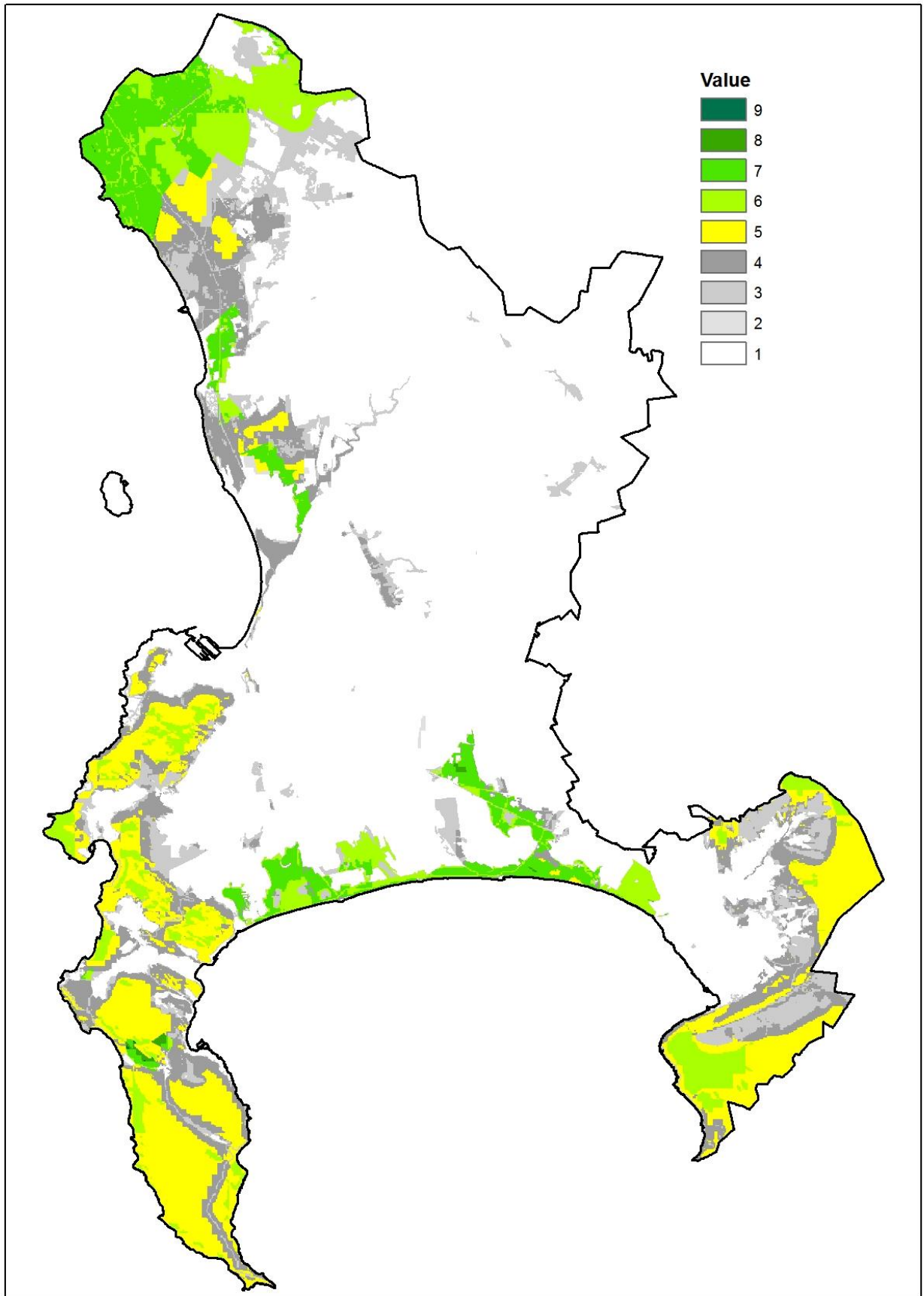


FIGURE 29: CONNECTIVITY & CLIMATE CHANGE ADAPTATION

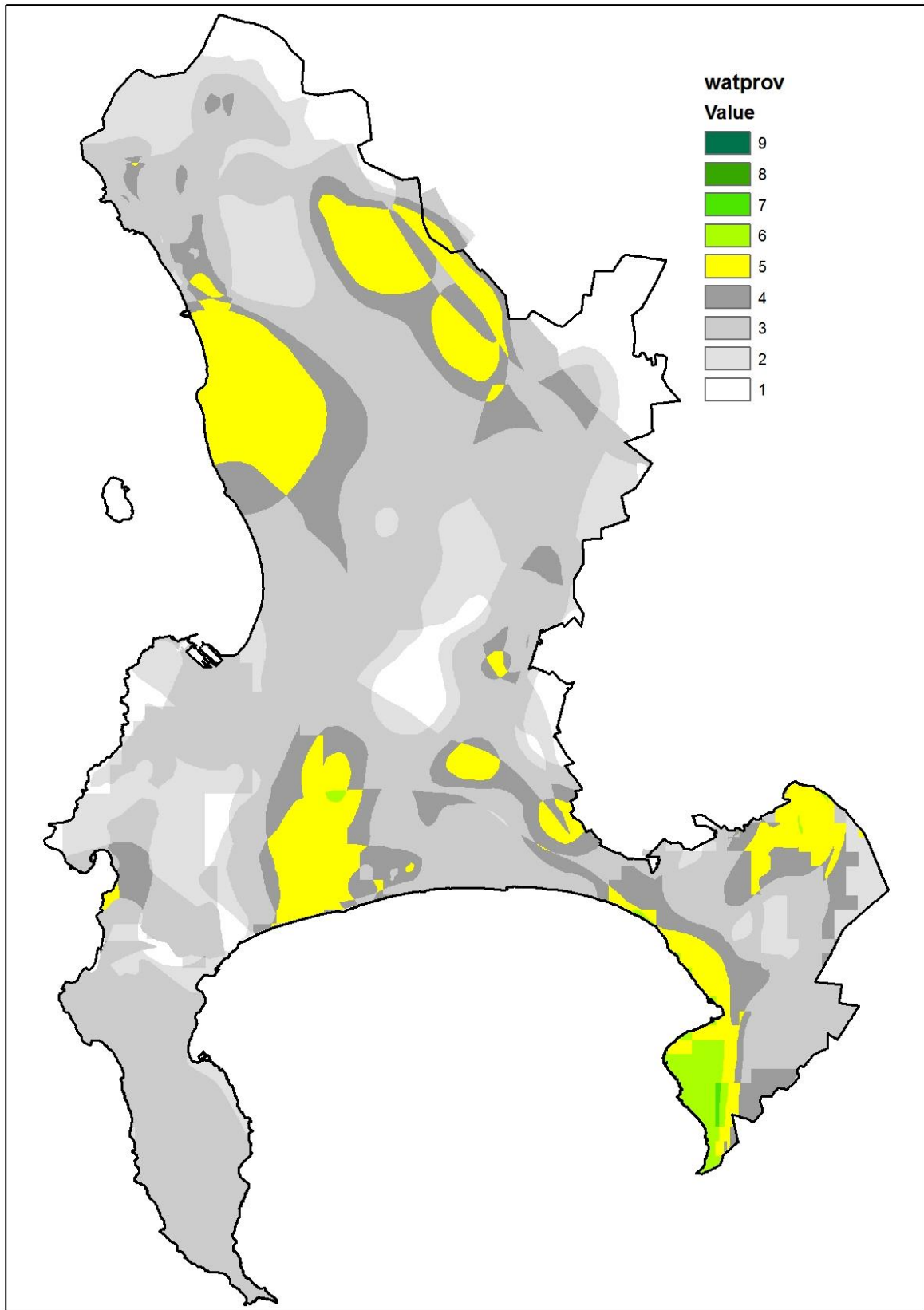


FIGURE 30: WATER PROVISION

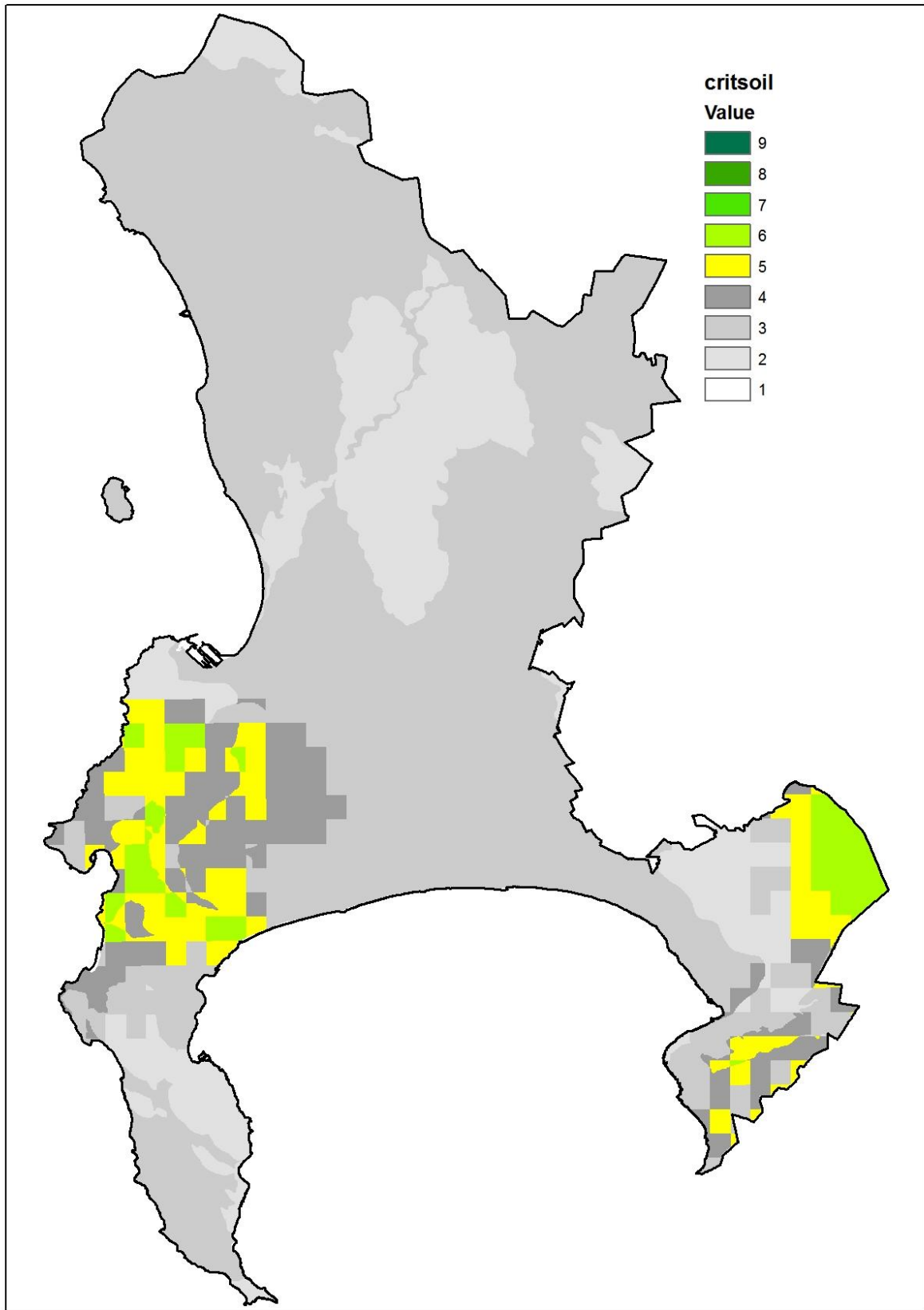


FIGURE 31: SOIL ERODIBILITY & CRITICAL INFILTRATION

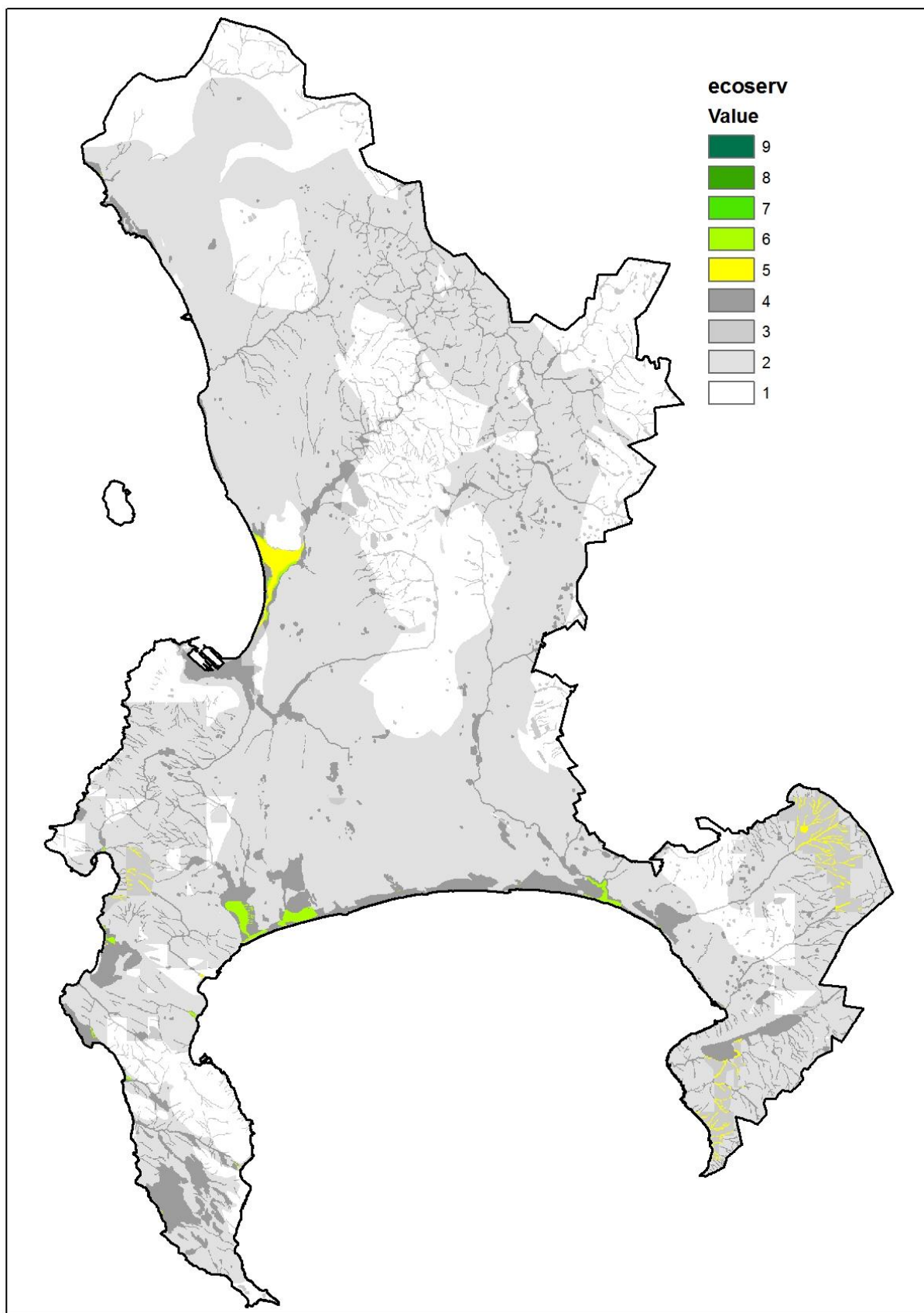


FIGURE 32: ECOSYSTEM SERVICES

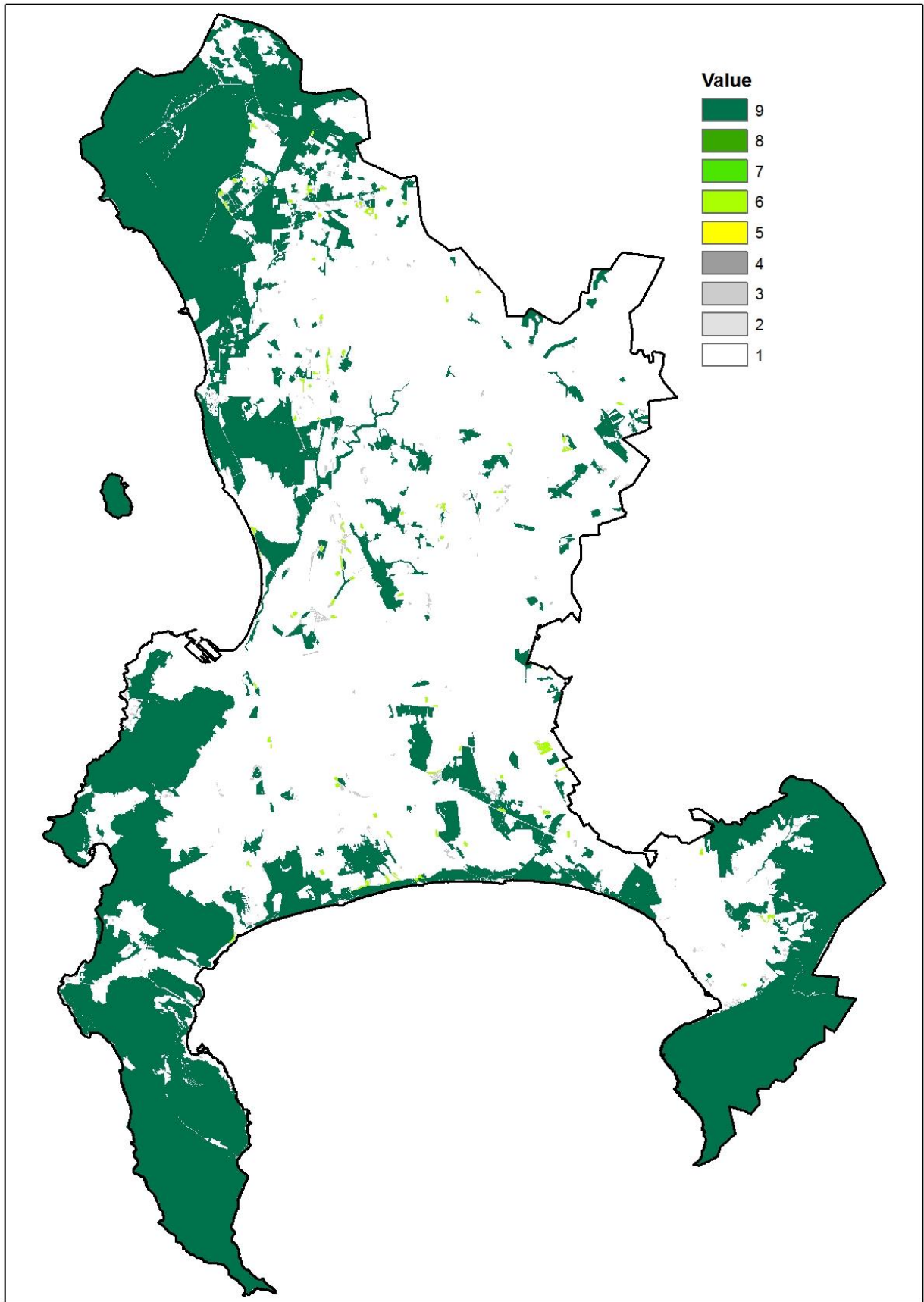


FIGURE 33: EDGE RATION & EFFECTS

Figures - Analysis Criteria Grids

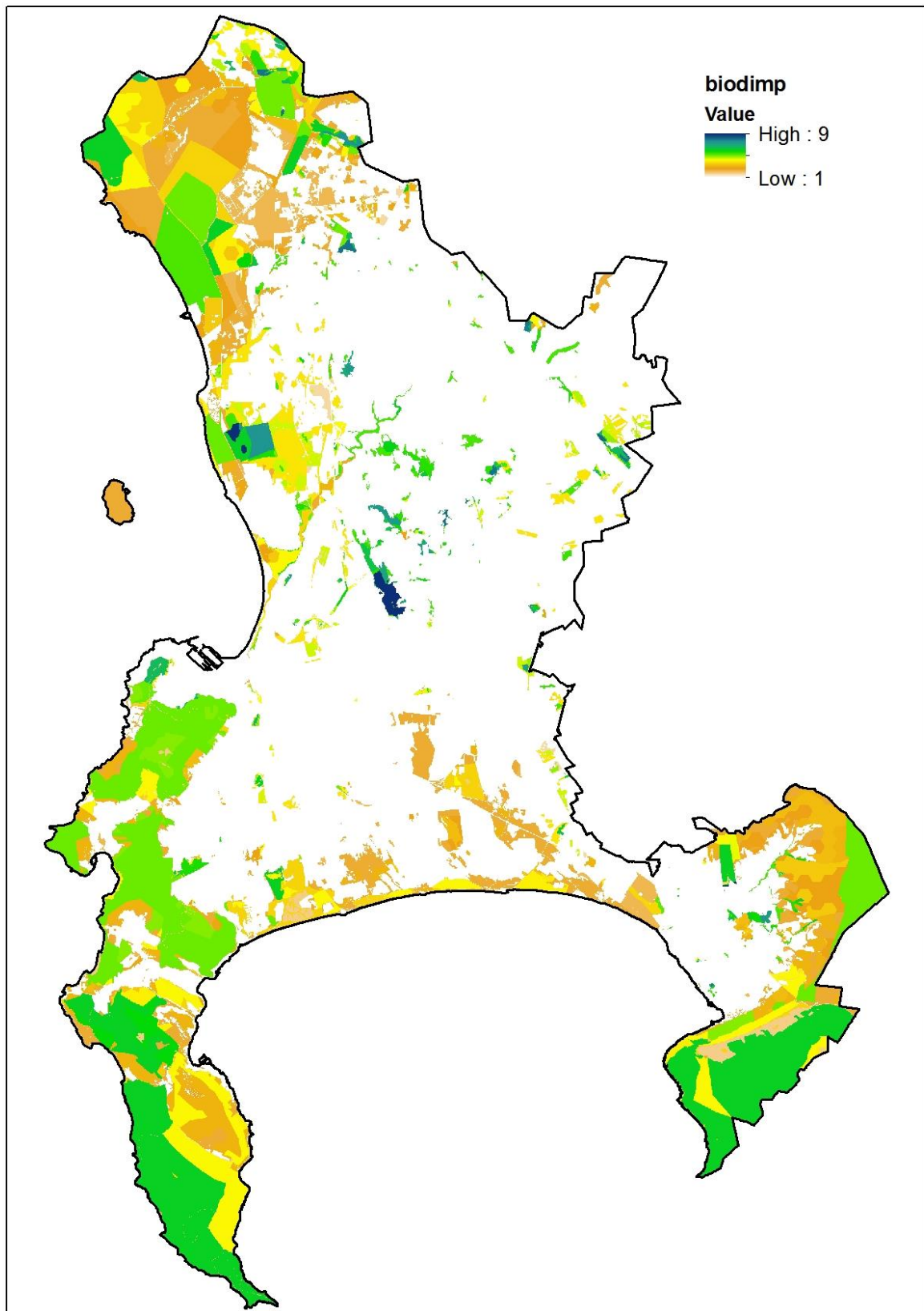


FIGURE 34: ACTIVE RESTORATION PRIORITISATION BASED ON BIODIVERSITY IMPORTANCE

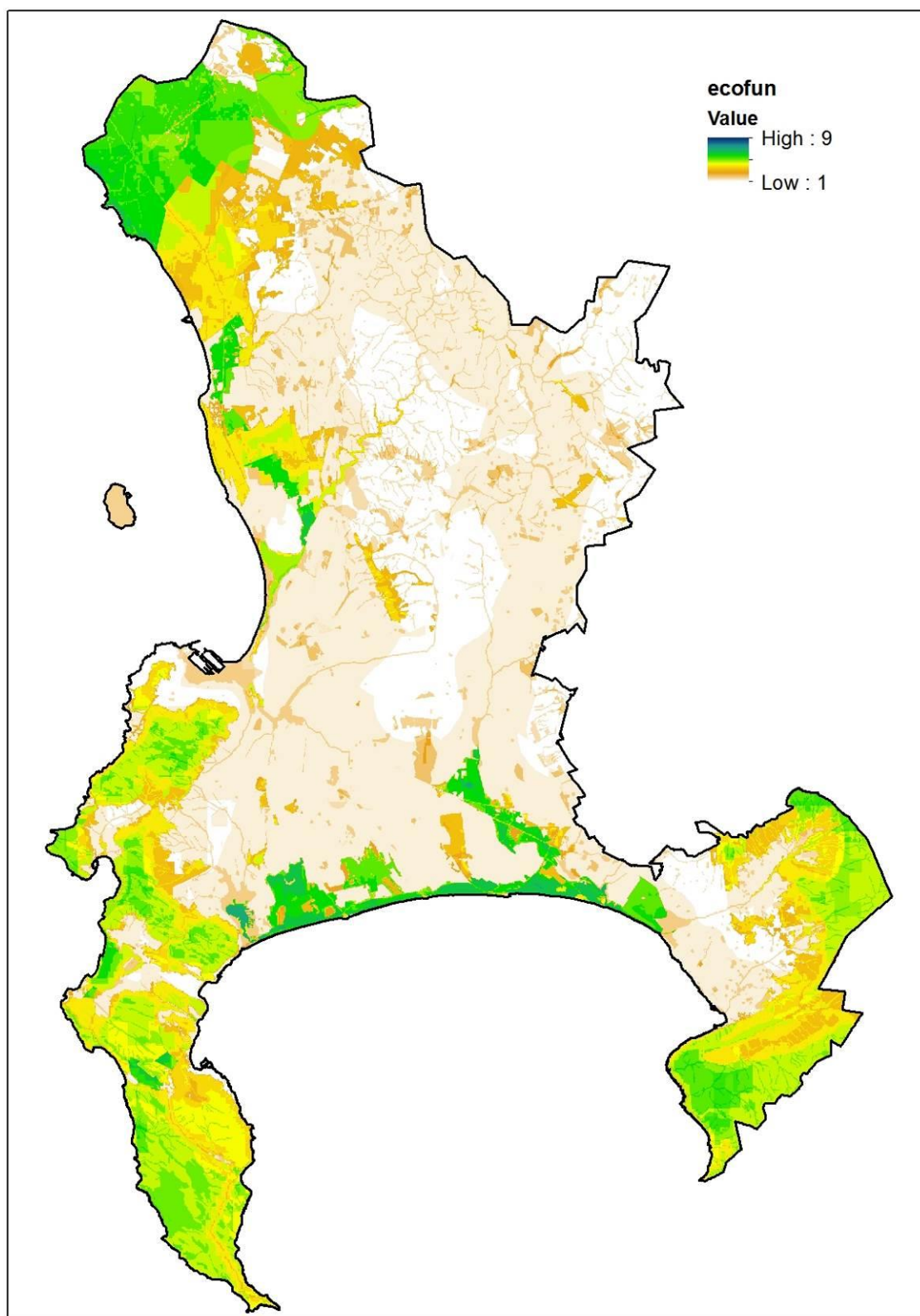


FIGURE 35: ACTIVE RESTORATION PRIORITISATION BASED ON ECOSYSTEM FUNCTION

TABLE 7: INDIGENOUS VEGETATION HABITAT CONDITION CATEGORIES

	Category	Definition	Restoration Actions
