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General Notice

NAMIBIA STATISTICS AGENCY

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NAMIBIA LAND COVER CLASSIFICATION STANDARD

1. Foreword by the Surveyor General

Namibia has been without a legislated uniform land cover management system since independence in 1990 and those that existed at regional and municipal levels were often incompatible and inconsistent. To realise a well-coordinated development planning as per the aspirations in our national development plans, government initiated the formulation of a harmonised land cover classification standard for the country through the National Spatial Data Infrastructure (NSDI) as per the Statistics Act, 2011 (Act No. 9 of 2011).

The NSDI is the technical framework through which standards for spatial information can be developed in Namibia. A National Land Cover Classification System is needed to properly classify different land covers for them to be comparable over time. The main aim is to provide a statistically uniform, effective and comprehensive system of spatial planning in the country. The spatial planning system consists of a number of components including spatial development frameworks; principles, norms and standards to guide spatial planning, land use management and land development.

This uniform land cover classification standard will benefit the country immensely and have a profound impact on tracking changes over time. Likewise, the Agenda 2030 has set out Sustainable Development Goals (SDGs) to measure the progress over time on a wider variety of themes. Some SDGs are proving to be difficult to statistically track/ compare due to the different and not harmonised national land cover classification systems.

I am delighted that as a country we have reached this milestone where we can have a harmonised land cover classification to guide spatial planning throughout the country. My expectation is that all Offices, Ministries and Agencies of government will immediately start the development and alignment of their local, regional, and national land cover maps for uniform statistical reporting.

N. SHANYENGANA
SURVEYOR-GENERAL AND CHAIRPERSON
OF THE COMMITTEE FOR SPATIAL DATA

2. Remarks by the Statistician General

As per the Statistics Act, 2011 (Act No. 9 of 2011), the Namibia Statistics Agency (NSA), together with the Ministry of Agriculture, Water and Land Reform are tasked to take the lead in developing the National Spatial Data Infrastructure (NSDI) in order to improve the production, sharing and use of spatial data in Namibia. An NSDI Policy was enacted in 2015 and serves as one of the major policy frameworks for the implementation of the NSDI. Having the NSDI policy in place assists with clarifying the value of spatial data in Namibia, avoiding duplication of efforts as well as wasteful use of government resources amongst other benefits.

The NSDI policy stipulates that standards relating to the NSDI shall be established. These include standards relating to data, metadata, processes, and other aspects of the NSDI to improve data quality for better decision making. Standards play a key role in implementing an effective SDI that delivers reliable geospatial services and products. Moreover, standards are aimed at ensuring that geospatial data from various sources can easily be discovered, tracked, integrated, and harmonised at minimal cost.

Furthermore, the NSDI policy makes provision for the adoption of the International Organization for Standardization (ISO) standardisation principles on geographic information and geomatics as embodied in the ISO TC/211 suite of standards. The policy also empowers the Statistician-General to establish the standards on geospatial data by notice in the Gazette after consultation with the NSDI Committee.

Since Namibia did not have a legislated uniform land cover management system for a long time, a number of land cover mapping exercises have not been uniformly conducted in the country. Although these various exercises were conducted to meet specific user requirements, it has been a challenge to statistically compare different land cover datasets as they are incompatible. This standard has been developed to address such challenges and ensure compatibility and harmonisation of land cover data sets in the country for statistical reporting purpose.

I would therefore like to thank the United Nations Development Programme (UNDP) and Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ) for supporting the development of this standard. I would also like to thank members of the NSDI Inter-Agency Steering Executive Subcommittee and members of the NSDI Environmental Technical Working Group for bringing their expertise to this engagement throughout the development process.

A. SHIMUAFENI
STATISTICIAN-GENERAL AND
CHIEF EXECUTIVE OFFICER

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3. Definitions

Land cover	The observed (bio)physical cover of the Earth's surface. Possible land cover classes are built-up, bare landscape, cultivated land, forest, savannah and shrubland, grassland, wetland, water body or marine water.
Land use	The arrangements, activities and inputs people undertake in a certain land cover type to produce from, change or maintain it. Possible land use classes are residential, conservation, industry, agriculture, mining, or infrastructure development (roads, harbours, airports).
Classification	An abstract representation of the situation in the field using well-defined diagnostic criteria. A classification describes the systematic framework with the names of the classes and the criteria used to distinguish them, and the relation between classes. Classification thus involves definition of class boundaries that should be clear, precise, possibly quantitative, and based upon objective criteria. A classification should therefore be: • Scale independent, meaning that the classes at all levels of the system should be applicable at any scale or level of detail; and • Source independent, implying that it is independent of the means used to collect information, whether satellite imagery, aerial photography, field survey or some combination of them is used.

Source: FAO (1997)

4. Difference between land cover and land use

Land cover indicates the **physical land type** such as forest or open water whereas land use documents **how people are using the land.** By comparing land cover data and maps over a period of time, it is possible to document land use trends and changes.

Land cover data documents how much of a region is covered by forests, wetlands, impervious surfaces, agriculture, and other land and water types. Water types may include wetlands or open water. On the other hand, land use shows how people use the landscape – whether for development, conservation, or mixed uses. The different types of land cover can be managed or used quite differently.

Land cover can be determined by analysing satellite and aerial imagery. Land use cannot be determined from satellite imagery. Land cover maps provide information to help managers best understand the current landscape. To see change over time, land cover maps for several different years are needed. With this information, decision makers can evaluate past management decisions as well as gain insight into the possible effects of their current decisions before they are implemented.

Land cover data and maps are used to better understand the impacts of natural phenomena and human use of the landscape. Maps can help to assess urban growth, model water quality issues, predict and assess impacts from floods and storm surges, track wetland losses and potential impacts from sea level rise, prioritise areas for conservation efforts, and compare land cover changes with effects in the environment or to connections in socioeconomic changes such as increasing population.

5. Standard Scope

Name of the Standard

The standard described in this document shall be known as Namibia Land Cover Classification Standard.

Scope

1. The standard has been developed by the NSDI technical working group in collaboration with stakeholders, under the coordination of the Namibia Statistics Agency.

2. The standard is predominantly about land cover classification and reflects land use only if this affects land cover.

3. The standard aims at standardising land cover related studies and statistics in Namibia and facilitating national and international comparisons as well as official reporting.

4. Any official work presenting or using land cover classes in Namibia must strictly use this classification system.

5. The definitions of the classes are associated, where relevant with specific metrics, in order to make the definitions as unequivocal as possible.

6. The standard includes a list of mandatory classes, which cover all relevant land cover categories in Namibia for general use.

7. For more specific usage, it is always possible to extend it with additional sub-classes. Those "customised" sub-classes shall however not be considered as part of the standard.

8. The standard is scale and source independent. It can be used to create land cover maps at local, regional, or national level, regardless of the source of the information (remote sensing, field work, etc.).

Audience

The use of the standard is mandatory for all public bodies (ministries, regional and local governments) aiming at producing official land cover maps and statistics at national or sub-national scale. The use of this standard is not mandatory but highly recommended for all other bodies (Universities, NGOs and private sector).

Linkage to existing laws and policies

This standard has been developed in accordance with the following laws and policies:

- Namibian Constitution
- National Development Plans
- Harambee Prosperity Plans
- National Land Policy of 1998
- Environmental Management Act, 2007 (Act No. 7 of 2007)
- Forest Act, 2002 (Act No. 12 of 2002)
- Statistics Act, 2011 (Act No. 9 of 2011)
- Urban and Regional Planning Act, 2018 (Act No. 5 of 2018)
- NSDI Policy of 2015

- NSDI Strategy and Action Plans
- It has also been developed keeping in mind the Agenda 2030 for the Sustainable Development Goals (SDGs) indicators.

Custodian

The custodian of this standard is the Namibia Statistics Agency in consultation with the Ministry of Agriculture, Water and Land Reform.

Updating

The standard will be updated and adjusted periodically, whenever deemed necessary through the NSDI Secretariat. Any change will be communicated through the usual official channels. Backward compatibility will be taken into account as much as possible.

Naming convention

The names of the classes must be strictly used as described later in this document.

Colour coding

The colours used to represent land cover classes on official maps must strictly respect the colour coding described later in this document. Minor deviations may be allowed after consultation with the NSDI Secretariat for noting as well as informing users of such deviation.

Land cover class cards

Each class and sub-classes are described in detail in a dedicated land cover class card. This card indicates specifically what landscape objects must be found or cannot be found in the said land cover class. In case of doubt, the land cover mappers must always go back to those cards to get the standard definition of each class.

Maintenance authority

Maintenance of the Namibia Land Cover Classification Standard is the responsibility of the NSDI Secretariat under the Namibia Statistics Agency. The Directorate of Survey and Mapping within the Ministry of Agriculture, Water and Land Reform will be responsible for the land cover mapping exercise and updating the National Land Cover Maps. Where a technical committee related to mapping of national land cover is constituted, the Ministry will lead such a committee while the Namibia Statistics Agency will provide secretarial function.

Any requests for amendments to this standard can be submitted by any organisation or individual to the NSDI Secretariat under the Namibia Statistics Agency for consideration. All such requests and comments must be addressed to:

NSDI Secretariat
Namibia Statistics Agency,
P.O. Box 2133, Windhoek
Email: NSDI@nsa.org.na

6. History of the Standard and Acknowledgments

In Namibia and elsewhere in the world, many projects, studies and research have produced land cover maps and statistics, sometimes locally (for example watershed) and sometimes nationally. The lack of a harmonised classification and of harmonised definitions make the interpretation of such maps very complex and ambiguous. In Namibia, seasonal changes make this issue even more acute. For example, should the Etosha pan be described as a water body or as shrubland? Without a standard, different institutions may make different conceptual choices and thus come up with conflicting or contradicting results.

The first national workshop was conducted on 14 and 15 November 2019 to address this issue and to start drafting a national land cover classification system for the Republic of Namibia. The main outcomes and lessons learnt from this workshop can be summarised as follows:

- Developing a full-fledge classification system is a very lengthy process, that must evolve step-wise. It is also very iterative: each step of the process might shed new light and require changes to the previous steps. It is therefore important to allow enough flexibility and agility during the whole process.

- The border between land cover and land use can in some cases be very thin and requires some efforts and discussion among the stakeholders for correct interpretation.

- Where possible and meaningful, existing national definitions must be used (and, if necessary, adapted), to guarantee compatibility with already existing datasets and maps. For Namibia, the *1:50 000 Map Feature Definitions and Issues* (1997), from the Ministry of Agriculture, Water and Land Reform formed the base on which several land cover definitions have been formulated.

Thematic working groups were constituted after the workshop in order to finalise the process and this standard is a final outcome of their work.

It is therefore worth noting that the Namibia Land Cover Classification standard was developed by experts from several sectors and organisations. Special thanks go to Carlos Dewasseige, Sussana Ipakwa, Moses Hanana, Natalia Nakashona, Oiva Akudhenga, Andreas Amukwaya, Martin Hipondoka, Frans Persendt, Helvi Shalongo, Paulus Shikongo, Fanuel Maanda, Gloria Simubali, Israel Hasheela, Ben Strohbach, Kaleb Negussie, Gilian Maggs-Kolling, Eugene Marais, Hilma Hamata, Anja Kreiner, Nicky Knox, Emilie Abraham, Maya Nanghanda, Charles Kondiri, Ronny Tjitemisa, Georgina Katjiuongua, Vera De Cauwer, Ezequiel Fabiano, Jerome Boys, Celine Awala, Schneidewind Sophia and Geraldine Itana.

In addition, the United Nations Development Programme (UNDP) and Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ) are thanked for supporting the development of this standard. Further acknowledgements go to the NSDI Secretariat: Alex Mudabeti, Isak Neema, Enrico Bezuidenhoudt, Nevel Ngahahe-Hangero, Lovisa Nangombe, Essen Mowa, Loise Iiyambo and Jose Junior for co-ordinating the development of this standard.

7. Namibia Land Cover Classification Standard

(a) Structure of the Standard

The Namibian Land Cover Standard is based on a hierarchical approach consisting of 4 levels. The most general classes (level 1) allow for high-level land cover mapping and are usually adapted for general use. Each of those classes can be subdivided into sub-classes (levels 2 and below) that will prove useful for distinguishing land cover types in a finer way. Each class and sub-classes are described in greater detail in the dedicated land cover class cards.

Respecting the standard (class names and definitions, as well as colour scheme) will vastly increase the compatibility of maps and studies produced by various institutions. This will in return improve the quality of land cover statistics that will be generated for official reporting.

(b) Standard Classification

Please see the land cover class cards for a detailed description of each class and sub-classes.

Level 1	Level 2	Level 3	Level 4	Main elements of the definition
Built-up				Built-up areas in which people reside on a permanent or near-permanent basis and or perform commercial or industrial activities.
	Built-up urban			An urban built-up area is an area with clearly defined boundaries, a high density of buildings and paved areas greater than 50% within the minimum functional area of 1 hectare.
		Residential		Built-up non-linear areas in which people reside on a permanent or near-permanent basis. This class is only found in urban environments.
			Residential formal	Residential areas built according to a planned and formal infrastructure base including building regulations.
			Residential informal	Residential areas built without any planned or formal infrastructure base and building regulations.
		Business		Built-up non-linear areas in which mostly business-related services are provided. This class is only found in urban environments and proclaimed areas.
		Industrial		Built-up non-linear areas in which mostly industrial services are provided. This class is only found in urban environments.
	Built-up rural			A rural built-up area is an area with predominantly undefined boundaries with a density of structures with a minimum of 20% and a maximum of 50% within the minimum functional area of 3 hectares.
		Scattered rural		A rural built-up area with dispersed settlements. These are characterised by vast distance between two households.
		Dense rural		A rural built-up area with dense settlements or structures close to each other.