5	Natural/ Good	Structurally an intact ecosystem with no evidence of any past major unnatural disturbance; species composition 80-100% of expected.	No active restoration required. Maintain optimal disturbance regime (e.g. fire, browsing) and invasive alien species control; monitor threatened or sensitive taxa.
4	Near-natural/ Good	Structurally a relatively intact ecosystem that may have suffered some negative impacts historically (e.g. altered fire regime, alien invasion, brush-cutting, resource extraction); species composition 50-80% of expected.	No active restoration required, unless there is evidence of recent local extinctions. In the latter case, re-introductions of species from the nearest local population source could be considered. Re-introduce optimal fire regime and invasive alien species control; monitor threatened and sensitive taxa.
3	Degraded/ Fair (3a & 3b)	3a. Altered ecosystem with some structural elements (e.g. overstorey shrub layer) completely missing; low to moderate species richness; soil seed banks depauperate; alien plant cover is low to closed-canopy; species composition 10-50% of expected. Area has suffered once-off, historical soil disturbance, such as ploughing or bulldozing. 3b. As above, but no obvious unnatural soil disturbance.	3a. Consider whether compacted or bulldozed soil requires scarification or replacement, respectively. Active restoration is required to re-introduce any missing structural elements, such as the overstorey proteoid layer after dense alien invasion. Plan re-introductions from nearest local populations, preferably by seed. Integrate restoration with invasive alien control and fire management plans. Over time it may be possible to re-introduce missing elements of biodiversity, in particular threatened species with small populations or those currently missing but previously recorded at the site. 3b. As above, without manipulation of substratum.