Level 1	Level 2	Level 3	Level 4	Main elements of the definition
	Landfill			Areas and well-engineered facilities designated for domestic and industrial waste disposal, collection, and management.
	Built-up green spaces			Vegetated open area purposely used and reserved for the improvement of the environmental conditions, protection and preservation of the biodiversity, promotion of recreational and sport activities in an urban setup.
	Transportation			Refers to areas with built artificial structure (impervious surface) and transport-related infrastructure meant for transportation services and conveyance of traffic and landing strip, linear in nature with standardized hierarchy. Land use development pattern assigned for road infrastructure and network (streets and path system).
Bare landscape				Natural and artificial non-vegetated areas where the substrate or soil is clearly apparent. Excluding agricultural fields with no crop cover and where the substrate or soil exposure is clearly apparent. The vegetation cover is greater than 4%.
	Bare soil and rock			Natural areas of exposed soil or rock with no or very little, perennial vegetation cover during any time of the year.
		Pebbly beach		A pebbly shore by the sea between high and low water marks. Maximum distance from the shoreline: 20 metres.
		Bare rock		Big rock outcrops, more than 10 hectares in size.
		Badlands/ Gramadullas		Predominantly bare rock outcrops and thin soil in steeply undulating topography covering an area greater than 4 hectares in size, less than 100 mm mean annual rainfall, less than 4% vegetation cover.
		Canyons		Deep narrow valley with steep to vertical sides of bare rock associated with rivers or streams, more than 500 metres long.

Level 1	Level 2	Level 3	Level 4	Main elements of the definition
		Ancient fluvial silts		Natural eroded areas covering an area greater than 1 hectare in size. Deep channels that have been cut more than 200 centimetres deep into thick clay or mud deposits of ancient river systems.
		Desert plains		Area with less than 4% perennial vegetation and less than 100mm precipitation with predominantly flat (slope less than 10 degrees) desert areas covered with gravel.
		Lichen fields		Area with less than 4% perennial vegetation cover, but with more than 40% biological soil crust (BSC) including lichen cover.
		Bare soil		Natural or semi-natural areas of exposed soil and clay with greater than 1 hectare in size.
		Gullies		Natural or semi-natural eroded areas covering an area greater than 1 hectare in size. Open, unstable run-off channels that have been cut more than 30 centimetres deep into the ground in disturbed and degraded areas.
	Sandy area			Areas more than 4 hectares that are naturally sandy with less than 4% perennial vegetation. These expanses are common features of shorelines and desert environments.
		Sandy beach		A sandy shore especially by the sea between high and low water marks.
		Aeolian dunes		Aeolian sand dunes higher than 1 meter consisting of unconsolidated sand and with less than 4% perennial vegetation, more than 4 hectares in size.
		Sandy plains		Low relief sandy plains with less than 4% perennial vegetation more than 10 hectares in size in areas with less than 100 mm mean annual rainfall.
		!nara fields		Sandy plains with more than 25% perennial vegetation, specifically Acanthosicyos horridus (! nara), more than 1 hecatre in size in areas with less than 100 mm mean annual rainfall.

Level 1	Level 2	Level 3	Level 4	Main elements of the definition
		Overgrazed sandy plains		Low relief sandy plains with less than 20% perennial vegetation more than 5 hectares in size in areas more than 100 mm mean annual rainfall.
	Industrial bare landscape			Artificial, man-made areas with exposed soil and rock and vegetation greater than 1% and less than 1 hectare in size as a consequence of industrial activities.
		Open pit mines and quarries		Bare rock or cemented soil depressions due to extraction of minerals of more than 10 metres deep and more than 5 hectares in size with less than 1% vegetation.
		Waste rock dump		Heaped bare rock or earth higher than 10 metres than the surrounding area with steep sides more than 1 hectare in size with less than 10% vegetation.
		Tailings dams		Fine pulverised rocks mixed with chemicals discarded as steep-sided rectangular man-made piles due to extraction of minerals of more than 3 m high and more than 1 hectare in size without vegetation.
		Industrial tailings		Bare soils contaminated by processing chemicals or highly acidic organic waste of more than 1 hectare in size without vegetation.
Cultivated land				Production relies on rain-fed or additional water sources during the growth period of the crop. Surface greater than 0.5 hectare Cultivated vegetation visible from November to May Bare soil visible from June to October
	Irrigated cultivated land			Production relies on water supplies by artificial means during the growth period of the crop. This additional water can be from any water source (borehole, dams, rivers, etc.) and applied to the crop through various irrigation mechanisms (pivot, drip, drag line, etc.).

Level 1	Level 2	Level 3	Level 4	Main elements of the definition
		Seasonal crops		Annual crops planted seasonally, year-round or can be on a rotational basis e.g. horticultural, agronomic and fodder crops. Surface greater than or equal to 1 hectare
			Agronomic crops	Annual crops planted seasonally e.g. cereal Surface Greater than 1 hectare
			Vegetables	Bi-annual crops planted seasonally or year-round, can be on a rotational basis e.g potatoes Surface greater than 0.5 hectare
			Planted pastures	Rain-fed or irrigated, perennial or annual forage material grown for livestock feeding e.g. Cenchrus ciliaris (bloubuffelgras), Lucerne etc. Surface greater than 1 hectare.
		Permanent crops		Annual crops planted seasonally, can be on a rotational basis e.g. horticultural, cereal. Surface greater than or equal to 1 hectare.
			Orchard	Refers to man-made tree plantations aimed at producing fruits or nuts. Can often be identified by the rows of trees. Surface greater than or equal to 1 hectare.
			Vineyard	Refers to plantations of grape-bearing vines, grown mainly for table grapes, raisins but also winemaking and non-alcoholic grape juice. Can often be identified by the rows of vines. Surface greater than or equal to 1 hectare.
	Dry land cultivated land (non irrigated)			Areas with no additional water source used during the growing periods of the crop and only natural water sources (rain) is available to the crop.
Forest				Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 %, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use.

Level 1	Level 2	Level 3	Level 4	Main elements of the definition
Savannah and shrubland				Area dominated by low, short, or high, woody, self-supporting, single- or multi-stemmed plants branching at or near the ground, with a graminoid layer Plant canopy 4 - 75%.
	Woodland savannah			Surface greater than 2 hectares Dominated by trees higher than 5 metres Shrub and graminoid layer present, but subdominant with canopy cover less than 10% Total canopy cover between 10% and 75%.
		Semi-open woodland savannah		Surface greater than 2 hectares Dominated by trees higher than 5 metres Shrub and graminoid layer present, but subdominant Total canopy cover between 20% and 50%.
		Semi-closed woodland savannah		Surface greater than 2 hectares Dominated by trees higher than 5 metres Shrub and graminoid layer present, but subdominant Total canopy cover between 50% and 75%.
		Desert woodland		Surface greater than 2 hectares Dominated by trees higher than 5 metres Shrub and graminoid layer present, but sparse Total canopy cover between 10% and 20%.
	Mixed tree and shrub savannah			Area dominated by low, short, or high, woody, self-supporting, single or multi-stemmed plants branching at or near the ground, with a graminoid layer. Plant canopy 5 - 50%, area greater than 5 hectares. Scattered trees up to 5 metres high, with prominent mixture of dwarf shrubs, and shrubs not exceeding 2 metres.
	Encroached shrubland			Surface area greater than 5 hectares, dominated by a uniform dense shrub component, canopy cover greater than 75%, shrub component usually one or a few woody species with low biodiversity.

Level 1	Level 2	Level 3	Level 4	Main elements of the definition
	Savannah and desert transition			Surface area greater than 5 hectares, with canopy cover less than 40%, significant of sparse vegetation but with the characteristics of the savannah transitioning to the desert, adjacent to the Namib Desert.
	Tree/shrub savannah			Land spanning more than 2 hectares with trees higher than 5 meters and a prominent shrub component higher than 1 metre. A graminoid layer is generally present. Total canopy cover is more than 10 %.
		Broad-leafed savannah		Land spanning more than 2 hectares with trees higher than 5 meters and a prominent shrub cover higher than 1 metre. Trees and shrubs are distinctly broad-leafed, deciduous, and non-thorny. A graminoid layer is generally present. Total canopy cover is more than 10 %.
		Thornbush savannah		Land spanning more than 2 hectares with trees higher than 5 meters and a prominent shrub cover higher than 1 metre. Trees and shrubs are dominantly fine-leafed, semi-deciduous and thorny (Acacia). A graminoid layer is generally present. Total canopy cover is more than 10 %.
		Mopane savannah		Land spanning more than 2 hectares with trees higher than 5 meters and a prominent shrub cover higher than 1 metre. The tree and shrub layers are dominated by Colophospermum mopane (Mopane / Omusati). A graminoid layer is generally present. Total canopy cover is more than 10 %.
	Karooid shrubland			Land spanning more than 2 hectares dominated by shrubs lower than 1 metre height, and with less than 1 % tree cover. It does not include land that is predominantly under urban land use.
		Nama-karoo shrubland		Land spanning more than 2 hectares dominated by non-succulent shrubs less than 1 meter height, and a total canopy cover of more than 4 %.

Level 1	Level 2	Level 3	Level 4	Main elements of the definition
		Succulent karoo		Land spanning more than 2 hectare dominated by succulent plants lower than 1 meter and a canopy cover of between 4 and 50%.
Grassland				Areas typically dominated by indigenous herbaceous graminoids (grasses) with less than 4% tree and shrub cover and between 20 to 100% grass cover.
	Natural grassland			Surface area greater than 5 hectares, area dominated by indigenous graminoid layer with a cover of 4-100%. Tree and shrub cover is less than 4%. Borderline of grassland is completely natural with irregular geometry.
	Manmade grassland			Surface area greater than 5 hectares, area dominated by indigenous graminoid layer with a cover of 4-100%. Tree and shrub cover is less than 4%. Boundaries are perfect straight or round. It is normally formerly bush controlled area, and it stand the risk of re-encroachment if not maintained in an open grass state.
Wetland				Wetlands are areas where water is the primary factor controlling the environment and the associated plant and animal life. They occur where the water table is at or near the surface of the land, or where the land is covered by water.
	Inland wetland			Saltwater and freshwater wetlands not located within coastal watersheds.
		Permanent wetlands		Saltwater and freshwater wetlands not located within coastal watersheds saturated or covered with water permanently.
		Seasonal wetlands		Saltwater and freshwater wetlands saturated or covered with water on temporary basis and typically occur in low areas in woods and open fields.
	Coastal wetland			Wetlands located within coastal watersheds and covered in permanent aquatic vegetation.

Level 1	Level 2	Level 3	Level 4	Main elements of the definition
Water body				Significant accumulation of water on the surface. It includes lakes, ponds, puddles, rivers, dams, pans, etc. They can be either perennial or ephemeral. It excludes marine water and swimming pools.
	River			Natural water flowing from land towards a sea, lake or another river or underground water reserve or inland depression.
		Perennial river		Rivers with continuous flow throughout the year.
		Ephemeral river		Rivers flows sporadically depending on rainfall.
	Natural standing water body			Natural water body with standing water in the same area.
		Perennial standing water body		In a hydrological year, the area is covered with water permanently.
		Ephemeral standing water body		Seasonal or every second or third year, the water stands for at least a portion of the year and the area is covered by water.
	Pans			Naturally unvegetated bare soil in depressions where water collected in the past or where water collects seasonally. It is not part of any recognisable drainage system but is usually an isolated feature out in the open. Pans can be dry, ephemeral, and mostly have a well-defined boundary marked by a change in vegetation or lack of vegetation.
		Saline Pans (sabkha)		Highly saline unvegetated depressions, occasionally with temporary water ponding.
		Iishana		Unvegetated depressions where water may collect or where endorheic rivers terminate, often defined by a rim of vegetation.

Level 1	Level 2	Level 3	Level 4	Main elements of the definition
		Vegetated pans		Surface area greater than 5 hectares with plant canopy cover up to 40%. It is periodically covered by shallow water which dries up soon after the rainy season. Vegetation mainly comprise of herbaceous layers with dwarf shrubs less than 1 metre. Tree cover is less than 4%.
	Artificial water body			All man-made water bodies (dams, water canals).
Marine water				Coastal sea waterbodies.

c. The Colour Scheme and the Codes

Code	Level	Label	Hex	R	G	B
BU	1	Built-up	#757575	217	217	217
BU01	2	Built-up urban	#888888	136	136	136
BU0101	3	Residential	#ECDB0F	236	219	15
BU010101	4	Residential formal	#242424	36	36	36
BU010102	4	Residential informal	#8C8C8C	140	140	140
BU0102	3	Business	#FF0000	205	0	0
BU0103	3	Industrial	#A020F0	160	32	240
BU02	2	Built-up rural	#D07802	208	120	02
BU0201	3	Scattered rural	#FEA32A	254	163	42
BU0202	3	Dense rural	#FD950B	253	149	11
BU03	2	Landfill	#F9547A	249	84	122
BU04	2	Built-up green spaces	#38A800	56	168	0
BU05	2	Transportation	#A80000	168	0	0
BA	1	Bare landscape	#FFBF6F	255	191	111
BA01	2	Bare soil and rock	#E0E0E0	224	224	224
BA0101	3	Pebbly beach	#E6D7C8	230	215	200
BA0102	3	Bare rock	#CCCCCC	204	204	204
BA0103	3	Badlands/ Gramadullas	#FF6316	255	99	22
BA0104	3	Canyons	#7C1413	124	20	19
BA0105	3	Desert plains	#F9F9A7	249	249	167
BA0106	3	Lichen fields	#9BC2B1	155	194	177
BA0107	3	Bare soil	#FFEBB0	255	235	176
BA0108	3	Gullies	#F9E0E0	249	224	224
BA0109	3	Ancient fluvial silts	#EDA5A5	237	165	165
BA02	2	Sandy area	#C2B280	194	178	128

BA0201	3	Sandy beach	#d7bb9c	215	187	156
BA0202	3	Aeolian dunes	#FFD480	255	212	128
BA0203	3	Sandy plains	#dcd5b9	220	213	185
BA0204	3	!nara fields	#AD9D5B	173	157	91
BA0205	3	Overgrazed sandy plains	#5C532E	93	82	46
BA03	2	Industrial bare landscape	#CC85F7	204	133	247
BA0301	3	Open pit mines and quarries	#BFB09E	191	176	158
BA0302	3	Waste rock dump	#A64D00	166	77	0
BA0303	3	Tailings dams	#EB5E5B	235	94	91
BA0304	3	Industrial tailings	#F1918F	241	145	143
CU	1	Cultivated land	#FAF2AD	250	242	173
CU01	2	Irrigated cultivated land	#786C57	120	108	87
CU0101	3	Seasonal crops	#1C8759	28	135	89
CU010101	4	Agronomic crops	#2ACC87	42	204	135
CU010102	4	Vegetables	#97BE11	151	190	17
CU010103	4	Planted pastures	#2C4C32	44	76	50
CU0102	3	Permanent crops	#FAF2AD	250	242	173
CU010201	4	Orchard	#F2A64D	242	166	77
CU010202	4	Vineyard	#E68000	230	128	0
CU02	2	Dry land cultivation (non-irrigated cultivated land)	#FFFFA8	255	255	168
FO	1	Forest	#E1E6CC	225	230	204
SH	1	Savannah and shrubland	#5AA357	90	163	87
SH01	2	Woodland savannah	#5E8000	94	128	0
SH0101	3	Semi-open woodland savannah	#C5FF33	197	255	51
SH0102	3	Semi-closed woodland savannah	#80B300	128	179	0
SH0103	3	Desert woodland	#F1FFCC	241	255	204
SH02	2	Mixed tree and shrub savannah	#9ADF0F	154	223	15
SH03	2	Encroached shrubland	#C2F40C	194	244	12
SH04	2	Savannah and desert transition	#FFFFC9	255	255	201
SH05	2	Tree/shrub savannah	#374938	55	73	56
SH0501	3	Broad-leafed savannah	#587459	88	116	89
SH0502	3	Thornbush savannah	#99B29A	153	178	154
SH0503	3	Mopane savannah	#D3DED4	211	222	212
SH06	2	Karooid shrubland	#6B6B47	107	107	71

SH0601	3	Nama-karoo shrubland	#ADAD85	173	173	133
SH0602	3	Succulent karoo	#D6D6C2	214	214	194
GR	1	Grassland	#F0F2D1	240	242	209
GR01	2	Natural grassland	#79B00C	121	176	12
GR02	2	Manmade grassland	#C2E3CC	194	227	204
WE	1	Wetland	#BFE8FF	191	232	255
WE01	2	Inland wetland	#A6A6FF	166	166	255
WE0101	3	Permanent wetlands	#CCCCFF	204	204	255
WE0102	3	Seasonal wetlands	#4D4DFF	077	077	255
WE02	2	Coastal wetland	#A6A6E6	166	166	230
WA	1	Water body	#CDE4EF	205	228	239
WA01	2	River	#00009F	0	0	159
WA0101	3	Perennial river	#86B4BC	134	180	188
WA0102	3	Ephemeral river	#97C5A3	151	197	163
WA02	2	Natural standing water body	#3F98C9	63	152	201
WA0201	3	Perennial standing water body	#26A6FF	38	166	255
WA0202	3	Ephemeral standing water body	#D1E0F2	209	224	242
WA03	2	Pans	#FFEBBF	255	235	191
WA0301	3	Saline Pans (sabkha)	#C5E8E7	197	232	231
WA0302	3	Iishana	#FFE9A3	225	233	163
WA0303	3	Vegetated pans	#FFF1C5	255	241	197
WA04	2	Artificial water body	#B5D5BD	181	213	189
MA	1	Marine water	#B4D7EA	180	215	234

8. Land Cover Class Cards

8.1 Built-up

BU	***Built-up***	Symbol *R = 217* *G= 217* *B=217* *Hex = #757575*
Level: 1	**Parent**: -	
Definition	Constructed surfaces or structures in which people reside on a permanent or near-permanent basis and or perform commercial or industrial activities.	

Criteria	**Metrics:** • Permanent • Semi-permanent **Mandatory features:** • Defined or undefined boundaries (urban or rural) • Traditional structures (huts, shacks) or engineered buildings or structures • Paved roads and streets **Optional features:** • Footpaths • Constructed fence • Gravel roads **Character:** • Natural and semi natural (rural) or artificial (urban) **Typical land uses to be found in this class:** • Residential • Commercial • Industrial • Agricultural activities **Layers / strata:** • Uniform roads, grass (lower layer) • Various types of traditional and formal buildings and infrastructure (upper layer) **Vegetation period / season:** • N/A **Physical / chemical parameters:** • N/A **Other temporal aspects:** • Grassland changes to bare soil from June-October (in rural areas and for the parks and other leisure areas in the urban areas) **Geographical indications: Where can this class mostly be found in Namibia?** • Throughout Namibia
Excludes	• N/A
Reference data	• Topographic maps • Land use maps • Hydrographic maps • Cadaster data • Local / urban / rural development plans • Geological maps
Possible sub-classes	• Built-up urban • Built-up rural

Examples	 Source: Google Earth
Literature	Urban and Regional Planning Act (2008)

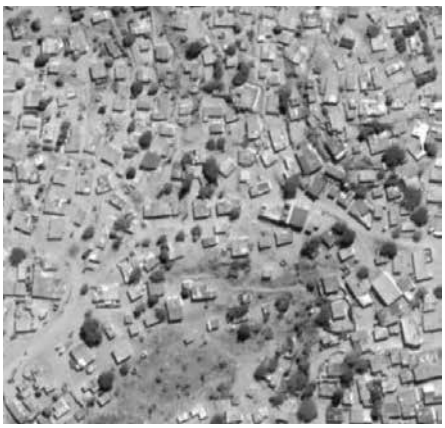
8.1.1 Built-up -urban

BU01	***Built-up – urban***	*Symbol* *R =136* *G=136* *B= 136* *Hex = #888888*
Level: 2	**Parent**: Built-up	
Definition	An urban built-up area is an area with clearly defined boundaries, a high density of buildings and paved areas greater than 50% within the minimum functional area of 1 hectare.	
Criteria	**Metrics:** • Minimum 50% must be paved or covered by buildings • Minimum area of 1 hectare **Mandatory features:** • Roads and airstrips • Paved areas • Building/structures **Optional features:** • Open spaces • Recreation parks • Botanical gardens • Trees **Character:** • Predominantly artificial and semi-natural characteristics	

	Typical land uses to be found in this class: • Residential • Business • Industrial • Cemetery • Institutional (churches, school, hospital, and other social service) • Office • General residential • Transportation • Urban agriculture • Public open spaces • Private open spaces • Lawn **Layers / strata:** • Roads, grass (lower layer) • Various types of buildings and infrastructure (upper layer) **Vegetation period / season:** • October – May (parks, gardens, etc.) **Physical / chemical parameters:** • None **Other temporal aspects:** • None **Geographical indications: Where can this class mostly be found in Namibia?** • All proclaimed towns and townlands (include proclaimed settlements)
Excludes	• Stock pens • Forest • Cultivated land bigger than 1 hectare
Reference data	• Land use maps • Hydrographic maps • Geological maps • National built-up structure frame • Transportation maps
Possible sub-classes	• Residential • Business • Industrial
Examples	 Source: Google Earth
Literature	Urban and Regional Planning Act (2008)

8.1.1.1. Residential

BU0101	***Residential***	*Symbol* *R = 236* *G = 219* *B = 15* *Hex = #ECDB0F*
Level: 3	**Parent**: Built-up urban	
Definition	Built-up non-linear areas in which people reside on a permanent or near-permanent basis. This class is only found in urban environments.	
Criteria	**Metrics:** • Minimum area of 1 hectare • Density of residential buildings more than 50 % **Mandatory features:** • Residential structures (individual houses, multi-storey buildings) • Roads/Streets **Optional features:** • Small leisure areas (gardens, parks) • Open spaces • Trees **Character:** • Artificial **Typical land uses to be found in this class:** • Residential **Layers / strata:** • Roads, grass (lower layer) • Various types of traditional and formal buildings and infrastructure (upper layer) **Vegetation period / season:** • N/A **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Urban areas and proclaimed settlements	
Excludes	• Areas greater than 1 hectare that are not covered by residential buildings (e.g. big parks within a city, big open market place, etc.)	

Reference data	• Topographic maps • Land use maps • Cadastral data • Urban / local development plans • National Built-up Structure Frame • Town planning schemes
Possible sub-classes	• Residential formal • Residential informal
Examples	  Source: Google Earth
Literature	Urban and Regional Planning Act (2008)

8.1.1.1.1 Residential formal

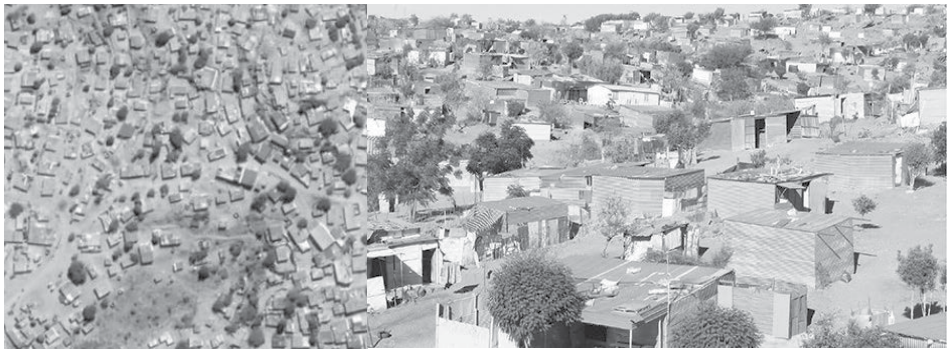
BU010101	***Residential formal***	*Symbol* *R = 36* *G = 36* *B = 36* *Hex = #242424*
Level: 4	**Parent**: Residential	
Definition	Residential areas built according to a planned and formal infrastructure base including building regulations.	
Criteria	**Metrics:** • Density of residential buildings not less than 70 % **Mandatory features:** • Residential structures (individual houses, multi-storey buildings) that can be found in the cadaster data in local / urban development plans, etc. **Optional features:** • Roads / streets • Small leisure areas (gardens, parks) **Character:** • Artificial	

	Typical land uses to be found in this class: • Residential **Layers / strata:** • Roads, grass (lower layer) • Various types of formal buildings and infrastructure (upper layer) **Vegetation period / season:** • N/A **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Urban areas and proclaimed settlements
Excludes	• Areas greater than 0.7 hectare that are not covered by residential buildings (e.g. big parks within a city, big market place, etc.)
Reference data	• Topographic maps • Land use maps • Cadastral data • Urban / local development plans
Possible sub-classes	• N/A
Examples	 Source:Google Earth
Literature	Urban and Regional Planning Act (2018)

8.1.1.1.2. Residential informal

BU010102	***Residential informal***	*Symbol* *R = 140* *G = 140* *B =140* *Hex = #8C8C8C*
Level: 4	**Parent**: Residential	

Definition	Residential areas built without any planned or formal infrastructure base and building regulations.
Criteria	**Metrics:** • Density of residential buildings not less than 70 % **Mandatory features:** • Informal residential structures that cannot be found in the cadastre in local / urban development plans, etc. • Footpaths • Tracks **Optional features:** • Roads / streets **Character:** • Artificial **Typical land uses to be found in this class:** • Residential **Layers / strata:** • Roads, grass (lower layer) • Various types of informal buildings and infrastructure (upper layer) **Vegetation period / season:** • N/A **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Urban areas and proclaimed settlements
Excludes	• Areas greater than 0.7 hectare that are not covered by informal residential buildings (e.g. big parks within a city, big market place, etc.)
Reference data	• Topographic maps • Land use maps • Cadastral data • Urban / local development plans
Possible sub-classes	• N/A

Examples	 Source: Google Earth; Tuyeimo Haiduwa
Literature	Urban and Regional Planning Act (2008)

8.1.1.2 Business

BU0102	***Business***	*Symbol* *R = 205* *G= 0* *B = 0* *Hex = #FF0000*
Level: 3	**Parent**: Built-up urban	
Definition	Built-up non-linear areas in which mostly business-related services are provided. This class is only found in urban environment and proclaimed areas.	
Criteria	**Metrics:** • Minimum 70% of the area that provides mostly commercial services • Minimum surface of the commercial area: Greater than 1 hectare **Mandatory features:** • Business structures (markets, commercial centres, institutional use etc.) • Roads / streets • Paved parking **Optional features:** • Small leisure areas (gardens, parks) **Character:** • Artificial **Typical land uses to be found in this class:** • Business **Layers / strata:** • Roads, grass, parkings (lower layer) • Various types of formal buildings and infrastructure (upper layer) **Vegetation period / season:** • N/A **Physical / chemical parameters:** • N/A	

	Other temporal aspects: • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Urban areas and proclaimed settlements
Excludes	• Areas where business activities are less than 70 %
Reference data	• Topographic maps • Land use maps • Cadaster data • Urban / local development plans
Possible sub-classes	• N/A
Examples	 Source: https://www.britannica.com/place/Windhoek
Literature	Urban and Regional Planning Act (2018)

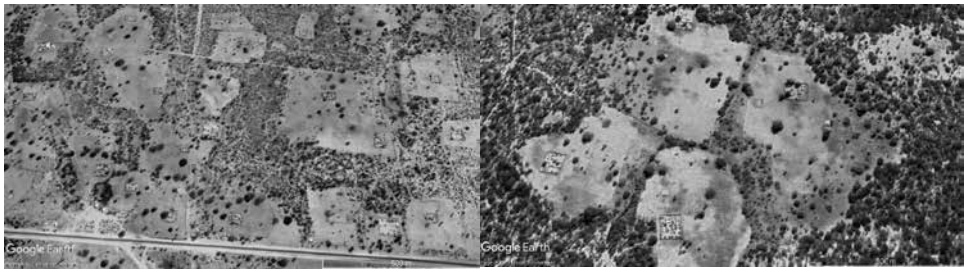
8.1.1.3 Industrial

BU0103	***Industrial***	*Symbol* *R = 160* *G= 32* *B= 240* *Hex* = #A020F0
Level: 3	**Parent**: Built-up urban	
Definition	Built-up nonlinear areas in which mostly industrial services are provided. This class is only found in urban environments.	
Criteria	**Metrics:** • Density of light and heavy Industrial buildings not less than 70 % **Mandatory features:** • Light and heavy Industrial structures (individual buildings, multi-story buildings) • Roads / streets	

	Optional features: • Small leisure areas (gardens, parks) **Character:** • Artificial **Typical land uses to be found in this class:** • Light and heavy industrial **Layers / strata:** • Roads, grass (lower layer) • Various types of light and heavy industrial buildings and infrastructure (upper layer) **Vegetation period / season:** • N/A **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Urban areas and proclaimed settlements
Excludes	• Areas bigger than 0.7 hectare that are not covered by industrial buildings (e.g. big parks within a city, big market place, etc.)
Reference data	• Topographic maps • Land use maps • Cadastral data • Urban / local development plans
Possible sub-classes	• N/A
Examples	 Source: Google Earth
Literature	Urban and Regional Planning Act (2018)