2	Heavily modified/ Poor	Vegetation structure is altered with many key elements missing (mainly weedy, herbaceous species remain owing to frequent brush cutting, fires, ploughing or long-standing invasion); soil seed banks largely depleted (little evidence of geophytes); alien plant cover is low to closed-canopy; species composition 1-10% of expected.	Consider whether compacted or bulldozed soil requires scarification or replacement, respectively. Active restoration is required to re-introduce all the main structural elements of the vegetation. Plan re-introductions from nearest local populations, preferably by seed. Integrate restoration with invasive alien control and fire management plans. Focus on restoring a structurally-representative vegetation stand that can function as naturally as possible. Over time it may be possible to re-introduce missing elements of biodiversity, in particular species that are under-represented or perform a keystone function (e.g. to sustain pollinators).
1	Transformed/ irreversibly modified	Land has been transformed by repeated ploughing (or other land-use activity) so that vegetation structure and soil-stored seed banks are destroyed and not restorable without significant intervention; species composition 0-1% of expected (some weedy indigenous ephemerals may have colonized old fields).	The decision to restore an old field will depend on the context of the particular site and whether it forms part of an important ecological corridor or buffers high quality remnants within a reserve. Active restoration is required to re-introduce all the main structural elements of the vegetation. Plan re-introductions from nearest local populations, preferably by seed. Integrate restoration with invasive alien control and fire management plans. Focus should be on restoring a structurally-representative vegetation stand that can function as naturally as possible. Over time it may be possible to re-introduce missing elements of biodiversity, in particular species that are under-represented or perform a keystone function (e.g. to sustain pollinators).
	Lost	Hard infrastructure (buildings, hard-surfacing) now replaces the historical ecosystem and the site is considered permanently altered and non-restorable.	No active restoration recommended. In places utility areas may be landscaped using local indigenous species, but this cannot be considered as ecological restoration. Some areas may be rehabilitated by removing foreign substrata, then over time restoration may be possible.
	Open Water	Permanent water body (natural or man-made)	Dependent on main function and objectives of the water body