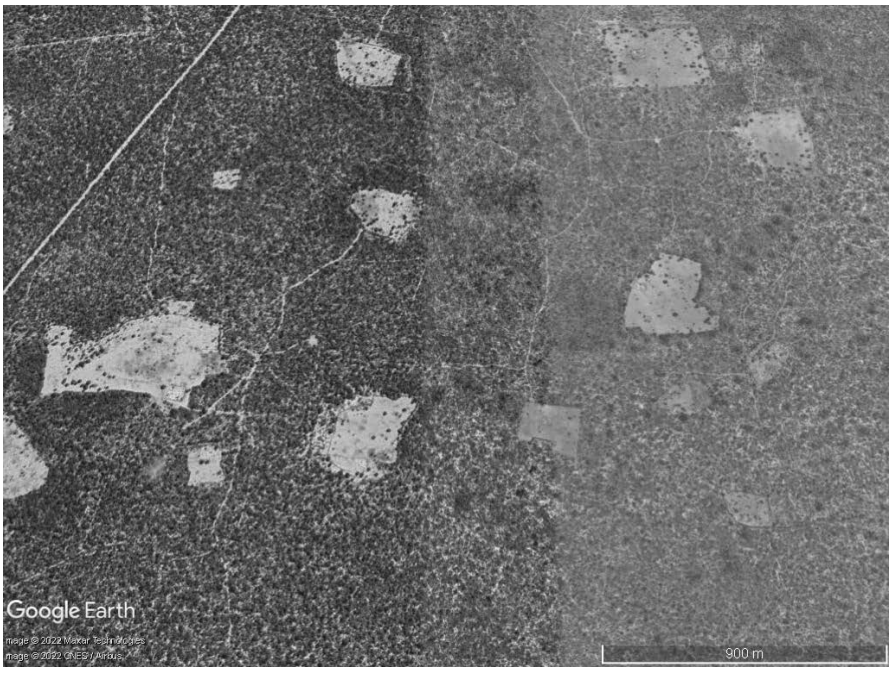
8.1.2 Built-up rural

BU02	***Built-up rural***	*Symbol* *R = 208* *G = 120* *B = 02* *Hex = #D07802*
Level: 2	**Parent**: Built-up	
Definition	A rural built-up area is an area with predominantly undefined boundaries with a density of structures with a minimum of 20% and a maximum of 50% within the minimum functional area of 3 hectares.	
Criteria	**Metrics:** • Minimum 20% and maximum 50% must be paved or covered by buildings • Minimum area of 3 hectares **Mandatory features:** • Undefined boundaries • Traditional structures (huts, shacks) • Detached structures • Footpaths • Roads (gravel and tar) • Stock pens • Cultivated fields **Optional features:** • Open spaces/grassland • Forests **Character:** • Natural and semi natural • Agricultural **Typical land uses to be found in this class:** • Residential • Business • Agricultural activities **Layers / strata:** • Roads, footpath, tracks, grass (lower layer) • Various types of traditional and formal buildings and infrastructure (upper layer) **Vegetation period / season:** • October – May for cultivated fields **Physical / chemical parameters:** • N/A **Other temporal aspects:** • Grassland changes to bare soil from June-October **Geographical indications: Where can this class mostly be found in Namibia?** • In all rural areas	

Excludes	• N/A
Reference data	• Topographic maps • Land use maps • Hydrographic maps • Geological maps
Possible sub-classes	Scattered rural and dense rural
Examples	 Source: Google Earth
Literature	Ministry of Urban, Regional and Local Government, Housing and Rural Development (2011)

8.1.2.1 Scattered rural

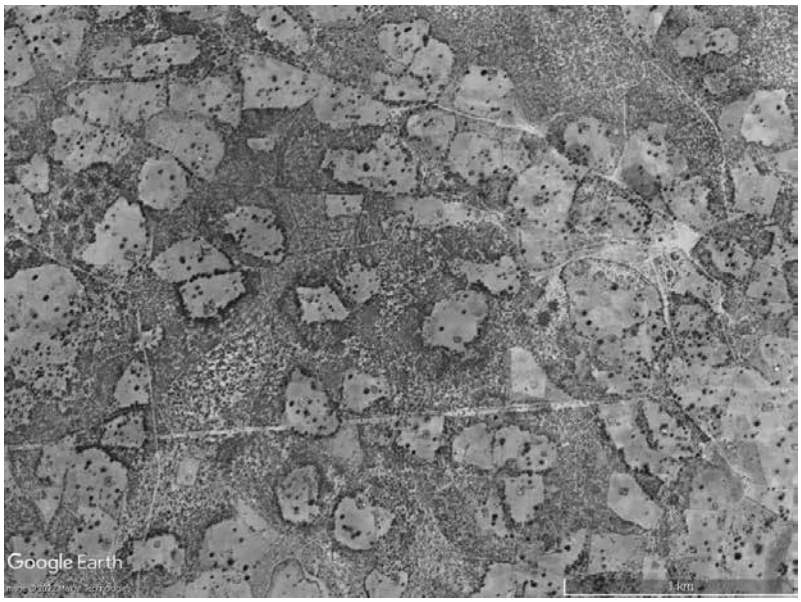
BU0201	***Scattered rural***	*Symbol* *R = 254* *G = 163* *B = 42* *Hex* = #FEA32A
Level: 3	**Parent**: Built-up rural	
Definition	A rural built-up area with dispersed settlements. These are characterized by vast distance between two households.	
Criteria	**Metrics:** • Maximum density of buildings / infrastructure: 10-30 % • Minimum distance between the buildings / infrastructures: 300-500 metres **Mandatory features:** • Undefined boundaries • Traditional structures (huts, shacks) • Detached structures • Footpaths • Roads (gravel and tar) • Stock pens • Cultivated fields **Optional features:** • Open spaces/grassland • Forests	

	Character: • Natural and semi natural • Agricultural **Typical land uses to be found in this class:** • Residential • Commercial • Agricultural activities **Layers / strata:** • Roads, grass (lower layer) • Various types of traditional and formal buildings and infrastructure (upper layer) **Vegetation period / season:** • October-May for cultivated fields **Physical / chemical parameters:** • N/A **Other temporal aspects:** • Grassland changes to bare soil from June-October **Geographical indications: Where can this class mostly be found in Namibia?** • In all rural areas
Excludes	• Dense homesteads
Reference data	• Topographic maps • Land use maps • Hydrographic maps • Geological maps
Possible sub-classes	• N/A
Examples	 Source: Google Earth

Literature	Ministry of Urban, Regional and Local Government, Housing and Rural Development ,2011

8.1.2.2 Dense rural

BU0202	***Dense rural***	*Symbol* *R = 253* *G = 149* *B = 11* *Hex = #FD950B*
Level: 3	**Parent**: Built-up rural	
Definition	A rural built-up area with dense settlements or structures close to each other.	
Criteria	**Metrics:** • Maximum density of buildings / infrastructure: 30-50 % • Minimum distance between the buildings / infrastructures: 100-300 metres **Mandatory features:** • Undefined boundaries • Traditional structures (huts, shacks) • Detached structures • Footpaths • Roads (gravel and tar) • Stock pens • Cultivated fields **Optional features:** • Open spaces/grassland • Forests **Character:** • Natural and semi natural • Agricultural **Typical land uses to be found in this class:** • Residential • Commercial • Agricultural activities **Layers / strata:** • Roads, grass (lower layer) • Various types of traditional and formal buildings and infrastructure (upper layer) **Vegetation period / season:** • October – May for cultivated fields **Physical / chemical parameters:** • N/A **Other temporal aspects:** • Grassland changes to bare soil from June-October	

	Geographical indications: Where can this class mostly be found in Namibia? • In rural areas
Excludes	• Scattered homesteads
Reference data	• Topographic maps • Land use maps • Hydrographic maps • Geological maps
Possible sub-classes	• N/A
Examples	 Source: Google Earth
Literature	Ministry of Urban, Regional and Local Government, Housing and Rural Development, 2011

8.1.3 Landfills

BU03	***Landfills***	*Symbol* *R = 249* *G = 84* *B= 122* *Hex = #F9547A*
Level: 2	**Parent**: Built-up	
Definition	Areas and well-engineered facilities designated for domestic and industrial waste disposal, collection, and management.	
Criteria	**Metrics:** • Area size: 0.5 – 3 Hectares **Mandatory features:** • Open dump and collection of waste materials – agriculture, solid, hazardous, industrial and construction waste **Optional features:** • Vegetation, rocks	

	Character: • Natural and artificial (urban or rural) **Typical land uses to be found in this class:** • Waste collection, segregation and disposal – sustainable waste management • Confine and compact waste to a designated area to safely hand and reduce volume **Layers / strata:** • Soil, vegetation, hip of waste materials (visible content) **Vegetation period / season:** • N/A **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • In proclaimed areas, at designated areas as guided by spatial planning framework
Excludes	• Sewage receptacles
Reference data	• Topographic maps • Land use maps • Cadaster data • Local / urban / rural development plans • Environment management plans
Possible sub-classes	• N/A
Examples	 Source: https://www.namibiansun.com/news/kupferberg-scavengers-chased-away
Literature	Environment Impact Assessment and Social Impact Assessment report (n.d)

8.1.4 Built-up green spaces

BU04	***Built-up green spaces***	*Symbol* *R = 56* *G = 168* *B =0* *Hex =#38A800*
Level: 2	**Parent**: Built-up	
Definition	Vegetated open area purposely used and reserved for the improvement of the environment conditions, protection and preservation of the biodiversity, promotion of recreational and sport activities in an urban setup.	
Criteria	**Metrics:** • Area size: Greater than 0.5 hectare **Mandatory features:** • Public and private recreational parks, trees, cemeteries, sport fields **Optional features:** • N/A **Character:** • Natural and artificial (urban) **Typical land uses to be found in this class:** • Urban parks • Burial sites • Community gardens • Greenery • Botanic gardens and sport activities - for promotion of out-door activities and active lifestyle **Layers / strata:** • Recreational parks, cemeteries, sport fields, vegetation, urban forest **Vegetation period / season:** • N/A **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications. Where can this class mostly be found in Namibia?** • In urban areas	
Excludes	• N/A	
Reference data	• Topographic maps • Land use maps (tourism guide maps) • Cadaster data • Local / urban / rural development plans	
Possible sub-classes	• N/A	

Examples	 Source: https://www.google.com/imgres?imgurl=https%3A%2F%2Fcdn.getyourguide.com
Literature	Ministry of Urban, Regional and Local Government, Housing and Rural Development (2011) Urban and Regional Planning Act (2018)

8.1.5 Transportation

BU05	***Transportation***	*Symbol* *R = 168* *G= 0* *B = 0* *Hex =#A80000*
Level: 2	**Parent**: Built-up	
Definition	Refers to areas with built artificial structure (impervious surface) and transport-related infrastructure meant for transportation services and conveyance of traffic and landing strip, linear in nature with standardized hierarchy. Land use development pattern assigned for road infrastructure and network (streets and path system).	
Criteria	**Metrics:** • N/A **Mandatory features:** • Impervious surface in proclaimed road infrastructure (road network) constructed with artificial structures (roads, streets, parking lots, pavements); • Concrete paving, paved walkways, airports, driveways, and parking lanes; sidewalks; airport buildings and railways **Optional features:** • Vegetation, rocks **Character:** • Artificial (urban or rural) **Typical land uses to be found in this class:** • Transport Infrastructure and pedestrian sidewalks • Cycling transit	

	Layers / strata: • Roads, streets, parking lanes, parking lots, airports **Vegetation period / season:** • N/A **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • In built-up environments
Excludes	• N/A
Reference data	• Topographic maps • Land use maps • Cadaster data • Local / urban / rural development plans • Environment management plans
Possible sub-classes	• N/A
Examples	 Source:1. https://insearchofchocolate.com/2018/07/17/driving-in-namibia-tips-for-a-road-trip-and-self-drive/gravel-road-namibia/; 2.https://freewheely.com/2015/03/last-days-in-the-namib-desert-railway-stations-and-wild-horses/  Source: New Era
Literature	Urban and Regional Planning Act (2018) Ministry of Urban, Regional and Local Government, Housing and Rural Development (2011)

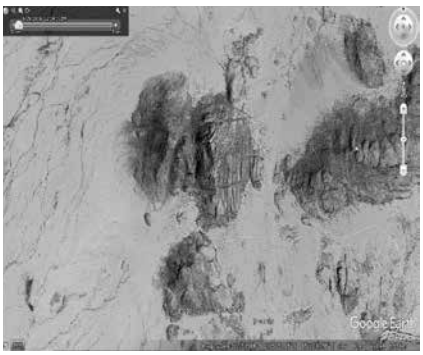
8.2 Bare landscape

BA	***Bare landscape***	*Symbol* *R = 255* *G = 191* *B = 111* *Hex = #FFBF6F*
Level: 1	**Parent**: **-**	
Definition	Natural and artificial non-vegetated areas where the substrate or soil is clearly apparent. Excluding agricultural fields with no crop cover and where the substrate or soil exposure is clearly apparent. Less than 4% vegetation cover.	
Criteria	**Metrics:** • Less than 4% perennial (annual grass and herbs excluded) vegetation cover **Mandatory features:** • Bare soil, rocks, clay or sand, gravel roads **Optional features:** • Limited vegetation including Vascular plants and non-Vascular (lichen) organisms **Character:** • Natural • Semi-natural • Managed **Typical land uses to be found in this class:** • Tourism • Sand mining • Mining and Quarries • Conservation, Game farming **Layers / strata:** • Bare soil and rock • Less than 4% of perennial vegetation **Vegetation period / season:** • Seasonal but might not be detectable on satellite images **Physical / chemical parameters:** • N/A **Other temporal aspects:** • Land is generally not vegetated for extended periods of time **Geographical indications: Where can this class mostly be found in Namibia?** • Coastal areas • Desert • Mountains • Scattered across the country	

Excludes	• Vegetated areas • Fallow agricultural fields • Built up areas • River beaches and ephemeral stream beds
Reference data	• Geological maps • Soil maps • Agro-ecological zone maps • Vegetation maps
Possible sub-classes	• Sandy area • Bare soil and rock • Industrial bare landscapes
Examples	 Source: Gobabeb Training and Research Centre
Literature	Ministry of Environment, Forestry and Tourism (2010)

8.2.1 Bare soil and rock

BA01	***Bare soil and rock***	*Symbol* *R = 224* *G = 224* *B = 224* *Hex = #E0E0E0*
Level: 2	**Parent**: Bare landscape	
Definition	Natural areas of exposed soil or rock with no or very little, perennial vegetation cover during any time of the year.	
Criteria	**Metrics:** • Less than 4% perennial vegetation cover **Mandatory features:** • Soil, rock **Optional features:** • Limited vegetation **Character:** • Natural • Semi-natural	

	Typical land uses to be found in this class: • Tourism • Mining and Quarries • Conservation • Game farming **Layers / strata:** • Bare soil and rocks • Less than 4% of perennial vegetation **Vegetation period / season:** • Seasonal but might not be detectable on satellite images **Physical / chemical parameters:** • N/A **Other temporal aspects:** • Land is generally not vegetated for extended periods **Geographical indications: Where can this class mostly be found in Namibia?** • Coastal areas • Desert • Mountains • Scattered across the country
Excludes	• Areas defined as sandy areas • Agricultural fields with no crop cover • Opencast mines • Quarries
Reference data	• Geological maps • Soil maps • Agro-ecological zone maps • Vegetation maps
Possible sub-classes	• Pebbly beach • Bare rock • Desert gravel plain • Lichen fields • Bare soil • Gullies
Examples	 Source: https://www.namibia-eco-tours.com/fairy-circles/
Literature	Ministry of Environment and Tourism (2010)

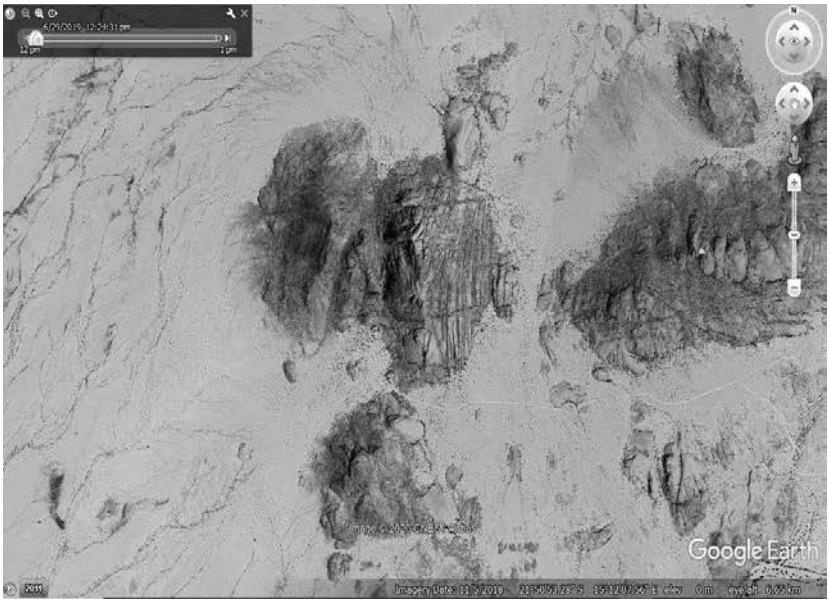
8.2.1.1 Pebbly beach

BA0101	***Pebbly beach***	*Symbol* *R = 230* *G = 215* *B = 200* *Hex = #E6D7C8*
Level: 3	**Parent**: Bare soil and rock -	
Definition	A pebbly shore by the sea between high and low water marks. Maximum distance from the shoreline is 20 metres.	
Criteria	**Metrics:** • Distance from the shore: 10-20 metres **Mandatory features:** • Pebbles **Optional features:** • Sand coverage, associated rock outcrops **Character:** • Natural • Semi-natural **Typical land uses to be found in this class:** • Tourism • Kelp harvesting • Line fishing, cray and mussel harvesting **Layers / strata:** • Rock • Sea water **Vegetation period / season:** • N/A **Physical / chemical parameters:** • N/A **Other temporal aspects:** • Low, high-tide and storms change the extent of the beaches **Geographical indications: Where can this class mostly be found in Namibia?** • Swakopmund, Skeleton Coast (Mostly along segments of Namibian coast)	
Excludes	• River banks	
Reference data	• N/A	
Possible sub-classes	• N/A	

Examples	 Source: https://omujevehuntingsafaris.com/a-walk-through-time/
Literature	• Molloy (2003); Miller (2008)

8.2.1.2 Bare rock

BA0102	***Bare rock***	*Symbol* *R = 204* *G = 204* *B = 204* *Hex = #CCCCCC*
Level: 3	**Parent**: Bare soil and rock -	
Definition	Big rock outcrops with more than 10 hectares in size. (Rocky point, Bogenfels, oyster cliffs, mercury island, Diaz point).	
Criteria	**Metrics:** • Less than 4% of perennial vegetation • Copy all metrics from the parent **Mandatory features:** • Rock **Optional features:** • Gravel, sand, wetlands (spring), caves **Character:** • Natural **Typical land uses to be found in this class:** • Tourism • Heritage conservation • Recreational use • Hunting (leopards, zebra) • Mining (gravestones/dimension stone, gravel) **Layers / strata:** • Bare soil and rock • Less than 4% of perennial vegetation	

	Vegetation period / season: • N/A **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Inselbergs in the Namib (e.g. Uri-Hauchab, Hauchab, Spitzkoppe) and elsewhere (Paresis, Omatako, Brandberg, offshore islands etc.)
Excludes	• Vegetated areas • Fallow agricultural fields • Built up areas • Ephemeral stream beds, badlands, canyons
Reference data	• Geological maps
Possible sub-classes	• Rocky shores • Granite sheets and inselbergs • Dolomite and marble ridges and hills
Examples	 Source: Google Earth
Literature	Burke (2001a)

8.2.1.3 Badlands/ Gramadullas

BA0103	***Badlands/ Gramadullas***	*Symbol* *R = 255* *G = 99* *B = 22* *Hex = #FF6316*

Level: 3	**Parent:** Bare soil and rock
Definition	Predominantly bare rock outcrops and thin soil in steeply undulating topography covering an area greater than 4 hectares in size, less than 100 mm mean annual rainfall, less than 4% vegetation.
Criteria	**Metrics:** • More than 4 hectares in size • Steeply undulating topography • Less than 4% vegetation cover • Less than 100 mm Mean Annual Precipitation • Seasonal grasslands after rain **Mandatory features:** • Bare rock • Steeply undulating topography • Less than 4% vegetation cover • Continuous large area **Optional features:** • Deep drainage network with rounded slopes • Schist or Granite bedrock • Sparse shrub vegetation • Seasonal grasslands • Dryland areas adjacent to large rivers **Character:** • Natural **Typical land uses to be found in this class:** • Conservation • Tourism • Seasonal grazing • Hunting/game farming • Mining • Film making **Layers / strata:** • Soil, rocks, • Less than 4% vegetation **Vegetation period / season:** • N/A **Physical / chemical parameters:** • N/A **Other temporal aspects:** • Seasonal vegetation (January – June) **Geographical indications: Where can this class mostly be found in Namibia?** • Kuiseb-Gaub Grammadullas • Moon Landscape (Swakop-Khan Confluence) • Orange River east of Sandfontein • Lower Huab River (Skeleton Coast Park)
Excludes	• Canyons
Reference data	• Geological maps • Topographic maps

Possible sub-classes	• N/A
Examples	 Source: Gobabeb Research and Training Centre
Literature	Goudie and Viles (2015)

8.2.1.4 Canyons

BA0104	***Canyons***	*Symbol* *R = 124* *G = 20* *B = 19* *Hex = #7C1413*
Level: 3	**Parent:** Bare soil and rock	
Definition	Deep narrow valley with steep to vertical sides of bare rock associated with rivers or streams, more than 500 m long.	
Criteria	**Metrics:** • Very steep to vertical sides of bare rock • More than 50 metres deep • More than 500 metres long **Mandatory features:** • Associated with rivers • Very steep to vertical sides **Optional features:** • Bare rock • Less than 4% vegetation • Perennial or seasonal rapids and waterfalls **Character:** • Natural	

	Typical land uses to be found in this class: • Tourism • Adventure sports • Film making • Conservation • Game farming • Hydroelectrical power generation • Dams **Layers / strata:** • Rivers, bare rock **Vegetation period / season:** • N/A **Physical / chemical parameters:** • N/A **Other temporal aspects:** • Seasonal floods **Geographical indications: Where can this class mostly be found in Namibia?** • Orange River Canyons • Fishriver Canyon • Sesrien Canyon • Ghaub Canyon • Kuiseb Canyon • Hoanib River below Sesfontein • Hoarusib below Purros • Ruacana Hydro-electric power station • Kunene River below Epupa
Includes	• N/A
Excludes	• Gullies
Reference data	• Geological maps • Hydrological maps
Possible sub-classes	• N/A
Examples	 Source: https://www.naturalworldsafaris.com/africa/namibia/fish-river-canyon
Literature	Goudie and Viles (2015)

8.2.1.5 Desert plains

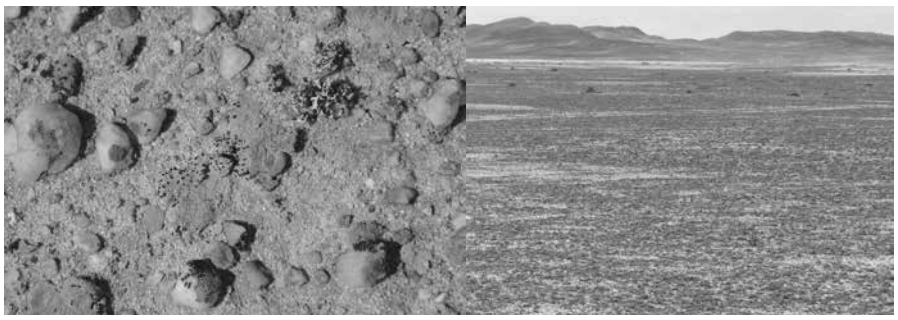
BA0105	***Desert plains***	*Symbol* *R = 249* *G = 249* *B = 167* *Hex = #F9F9A7*
Level: 3	**Parent**: Bare soil and rock	
Definition	Area with less than 4% perennial vegetation and less than 100mm precipitation with predominantly flat (slope less than 10 degrees) desert areas covered with gravel.	
Criteria	**Metrics:** • More than 4 hectares in size • Less than 4% vegetation cover • Less than 100 mm Mean Annual Precipitation • Seasonal grasslands after rain **Mandatory features:** • Soil and gravel • Desert armour (layer of coarse sand, gravel, pebbles, or cobbles stabilising underlying soils or sand) • Flat slopes, less than 10 degrees • Less than 4% perennial vegetation • Continuous large areas (not patchy) **Optional features:** • Shallow drainage systems • Seasonal grasslands may temporarily transform into brief, perennial grasslands after successive good rain seasons until the next drought • Fairy circles • Isolated inselbergs • Subsurface and surface Calcrete 50-100 mm mean annual rainfall, transitioning to Gypcrete 0-50 mm mean annual rainfall • Few lichens • Sandy areas • Rocky ridges • Boulder fields **Character:** • Natural **Typical land uses to be found in this class:** • Conservation • Tourism • Seasonal grazing • Hunting/game farming • Mining • Film making **Layers / strata:** • Soil, rocks, less than 4% vegetation	

	Vegetation period / season: • N/A **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Tsondab Plains in Namib Sand Sea • Central Namib desert (e.g. Gobabeb, Namib-Naukluft National Park, Dorob National Park, Tsiseb Conservancy) • Skeleton Coast National Park • Puros Conservancy • Hartmann's Valley
Excludes	• Lichen fields • Natural grasslands bordering on the Namib Desert
Reference data	• Geological maps
Possible sub-classes	• N/A
Examples	 Source: F. Otto
Literature	Goudie and Viles (2015)

8.2.1.6 Lichen fields

BA0106	***Lichen fields***	*Symbol* *R = 155* *G = 194* *B = 177* *Hex = #9BC2B1*
Level: 3	**Parent**: Bare soil and rock	
Definition	Area with less than 4% perennial vegetation cover, but with more than 40% biological soil crust (BSC) including lichen cover.	

Criteria	**Metrics:** • Less than 4% perennial vegetation • More than 2 hectares • More than 40% lichen cover • Areas with less than 50 mm mean annual precipitation • Fog dominated areas **Mandatory features:** • Biological soil crusts **Optional features:** • Gypsum soils and crusts • Sparse shrubs • Sandy areas • Drainage channels and washes • Rocky outcrops • Gentle slopes • Marble ridges **Character:** • Natural **Typical land uses to be found in this class:** • Conservation • Tourism and recreation • Mining **Layers / strata:** • Soil / Lichens **Vegetation period / season:** • N/A **Physical / chemical parameters:** • N/A **Other temporal aspects:** • Photosynthetic activity peaks after fog events **Geographical indications: Where can this class mostly be found in Namibia?** • Namib Desert (e.g. Swartkoppie, Oranjemund, Bogenfels, Cape cross, Wlotzkasbaken, South east of Walvisbay, Skeleton Coast Park,)
Excludes	• Namib plains
Reference data	Schultz (2006)
Possible sub-classes	• N/A

Examples	 Source: B. Strohbach; Gobabeb Research and Training Center
Literature	Schieferstein and Loris (1992), Jürgens and Niebel-Lohmann (1995), Lalley and Viles (2005), Lalley et al. (2006), Schultz (2006), Wirth (2007), Jürgens et al. (2013)