1. Note that the above applies to terrestrial and seasonal wetlands ecosystems, but not to permanent water bodies or perennial wetlands which will require different assessment criteria and interventions.
2. Note also that in order to maintain a restored ecosystem, the natural disturbance regime must be re-instated and maintained (e.g. fire, browsing, hydrological condition etc.)

TABLE 8: ACTIVE RESTORATION 2018/9 MEAN SCORE (ANY VEGETATION TYPE, ANY HABITAT CONDITION) FOR ALL RESERVES

PA name	MEAN (any vegetation type, any habitat condition)
Aurora Park	4.575
Blaauwberg	5.497
Bo-Kloof	3.618
Boskloof Eco Estate	3.742
Bothasig Fynbos	4.652
Botterblom	5.643
Bracken	4.964
Brakkefontein	4.088
Camphill	2.502
Capaia Wines	5.443
Cape Flats	3.561
Coastal Corridor (West Coast)	4.879
Crammix	2.501
Dankbaar	3.489
Dassenberg	4.621
De Hel	3.095
Die Oog	1.990
Driftsands	4.299
Durbanville	4.510
Edith Stephens	3.625
Epping	3.561
False Bay - Coastal Corridor section	4.395
False Bay - Pelican Park section	4.546
False Bay - Rondevlei section	5.659
False Bay - Slangetjebos section	4.540
False Bay - Strandfontein Birding Area section	3.728
False Bay - Zeekoevlei section	4.475
Fraai Uitsig	4.610
Glencairn Wetlands	3.289
Haasendal	4.820
Harmony Flats	5.444
Helderberg	5.007
Helderberg - Silwerboomkloof section	3.242
Highberry Wine Estate	4.663
Hillcrest Wine Estate	3.655
Hottentots-Holland	4.779
Hunters Valley	2.720
Intaka Island	4.221
Jack Muller	3.972
Joostenberg Kloof	4.463
Joubert Family	2.365
Kanonkop	4.407
Kenilworth Race Course	4.697
Kirstenbosch Gardens	3.087
Klein Dassenberg	4.949
Knorhoek	3.374

PA name	MEAN (any vegetation type, any habitat condition)
Koeberg	4.373
Lentegeur/ Mitchells Plain	2.507
Loevenstein	3.683
Loevenstein Park	4.216
Lower Silvermine Wetlands	3.439
Macassar Dunes	4.706
Magic Forest	2.493
Manning Family	2.516
Meadowridge Common	4.041
Melkbos	4.619
Mellish	5.285
Muizenberg East	2.898
Nirvana	4.557
Penhill	2.625
Plattekloof	3.918
Princessvlei & Little Princessvlei	2.989
Rondebosch Common	4.351
Rondebosch East Common	3.371
San Michell	3.288
Sandown	4.700
Sonop	4.946
Steenbras	5.038
Summervale	3.964
Table Bay - Fynbos Corridor	4.875
Table Bay - Milnerton Race Course section	4.863
Table Bay - Rietvlei section	4.092
Table Bay - Rivergate section	5.150
Table Bay - Zoarvlei section	3.911
Table Mountain	4.952
Table Mountain - Tokai Park section	4.765
Three Fountains	3.399
Two Rivers Urban Park	3.158
Tydstroom	3.486
Tygerberg	6.969
Tygerberg High	3.120
Tygerberg Hill	5.097
Uitkamp Wetland	5.808
Van Schoorsdrift	2.810
Vergelegen	3.667
Waterkloof	3.304
Welbeloond	3.739
Wesfleur	3.416
Westlake	3.012
Westridge Dune	3.735
Witzands Aquifer	4.449
Wolfgat	4.755
Woodlands	2.872
Zandvlei Estuary	4.684
Zonnestraal	2.487

TABLE 9: PRIORITY SITES FOR ACTIVE RESTORATION 2018/9

Priorities for 2018/9 for seed collecting & propagation based on 1) existing restoration projects, 2) restoration prioritization assessment, 3) restoration, fire & alien planning (excludes WfWet projects).

* Sites listed in decreasing order of prioritization according to overall mean score (any vegetation type, any habitat condition). Likely projects highlighted in yellow.