8.2.1.7 Bare soil

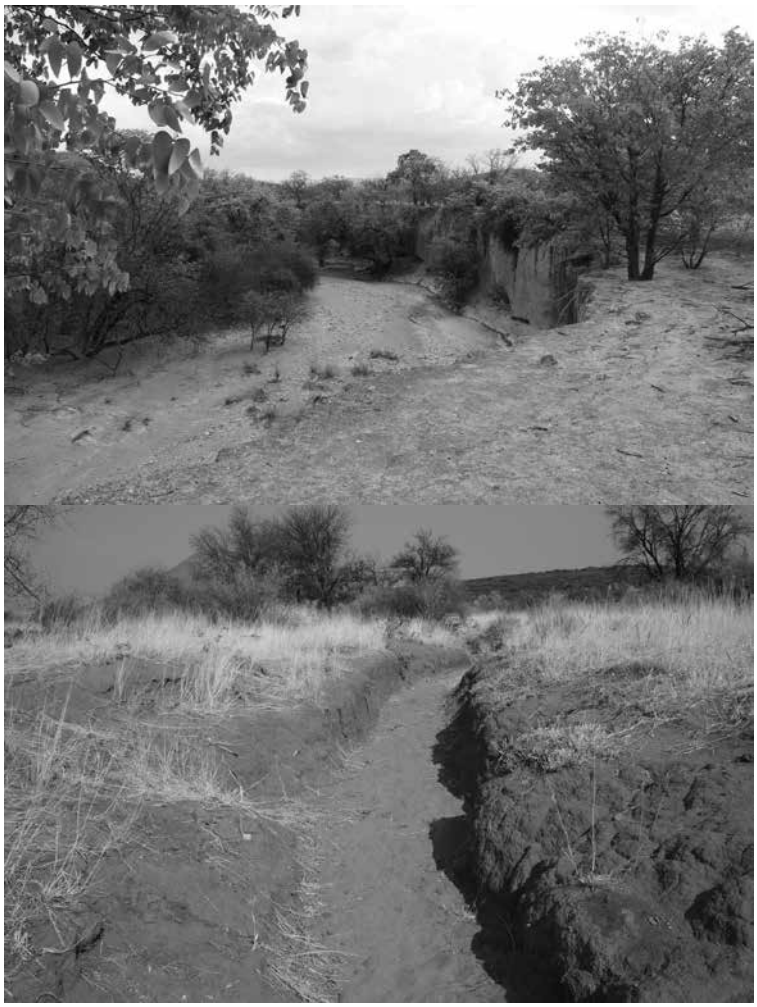
BA0107	***Bare soil***	*Symbol* *R =255* *G= 235* *B = 176* *Hex = #FFEBB0*
Level: 3	**Parent**: Bare soil and rock	
Definition	Natural or semi-natural areas of exposed soil and clay with greater than 1 hectare in size.	
Criteria	**Metrics:** • Less than 4% perennial vegetation cover • Slope less than 2 degrees **Mandatory features:** • Soil **Optional features:** • Piospheres around water points or natural springs • Animal migration routes or livestock corridors • Cutline and firebreaks **Character:** • Semi-natural and natural **Typical land uses to be found in this class:** • Infrastructure • Livestock and game farming • Conservation **Layers / strata:** • Soil **Vegetation period / season:** • N/A	

	Physical / chemical parameters: • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Communal and commercial water points • Namib Desert • Northeast of Namibia
Excludes	• Crop fields without current crop, desert plains, gullies, bare rock, riverbanks and lichen fields
Reference data	• Water points and water holes • Hydrological map of Namibia
Possible sub-classes	• Piospheres • Firebreaks and cutlines • Pan floors and dry mudflats
Examples	 Source: Gobabeb Research and Training Center
Literature	Burke (2003b, 2008), Diener (2018), Strohbach *et al.* (2018), Shikomba (2020)

8.2.1.8 Gullies

BA0108	***Gullies***	*Symbol* *R = 249* *G =224* *B = 224* *Hex = #F9E0E0*
Level: 3	**Parent**: Bare soil and rock	
Definition	Natural or semi-natural eroded areas covering an area greater than 1 hectare in size. Open, unstable run-off channels that have been cut more than 30 cm deep into the ground in disturbed and degraded areas.	

Criteria	**Metrics:** • Rough terrain with steep slopes • Greater than 30 cm deep into the ground **Mandatory features:** • Soil losses • Deep gullies • Unstable walls • Land degradation **Optional features:** • Change in relief • Trees and shrubs • Headwaters of drainage channels • Often deep clay soils, rarely on sandy soils • Overgrazed areas **Character:** • Natural • Semi-natural **Typical land uses to be found in this class:** • Livestock production • Land clearing • Near seasonal water bodies • Near crop gardens • Roads • Mining activity **Layers / strata:** • Bare soil • Shrub vegetation **Vegetation period / season:** • Perennial woody vegetation outside the gullies • Thin seasonal vegetation cover January-May. **Physical / chemical parameters:** • High level of soil compaction in gully surroundings. • High amount of sediment flows **Other temporal aspects:** • Very sparse vegetation inside the gullies **Geographical indications: Where can this class mostly be found in Namibia?** • Around Otjiu (Kunene Region) • Around Opuwo (Kunene Region) • Beesvalake-Khowarib-Warmquelle area Okongwati area (Kunene Region) Aussenkehr (//Kharas Region)
Excludes	• Ancient fluvial silts • Bare soil • Lichen fields • Desert plains • Bare rock
Reference data	• Geological maps

Possible sub-classes	• Permanent or ephemeral gullies • Urban or rural gullies
Examples	 Source: K. Negussie, M. Orti, B. Hofle, O. Bubenzer
Literature	Orti, Hofle, Bubenzer and Negussie, (2021)

8.2.1.9 Ancient fluvial silts

BA0109	***Ancient fluvial silts***	*Symbol* *R = 237* *G = 165* *B = 165* *#EDA5A5*
Level: 3	**Parent**: Bare soil and rock	
Definition	Natural eroded areas covering an area greater than 1 hectare in size. Deep channels that have been cut more than 200 centimetres deep into thick clay or mud deposits of ancient river systems.	

Criteria	**Metrics:** • Less than 1% vegetation • Rough terrain with steep slopes • Channels greater than 200 entimetres deep into the ground **Mandatory features:** • Thick clay greater than 200 entimetres • Deep gullies **Optional features:** • Change in relief • Adjacent to seasonal or perennial rivers **Character:** • Natural **Typical land uses to be found in this class:** • Tourism • Conservation • Clay mining **Layers / strata:** • Bare soil **Vegetation period / season:** • N/A **Physical / chemical parameters:** • Compacted soil • High clay content **Other temporal aspects:** • Very sparse vegetation inside the gullies **Geographical indications: Where can this class mostly be found in Namibia?** • Clay Castles (Skeleton Coast Park) • Amspoort Silts (Huab) • Lorelei (Orange River) Homeb Silts (Kuiseb) • Dieprivier (Khorixas)
Excludes	• Gullies • Gramadullas • Bare Soil • Lichen Fields • Desert Plains • Bare Rock • Canyons
Reference data	• Geological maps
Possible sub-classes	• N/A

Examples	 Source: Gobabeb Research and Training Center
Literature	Goudie and Viles (2015)

8.2.2 Sandy area

BA02	***Sandy area***	*Symbol* *R = 194* *G = 178* *B = 128* *Hex = #C2B280*
Level: 2	**Parent**: Bare landscape	
Definition	Areas more than 4 hectares that are naturally sandy with less than 4% perennial vegetation. These expanses are common features of shorelines and desert environments.	
Criteria	**Metrics:** • More than 4 hectares in size • Maximum vegetation coverage: 4% **Mandatory features:** • Sand • More than 4 hectares continuous **Optional features:** • Hummock-forming vegetation • Aeolian dunes • Seasonal grasslands after rain **Character:** • Natural and semi-natural **Typical land uses to be found in this class:** • Line fishing • Game farming • Livestock farming • Conservation • Tourism • Mining	

	Layers / strata: • Sand **Vegetation period / season:** • N/A **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Coastline • Namib Sand Sea • Sandy areas in the Namib (Tsau-Khaeb, Dorob, Skeleton Coast National Parks) • Denuded Kalahari dunes
Excludes	• Ephemeral river beds • Perennial river banks (e.g. Orange, Kavango, Zambezi) • Vegetated dunes of the Kalahari
Reference data	• Geological maps • Soil maps
Possible sub-classes	• Sandy beaches • Aeolian dunes • Sandy plains • !nara fields • Overgrazed sand plains
Examples	 Source: Gobabeb Research and Training Center
Literature	Goudie and Viles (2015)

8.2.2.1 Sandy beach

BA0201	**Sandy beach**	*Symbol* *R = 215* *G= 187* *B = 156* *Hex = #D7BB9C*
Level: 3	**Parent**: Sandy area	

Definition	A sandy shore especially by the sea between high and low water marks.
Criteria	**Metrics:** Maximum distance from the shore: less than or equal to 50 metres **Mandatory features:** • Sand • No vegetation • Close to a major water body **Optional features:** • Sea water • Edge of big pans like Etosha or Aminuis **Character:** • Natural • Semi-natural **Typical land uses to be found in this class:** • Tourism and recreation • Line fishing • Diamond mining • Conservation for seals • Seal harvesting • Sand mussel harvesting **Layers / strata:** • Sand • Water **Vegetation period / season:** • N/A **Physical / chemical parameters:** • Saline **Other temporal aspects:** • Low and high tide change the extent of the beaches **Geographical indications: Where can this class mostly be found in Namibia?** • Along the entire Namibian coast (interrupted by some rocky shores) • Around large salt pans
Excludes	• Sandy shores along perennial Rivers (Kunene, Kavango, Zambezi, Orange) • Sandy plains
Reference data	• Marine Environment of Namibia • Marine Spatial Plan • Hydrographic maps
Possible sub-classes	• Marine sandy beaches • Salt pan beaches

Examples	 Source: Gobabeb Research and Training Center
Literature	Molloy (2003)

8.2.2.2 Aeolian dunes

BA0202	**Aeolian dunes**	*Symbol* *R = 255* *B = 212* *G = 128* *Hex = #FFD480*
Level: 3	**Parent**: Sandy area	
Definition	Aeolian sand dunes higher than 1 meter consisting of unconsolidated sand and with less than 4% perennial vegetation, more than 4 hectares in size.	
Criteria	**Metrics:** • Less than 4% perennial vegetation • Unconsolidated Aeolian sands • Consists of dunes • Continuous sand more than 4 hectares in size **Mandatory features:** • Sand • Dunes higher than 1 metre **Optional features:** • Gravel or sand inter-dunes • Specialised hummock-forming dune vegetation **Character:** • Natural **Typical land uses to be found in this class:** • Tourism and recreation • Conservation (World Heritage Site) • Mining	

	Layers / strata: • Sand • Seasonal vegetation restricted to interdune areas **Vegetation period / season:** • N/A **Physical / chemical parameters:** • N/A **Other temporal aspects:** • Mobile dunes **Geographical indications: Where can this class mostly be found in Namibia?** • Namib Sand Sea (//Kharas, Hardap & Erongo Regions) • Skeleton coast dune fields (Kunene Region) • Obib dunefields (Tsau-khaeb National Park)
Excludes	• River banks
Reference data	• Soil map of Namibia • Geological maps of Namibia
Possible sub-classes	• Lunette dunes
Examples	 Source: https://whc.unesco.org/en/list/1430/
Literature	Coetzee (2021)

8.2.2.3. Sandy plain

BA0203	**Sandy plain**	*Symbol* *R = 220* *G = 213* *B = 185* *Hex* = #DCD5B9
Level: 3	**Parent**: Sandy area	

Definition	Low relief sandy plains with less than 4% perennial vegetation more than 10 hectares in size in areas less than 100 mm mean annual rainfall.
Criteria	**Metrics:** • No dunes or sand hummocks higher than 1m • 10 hectares in size • Less than 4% perennial vegetation • Less than 100 mm mean annual precipitation **Mandatory features:** • Sand • Low relief **Optional features:** • Seasonal vegetation • Adjacent to ridges or inselbergs (Sand Ramps) • Between high dunes (Interdune Sandy Plains) • Fairy circles • Sand hummocks at sparse perennial shrubs • Shallow washes with sparse trees **Character:** • Natural **Typical land uses to be found in this class:** • Conservation • Tourism • Seasonal grazing • Mining **Layers / strata:** • Bare soil • Seasonal vegetation **Vegetation period / season:** • Seasonal (January – June) **Physical / chemical parameters:** • N/A **Other temporal aspects:** • Small hummocks at perennial shrubs **Geographical indications: Where can this class mostly be found in Namibia?** • Throughout south to west Namibia (from //Kharas, e.g. Warmbad, Rosh Pinah, Aus to Kunene Region (Skeleton Coast, Hartmann's Valley)
Excludes	• Aeolian dunes • Sandy beaches • !nara fields • Overgrazed sandy plains
Reference data	• Geological map of Namibia

Possible sub-classes	• Sand ramps • Interdune sandy plains
Examples	 Source: Gobabeb Research and Training Center
Literature	Goudie and Viles (2015)

8.2.2.4 !nara fields

BA0204	***!nara fields***	*Symbol* *R = 173* *G = 157* *B = 91* *Hex = #AD9D5B*
Level: 3	**Parent**: Sandy area	
Definition	Sandy plains with more than 25% perennial vegetation, specifically Acanthosicyos horridus (!nara), more than 1 hectare in size in areas with less than 100 mm mean annual rainfall.	
Criteria	**Metrics:** • Greater than 25% !nara vegetation • Greater than 1 hectare in size • Sandy areas • Less than 100 mm mean annual precipitation **Mandatory features:** • Sand • !nara vegetation **Optional features:** • Hummocks greater than 1 metre high • Adjacent to seasonal water bodies • Interdune valleys • Dune bases	

	Character: • Natural **Typical land uses to be found in this class:** • Conservation • Tourism • Seasonal harvesting **Layers / strata:** • Bare soil • Perennial vegetation less than 100 mm mean annual precipitation **Vegetation period / season:** • N/A **Physical / chemical parameters:** • Sand **Other temporal aspects:** • Large hummocks in wind corridors **Geographical indications: Where can this class mostly be found in Namibia?** • Koichab Pan (Lüderitz) • Sossusvlei • Kuiseb Delta • Uniab Delta • Nadas-Munutum Valleys • Northeastern Skeleton Coast National Park
Excludes	• Aeolian dunes • Sandy plains • Littoral zone
Reference data	• *Acanthosicyos horridus* distribution data
Possible sub-classes	• N/A
Examples	 Source: Gobabeb Research and Training Center
Literature	Millennium Challenge Account (2014)

8.2.2.5 Overgrazed sandy plains

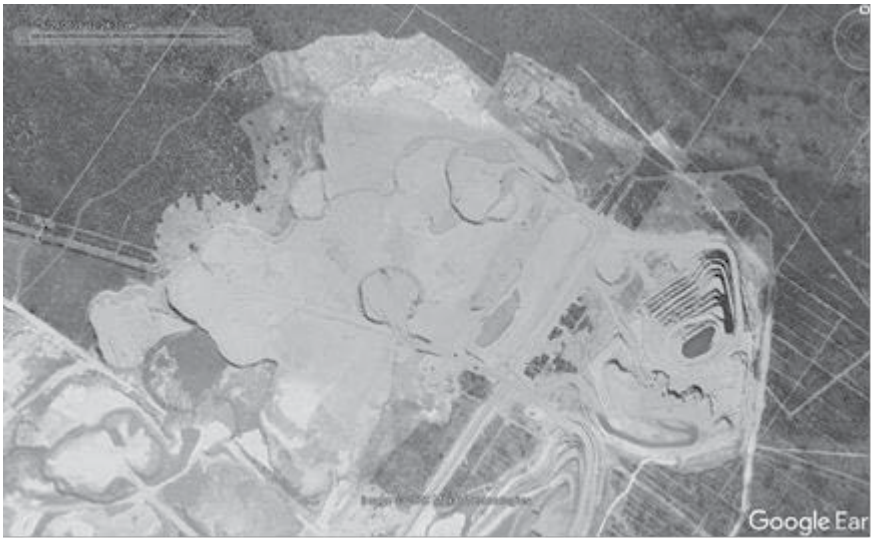
BA0205	**Overgrazed sandy plains**	*Symbol* *R = 93* *G = 82* *B = 46* *Hex = #5C532E*
Level: 3	**Parent**: Sandy area	
Definition	Low relief sandy plains with less than 20% perennial vegetation more than 5 hectares in size in areas more than 100 mm mean annual rainfall.	
Criteria	**Metrics:** • Bare sand • Greater than 5 hectares in size • Less than 20% perennial vegetation • Greater than 100 mm mean annual precipitation **Mandatory features:** • Sand • Low relief • No perennial grass **Optional features:** • Seasonal vegetation • Fairy circles • Perennial shrubs and trees (including alien invasive and pioneer plants) • Shallow washes • Erosion gullies **Character:** • Semi-natural **Typical land uses to be found in this class:** • Livestock farming • Seasonal grazing • Sand mining • Tourism • Game farming **Layers / strata:** • Bare soil • Sparse less than 20% permanent vegetation • Seasonal vegetation **Vegetation period / season:** • Seasonal (January – May) **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A	

	Geographical indications: Where can this class mostly be found in Namibia? • Aroab area (//Kharas) • Gochas area (Hardap) • Eastern edge of Namib • Omatjette area (Erongo) • Okakarara area (Otjozondjupa) • Etanga area (Kunene) • Marienfluss Valley (Kunene)
Excludes	• Sandy Plains
Reference data	• Geological maps • Topographical maps • MAWLR Carrying Capacity/Rangeland Condition indices
Possible sub-classes	• N/A
Examples	 Source: B.Strohbach
Literature	Strohbach (2001)

8.2.3 Industrial bare landscape

BA03	***Industrial bare landscape***	*Symbol* *R= 204* *G = 133* *B = 247* *Hex = #CC85F7*
Level: 2	**Parent**: Bare landscape	
Definition	Artificial, man-made areas with exposed soil and rock and less than 1% vegetation and greater than 1 hectare in size as a consequence of industrial activities.	
Criteria	**Metrics:** • Exposed substrate • Less than 1% vegetation • Greater than 1 hectare • Roads	

	Mandatory features: • Exposed substrate • Industrial activity (past or present) • Linked to transport infrastructure **Optional features:** • Polluted soils • Pioneer or invasive vegetation • Attempted rehabilitation or restoration • Industrial debris **Character:** • Man-made **Typical land uses to be found in this class:** • Mining • Manufacturing • Recreation • Film-making • Informal settlement • Industrial processing • Industrial livestock farming **Layers / strata:** • Bare soil • Transportation infrastructure **Vegetation period / season:** • N/A **Physical / chemical parameters:** • Pollutants **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • All mining areas, e.g. Uis Mine, Khan Mine, Otjikoto Mine, Otjihase Mine, Rosh Pinah Mine, Tsumeb Mine, Berg Aukas, Navachab Mine, Kombat Mine • Cement and other chemical factories • Salt works • Industrial Livestock Production, e.g. Okapuka feedlot, Mariental superfarm
Excludes	• Bare rock and soil classes • Landfill sites
Reference data	• Geological maps • Topographic maps
Possible sub-classes	• Open pit mines and quarries • Waste rock dumps • Tailings dams • Industrial tailings

Examples	 Source: Google Earth
Literature	Hahn, Solesbury and Mwiya (2004)

8.2.3.1 Open pit mines and quarries

BA0301	***Open pit mines and quarries***	*Symbol* *R = 191* *G = 176* *B = 158* *Hex: #BFB09E*
Level: 3	**Parent**: Industrial bare landscape	
Definition	Bare rock or cemented soil depressions due to extraction of minerals of more than 10 metres deep and more than 5 hectares in size with less than 1% vegetation.	
Criteria	**Metrics:** • Exposed substrate • Less than 1% vegetation • Greater than 5 hectares • Depression greater than 10 metres with steep slopes • Roads **Mandatory features:** • Exposed substrate • Depression with steep slopes • Mining activity (past or present) **Optional features:** • Polluted soils • Pioneer or invasive vegetation • Attempted rehabilitation or restoration • Filled with water (e.g. “dead sea” near Henties Bay) • Informal settlements around pit area • Mining infrastructure **Character:** • Man-made	

	Typical land uses to be found in this class: • Mining • Recreation (abandoned sites) • Film-making (abandoned sites) • Informal settlement (abandoned sites) **Layers / strata:** • Bare rock • Regular geometric depressions **Vegetation period / season:** • N/A **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • All open-pit mining areas, e.g. Rössing Mine; Uis Mine, Otjikoto Mine, Scorpion Mine, Langer Heinrich Mine, Husab Mine, Navachab Mine, Kombat Mine,Karibib Marble quarry, Aris Quarry; Ohorongo Cement
Excludes	• All other bare rock classes
Reference data	• Geological maps • Topographical maps
Possible sub-classes	• Open pit mines • Quarries • Sand mines
Examples	 Source: Google Earth
Literature	Ministry of Mines (2010)

8.2.3.2 Waste rock dump

BA0302	***Waste rock dump***	*Symbol* *R = 166* *G = 77* *B = 0* *Hex = #A64D00*
Level: 3	**Parent**: Industrial bare landscape	
Definition	Heaped bare rock or earth higher than 10 metres than the surrounding area with steep sides more than 1 hectare in size with less than 10% vegetation.	
Criteria	**Metrics:** • Heaped bare rock or soil • Less than 10% vegetation • Greater than 1 hectare • Greater than 10 metres high • Steep sides **Mandatory features:** • Bare rock or soil • Mining • Haul roads • Unstable steep sided heaps **Optional features:** • Regular linear geometry • Varies in size from coarse, angular fragments and large boulders of more than 1 metres in diameter, to gravel-sized particles and sand. • Pioneer or invasive vegetation • Attempted rehabilitation or restoration **Character:** • Man-made **Typical land uses to be found in this class:** • Mining **Layers / strata:** • Bare rock • Regular steep-sided geometry **Vegetation period / season:** • N/A **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • All mining areas, e.g. Oranjemund/Auchas mining areas; Uis Mine, Rössing Mine; Husab Mine; Langer Heinrich Mine; Otjikoto Mine, Rosh Pinah Mine, Tsumeb Mine.	

Excludes	• All other bare rock classes
Reference data	• Geological maps • Topographical maps
Possible sub-classes	• N/A
Examples	 Source: Rossing Uranium
Literature	Rossing Uranuim (2014)

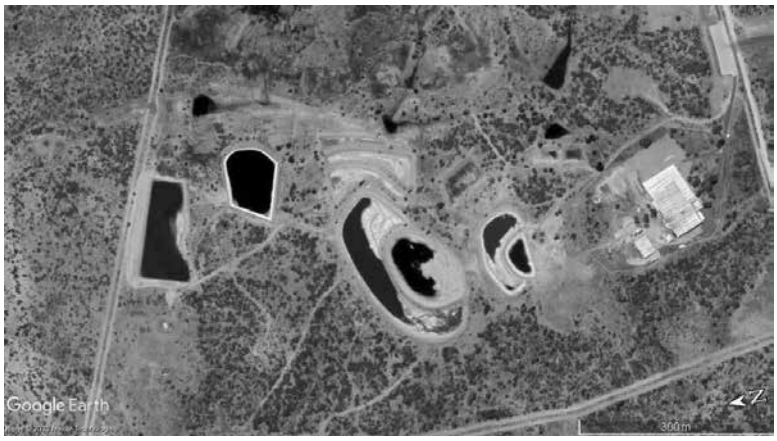
8.2.3.3 Tailing dams

BA0303	***Tailing dams***	*Symbol* *R = 235* *G = 94* *B = 91* *Hex* = #EB5E5B
Level: 3	**Parent**: Industrial bare landscape	
Definition	Fine pulverised rocks mixed with chemicals discarded as steep-sided rectangular man-made piles due to extraction of minerals of more than 3 metres high and more than 1 hectare in size without vegetation.	
Criteria	**Metrics:** • Fine-grained bare soil • Steep-sided rectangular piles • No vegetation • Greater than 1 hectare **Mandatory features:** • Bare substrate • Mining • Regular geometry • Chemically polluted soils	

	Optional features: • Interior evaporation pond • Sides may be stabilised or camouflaged with pioneer vegetation • Light-coloured **Character:** • Man-made **Typical land uses to be found in this class:** • Mining • Water conservation **Layers / strata:** • Bare soil • Rectangular shape **Vegetation period / season:** • N/A **Physical / chemical parameters:** • High levels of Chemical or metal pollutants • Fine-grained mud **Other temporal aspects:** • Evaporation ponding • Downwind toxic dust exposure **Geographical indications: Where can this class mostly be found in Namibia?** • All mining areas, e.g. Uis Mine, Khan Mine, Otjikoto Mine, Otjihase Mine, Matchless Mine, Rosh Pinah Mine, Tsumeb Mine, Berg Aukas, Navachab Mine, Kombat Mine.
Excludes	• All other bare rock classes
Reference data	• Geological maps • Topographical maps
Possible sub-classes	• N/A
Examples	 Source: Google Earth
Literature	Schneeweiss and Müller (2009)

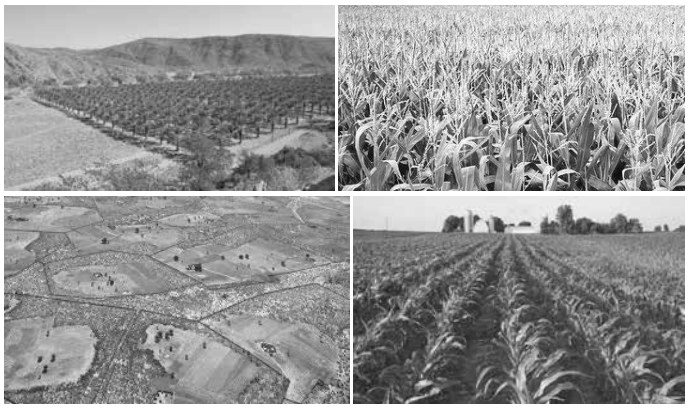
8.2.3.4 Industrial tailings

BA0304	***Industrial tailings***	*Symbol* *R = 241* *G = 145* *B = 143* *Hex = #F1918F*
Level: 3	**Parent**: Industrial bare landscape	
Definition	Bare soils contaminated by processing chemicals or highly acidic organic waste of more than 1 hectare in size without vegetation.	
Criteria	**Metrics:** • Bare soil • No vegetation • Greater than 1 hectare • Road access **Mandatory features:** • Bare substrate • Chemically polluted soils **Optional features:** • Industrial debris • Close to industrial facility • Differently coloured substrate **Character:** • Man-made **Typical land uses to be found in this class:** • Industrial **Layers / strata:** • Bare soil **Vegetation period / season:** • N/A **Physical / chemical parameters:** • High levels of chemical or organic pollutants **Other temporal aspects:** • Dynamic footprint • Downslope toxic seepage **Geographical indications: Where can this class mostly be found in Namibia?** • Industrial waste disposal areas, e.g. Okapuka Feedlot, Okapuka Tannery, Van Eck Power Station Ash Disposal, Mariental superfarm	
Excludes	• All other bare rock classes • Tailings dams	

Reference data	• Topographical maps
Possible sub-classes	• N/A
Examples	 Source: Google Earth
Literature	Hahn, Solesbury and Mwiya (2004)

8.3 Cultivated land

CU	***Cultivated land***	*Symbol* *R 250* *G 242* *B 173* *Hex: #FAF2AD*
Level: 1	**Parent**: -	
Definition	Production relies on rain fed or additional water sources during the growth period of the crop. Cultivated crops and other vegetation visible from November to May Bare soil visible from June to October. Surface Greater than 0.5 hectare.	
Criteria	**Metrics:** • Minimum area: 1 hectare • Minimum area coverage of trees in a plantation: 10 % • Maximum distance between 2 fields: 5-20 metres • Maximum grass coverage: 20 % **Mandatory features:** • Cultivated vegetation (during the vegetation season) **Optional features:** • Fences • Small infrastructure on the fields (irrigation equipment, small buildings, etc.) • Farm dams/water reservoir **Character:** • Managed / agricultural	

	Typical land uses to be found in this class: • Agriculture **Layers / strata:** For the crops: • Grass, soil (lower layer) • Other vegetative species (upper layer) **For the plantations:** • Grass / bushes (lower layer) • Trees (upper layer) **Vegetation period / season:** • November-May for rain fed cultivated fields • Year round for irrigated fields • Bare soil visible from June to October **Physical / chemical parameters:** • N/A **Other temporal aspects:** • Fields change to bare soil from June-October for rain fed fields **Geographical indications: Where can this class mostly be found in Namibia?** • Throughout Namibia
Excludes	• Tree plantations for timber production • Nursery • Urban parks • Sports fields • Fallows
Reference data	• 1: 50 000 Map Feature Definitions and Issues (Ministry of Agriculture, Water and Land Reform)
Possible sub-classes	• Irrigated Cultivated Land Dry land (Non-irrigated) Cultivated Land
Examples	 Source: J. Zheng
Literature	Zheng (2012)

8.3.1 Irrigated cultivated land

CU01	***Irrigated cultivated land***	*Symbol* *R = 120* *G = 108* *B = 87* *Hex = #786C57*
Level: 2	**Parent**: Cultivated land	
Definition	Production relies on water supplies by artificial means during the growth period of the crop. This additional water can be from any water source (borehole, dams, rivers, etc.) and applied to the crop through various irrigation mechanisms (pivot, drip, drag line, etc.).	
Criteria	**Metrics:** • Minimum area: 1 hectare • Minimum coverage of trees in a plantation: 10% • Maximum distance between 2 fields: 5-10 metres • Maximum grass coverage: 10 % **Mandatory features:** • Cultivated vegetation (during the vegetation season) • Indication of irrigation practices **Optional features:** • Fences • Small infrastructure on the fields (irrigation, small buildings, etc.) • Farm dams/water reservoir **Character:** • Managed / agricultural **Typical land uses to be found in this class:** • Agriculture **Layers / strata:** **For the crops:** • Grass, soil (lower layer) • Other vegetative species (upper layer) **For the plantations:** • Grass / bushes (lower layer) • Trees (upper layer) **Vegetation period / season:** • November – May for cultivated fields **Physical / chemical parameters:** • N/A	