** Mean score per vegetation type (any habitat condition).

*** Total hectares of vegetation of degraded and modified habitat condition.

Protected Area name*	2017/18 propagation	Mean prioritisation score**	degraded + modified (ha)	Mean prioritisation score**	degraded + modified (ha)	Mean prioritisation score**	degraded + modified (ha)	Mean prioritisation score**	degraded + modified (ha)	Restoration plan	2018/19 seed	2018 foot/19 propagation	Notes	Total degraded + modified (ha)***
		Fynbos		Other		Renosterveld		Strandveld						
Blaauwberg		6.215	485.57			7.279	80.75	4.827	304.1	x	x		Renosterveld & Fynbos project areas	870.42
Helderberg		4.967	51.39			6.996	2.45			x				53.84
Tygerberg		5.570	0.21			6.973	131.52			x	x		P. Glanville to advise on RF involvement	131.73
Coastal Corridor (West Coast)		4.703	127.02			5.959	39.73	5.679	0					166.75
Dassenberg		4.228	66.72			5.959	0							66.72
False Bay - Rondevlei section		5.891	10.55	5.358	24.89			5.758	95.08					130.52
Uitkamp Wetland						5.808	19.12			x				19.12
Botterblom						5.643								0
Table Mountain		4.940	126.25	4.702	0	5.503	0.04	5.159	0.17					126.46
Sonop		4.706	0			5.472	0							0
Harmony Flats		5.444	4.68							Draft			H.Wittridge to complete draft	4.68
Joostenberg Kloof	x	4.031	46.79			5.404	4.86							51.65
Klein Dassenberg	x	4.947	57.41			5.392	0			x				57.41

Protected Area name*	2017/18 propagation	Mean prioritisation score**	degraded + modified (ha)	Mean prioritisation score**	degraded + modified (ha)	Mean prioritisation score**	degraded + modified (ha)	Mean prioritisation score**	degraded + modified (ha)	Restoration plan	2018/19 seed	2018 foot/19 propagation	Notes	Total degraded + modified (ha)***
		Fynbos		Other		Renosterveld		Strandveld						
Capaia Wines						5.443	0							0
Mellish						5.285	0							0
Table Bay - Fynbos Corridor		5.221	113.73	4.429	96.35									210.08
False Bay - Zeekoevlei section		5.187	4.37	4.454	20.79			4.478	131.17		x	x	S.Dorse to advise on RF involvement	156.33
Melkbos		5.165	24.92					4.216	12.5					37.42
Table Bay - Rivergate section		5.150	11.74											11.74
Tygerberg Hill		2.685	0			5.120	0							0
Zandvlei Estuary		5.036	13.79	4.694	17.83			4.621	56.96	x				88.58
Steenbras		5.034	54.79	5.182	0.45			3.766	4.55					59.79
Witzands Aquifer		4.976	39.16					4.440	15.21					54.37
Durbanville		4.058	0.5			4.974	0.46			x				0.96
Bracken		4.964	34.73							x				34.73
Table Bay - Milnerton Race Course section		4.863	9.53							x				
Haasendal		4.847	35.96			3.901	1.1			x				37.06
Hottentots-Holland		4.778	0.84	4.884	0									0.84
Table Mountain - Tokai Park section		4.765	0.1											0.1
Fraai Uitsig		3.733	8.73			4.756	50.46							59.19
Wolfgat								4.755	49.28					49.28
Macassar Dunes								4.706	27.9					27.9
Sandown		4.700	13.71											13.71
Kenilworth Race Course		4.697	18.48											18.48

Protected Area name*	2017/18 propagation	Mean prioritisation score**	degraded + modified (ha)	Mean prioritisation score**	degraded + modified (ha)	Mean prioritisation score**	degraded + modified (ha)	Mean prioritisation score**	degraded + modified (ha)	Restoration plan	2018/19 seed	2018 foot/19 propagation	Notes	Total degraded + modified (ha)***
		Fynbos		Other		Renosterveld		Strandveld						
Highberry Wine Estate	x	4.061	0			4.684	0							0
Bothasig Fynbos		4.652	6.62							x	x	x	P.Glanville to advise on RF involvement	6.62
Aurora Park						4.575	0							0
Nirvana		4.557	0.23											0.23
False Bay - Pelican Park section								4.546	91.67					91.67
False Bay - Slangetjebos section								4.540	106.72					106.72
Dassenview - Sand Fynbos	x												not ecosystem restoration	
DCCP - Sand Fynbos	x												not ecosystem restoration	
Groenfontyn - Sand Fynbos	x												not ecosystem restoration	
Highberry - Fynbos	x												not ecosystem restoration	
Meadowridge Common - Sand Fynbos	x												not ecosystem restoration	
Old Boyes Drive - Granite Fynbos	x												not ecosystem restoration	
Rondebosch East Common - Sand Fynbos	x												not ecosystem restoration	

Protected Area name*	2017/18 propagation	Mean prioritisation score**	degraded + modified (ha)	Mean prioritisation score**	degraded + modified (ha)	Mean prioritisation score**	degraded + modified (ha)	Mean prioritisation score**	degraded + modified (ha)	Restoration plan	2018/19 seed	2018 foot/19 propagation	Notes	Total degraded + modified (ha)***
		Fynbos		Other		Renosterveld		Strandveld						
Skilpadsvlei - Sand Fynbos/ wetland	x												completed	
Telkom Radio Farm	x												not ecosystem restoration	
Van Schoorsdrif - Sand Fynbos	x												not ecosystem restoration	
Westlake - Granite Fynbos	x												not ecosystem restoration	