	Other temporal aspects: • Fields change to bare soil from June-October **Geographical indications: Where can this class mostly be found in Namibia?** • Kavango East, Kavango West and Hardap Regions
Excludes	• Tree plantations for timber production • Nursery • Urban parks • Sports fields
Reference data	• 1: 50 000 Map Feature Definitions and Issues (Ministry of Agriculture, Water and Land Reform)
Possible sub-classes	• Seasonal crops • Permanent crops
Examples	 Source: J. Zheng
Literature	Zheng (2012)

8.3.1.1 Seasonal crops

CU0101	***Seasonal crops***	*Symbol* *R = 28* *G = 135* *B = 89* *Hex =* #1C8759
Level: 3	**Parent**: Irrigated cultivated land	
Definition	Annual crops planted seasonally, year-round or can be on a rotational basis e.g. horticultural and agronomic and fodder crops. Greater than or equal to 1 hectare.	
Criteria	**Metrics:** • Minimum area: 1 hectare • Minimum coverage of trees in a plantation: 10 % • Maximum distance between 2 fields: 5-10 metres • Maximum grass coverage: 10 % **Mandatory features:** • Cultivated vegetation (during the vegetation season) • Indication of irrigation practices	

	Optional features: • Fences • Small infrastructure on the fields (irrigation, small buildings, etc.) • Small water dams **Character:** • Managed / agricultural **Typical land uses to be found in this class:** • Agriculture **Layers / strata:** **For the crops:** • Grass, soil (lower layer) • Other vegetative species (upper layer) **For the plantations:** • Grass / bushes (lower layer) • Trees (upper layer) **Vegetation period / season:** • November-May for cultivated fields **Physical / chemical parameters:** • N/A **Other temporal aspects:** • Fields change to bare soil from June-October **Geographical indications: Where can this class mostly be found in Namibia?** • Northern Namibia, North-Eastern Namibia and Central Namibia
Excludes	• Tree plantations for timber production • Nursery • Urban parks • Sports fields
Reference data	• 1: 50 000 Map Feature Definitions and Issues (Ministry of Agriculture, Water and Land reform)
Possible sub-classes	• Agronomic crops • Vegetables • Planted pastures

Examples	 Source:Namibia Agronomic board
Literature	Zheng (2012)

8.3.1.1.1 Agronomic crops

CU010101	***Agronomic crops***	*Symbol* *R = 42* *G = 204* *B = 135* *Hex = #2ACC87*
Level: 4	**Parent**: Seasonal crops	
Definition	Annual crops planted seasonally e.g grain crops. Greater than 1 hectare.	
Criteria	**Metrics:** • Minimum area: 0.5 hectare • Minimum coverage of grain: 95 % • Maximum weed coverage: 5 % **Mandatory features:** • Grain plants • Weeds • Soil **Optional features:** • Ridges • Few trees • Irrigation infrastructure **Character:** • Not natural **Typical land uses to be found in this class:** • Agriculture	

	Layers / strata: • Soil (lower layer) • Grass/weed (mid layer) • Crop (top layer) **Vegetation period / season:** • Dry leaves May – Oct-Nov • Bare land July – Nov • Green leaves December – April **Other temporal aspects:** • Fields change to bare soil from June – October **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Mostly northern and central Namibia
Excludes	• Irrigated crops, horticulture
Reference data	• 1: 50 000 Map Feature Definitions and Issues (Ministry of Agriculture, Water and Land reform)
Possible sub-classes	• N/A
Examples	 Source: Namibia Agronomic Board
Literature	Zheng (2012)

8.3.1.1.2 Vegetables

CU010102	***Vegetables***	*Symbol* *R = 151* *G = 190* *B = 17* *Hex = #97BE11*
Level: 4	**Parent**: Seasonal crops	
Definition	Bi-annual crops planted seasonally or year-round, can be on a rotational basis e.g , cabbage Greater than 0.3 hectare.	
Criteria	**Metrics:** • Minimum area: 0.3 hectare • Minimum coverage of crop: 95 % • Maximum weed coverage: 5 % **Mandatory features:** • Vegetables • Weeds • Soil **Optional features:** • Ridges • Few trees • Irrigation infrastructure **Character:** • Not natural **Typical land uses to be found in this class:** • Agriculture **Layers / strata:** • Soil (lower layer) • Grass/weed (mid layer) **Vegetation period / season:** • Green leaves seasonally/all year round **Other temporal aspects:** • Bare soil may in fields with rotational method **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Throughout Namibia	
Excludes	• Orchards • Vineyards	

Reference data	• 1: 50 000 Map Feature Definitions and Issues (Ministry of Agriculture, Water and Land reform)
Possible sub-classes	• N/A
Examples	 Source:Wingenbach
Literature	Namibia Agricultural Union (2008)

8.3.1.1.3 Planted pastures

CU010103	***Planted pastures***	*Symbol* *R = 44* *G = 76* *B = 50* *Hex = #2C4C32*
Level: 4	**Parent**: Seasonal crops	
Definition	Rain-fed or irrigated, perennial or annual forage material grown for livestock feeding e.g. Cenchrus ciliaris (bloubuffelgras), Lucerne etc. Greater than 1 hectare.	
Criteria	**Metrics:** • Surface area greater than 1 hectare • A single species forage crop **Mandatory features:** • Single forage species • Soil **Optional features:** • Grass • Bush/shrubs • Irrigation infrastructure **Character:** • Not natural	

	Typical land uses to be found in this class: • Grazing • Pasture farming **Layers / strata:** • Sand / Soil (lower layer) • Grass (mid layer, **Vegetation period / season:** • Dry leaves May – August • Green leaves September – April/May **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Throughout Namibia
Excludes	• Vegetables
Reference data	• 1: 50 000 Map Feature Definitions and Issues (Ministry of Agriculture, Water and Land reform)
Possible sub-classes	• N/A
Examples	 Source: https://www.tropicalforages.info/text/entities/cenchrus_ciliaris.htm
Literature	Namibia Agricultural Union (2008)

8.3.1.2 Permanent crops

CU0102	***Permanent crops***	*Symbol* *R = 250* *G = 242* *B = 173* *Hex = #FAF2AD*
Level: 3	**Parent**: Irrigated cultivated land	

Definition	Annual crops planted seasonally, can be on a rotational basis e.g., horticultural, cereal. Greater than or equal to 1 hectare.
Criteria	**Metrics:** • Minimum area: 1 hectare • Minimum coverage of trees in a plantation: 10 % • Maximum grass coverage: 10 % **Mandatory features:** • Cultivated vegetation (during the vegetation season) • Indication of irrigation practices **Optional features:** • Fences • Small infrastructure on the fields (irrigation, small buildings, etc.) • Small water ponds **Character:** • Managed / agricultural **Typical land uses to be found in this class:** • Agriculture **Layers / strata:** **For the crops:** • Grass, soil (lower layer) • Other vegetative species (upper layer) **For the plantations:** • Grass / bushes (lower layer) • Trees (upper layer) **Vegetation period / season:** • November-May for cultivated fields **Physical / chemical parameters:** • N/A **Other temporal aspects:** • Fallow • Fields change to bare soil from June-October **Geographical indications: Where can this class mostly be found in Namibia?** • Central Namibia
Excludes	• Tree plantations for timber production • Nursery & Greenhouses • Urban parks • Sports fields
Reference data	• 1: 50 000 Map Feature Definitions and Issues (Ministry of Lands and Reform)
Possible sub-classes	• Orchard • Vineyard

Examples	 Source: C. Mattison
Literature	Ministry of Agriculture Water and Forestry (2017)

8.3.1.2.1 Orchard

CU010201	***Orchard***	*Symbol* *R = 242* *G = 166* *B = 77* *Hex* = #F2A64D
Level: 4	**Parent**: Permanent crops	
Definition	Refers to man-made tree plantations aimed at producing fruits or nuts. Can often be identified by the rows of trees. Greater than or equal to 1 hectare.	
Criteria	**Metrics:** • Minimum area: 1 hectare • Minimum coverage of trees in an orchard: 80 % • Maximum grass coverage: 10 % • Maximum height that trees can reach at a mature stage: 50 metres **Mandatory features:** • Planted fruit / nut trees e.g citrus fruits, macadamians • Indication of irrigation practices **Optional features:** • Fences • Small infrastructure on the orchard (irrigation equipment's, small buildings, etc.) • Small water dams **Character:** • Managed / agricultural **Typical land uses to be found in this class:** • Agriculture	

	Layers / strata: **For the plantations:** • Grass / bushes (lower layer) • Trees (upper layer) **Vegetation period / season:** • N/A **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Naute, Aussenkher, Hardap
Excludes	• Natural forests • Tree plantations for timber production • Nursery • Urban parks
Reference data	• 1: 50 000 Map Feature Definitions and Issues (Ministry of Agriculture, Water and Land Reform)
Possible sub-classes	• N/A
Examples	 Source: https://www.123rf.com/photo_87942077_cactus-fruit-or-prickly-pear-plantation-with-many-cacti-rows-in-omaruru-namibia-southern-africa.html
Literature	Namibia Agricultural Union (2008)

8.3.1.2.2 Vineyard

CU010202	***Vineyard***	*Symbol* *R = 230* *G = 128* *B = 0* *Hex = #E68000*
Level: 4	**Parent**: Permanent crops	
Definition	Refers to plantations of grape-bearing vines, grown mainly for table grapes, raisins but also winemaking and non-alcoholic grape juice. Can often be identified by the rows of vines. Greater than or equal to 1 hectare.	
Criteria	**Metrics:** • Minimum area: 1 hectare • Minimum coverage of vines: 90 % **Mandatory features:** • Vines **Optional features:** • Fences • Small infrastructure on the vineyard (irrigation, buildings (pack houses) etc. **Character:** • Managed / agricultural **Typical land uses to be found in this class:** • Agriculture **Layers / strata:** **For the plantations:** • Soil (lower layer) • Vines (upper layer) **Vegetation period / season:** • October – May **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Aussenkher, Noordoewer, Hardap, Kavango	
Excludes	• N/A	
Reference data	• 1: 50 000 Map Feature Definitions and Issues (Ministry of Agriculture, Water and Land Reform)	
Possible sub-classes	• N/A	

Examples	 Source: C. Mattison
Literature	Namibia Agricultural Union (2008)

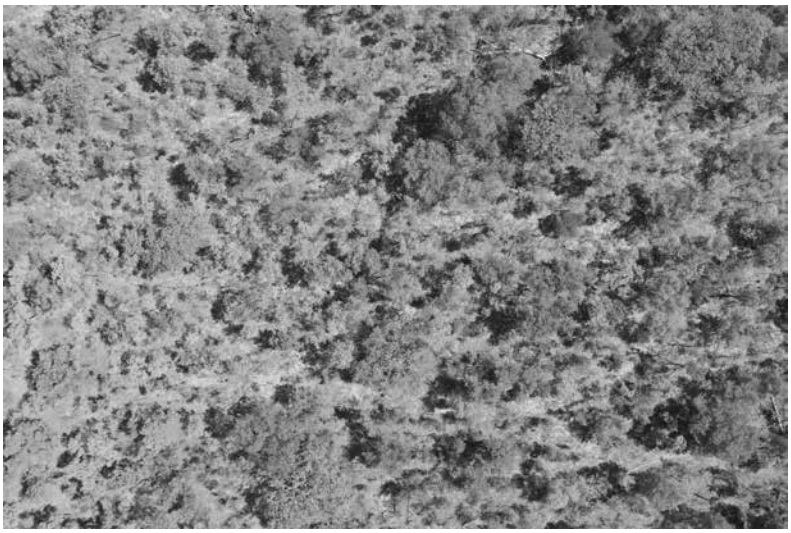
8.3.2 Dryland cultivation (non-irrigated cultivated land)

CU02	***Dryland cultivation (non-irrigated cultivated land)***	*Symbol* *R = 255* *G =255* *B = 168* *Hex = #FFFFA8*
Level: 2	**Parent**: Cultivated land	
Definition	Areas with no additional water source used during the growing periods of the crop and only natural water sources (rain) is available to the crop.	
Criteria	**Metrics:** • Minimum area: 1 hectare • Minimum coverage of trees in a plantation: 10 % • Maximum grass coverage: 10-20 % **Mandatory features:** • Rain-fed vegetation (during the vegetation season) **Optional features:** • Fences • Small infrastructure on the fields (small buildings, etc.) • Small water dams **Character:** • Managed / agricultural **Typical land uses to be found in this class:** • Agriculture	

	Layers / strata: **For the crops:** • Grass, soil (lower layer) • Other vegetative species (upper layer) **For the plantations:** • Grass / bushes (lower layer) • Trees (upper layer) **Vegetation period / season:** • November – May for cultivated fields **Physical / chemical parameters:** • N/A **Other temporal aspects:** • Fallow • Fields change to bare soil from June – October **Geographical indications: Where can this class mostly be found in Namibia?** • Northern to northwest
Excludes	• Nursery and greenhouses • Urban parks • Sports fields
Reference data	• 1: 50 000 Map Feature Definitions and Issues (Ministry Agriculture, Water and Land and Reform)
Possible sub-classes	• Planted pastures • Seasonal crops • Agronomic crops
Examples	 Source: Namibia Agronomic Board
Literature	Namibia Agricultural Union (2008)

8.4 Forest

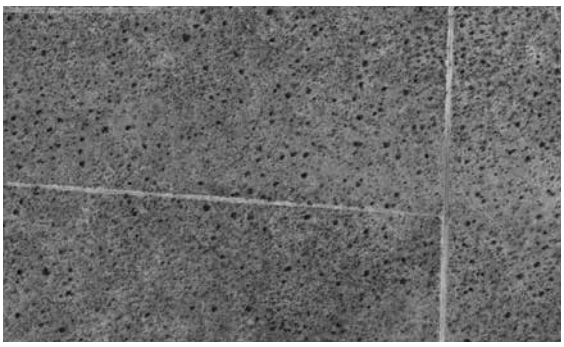
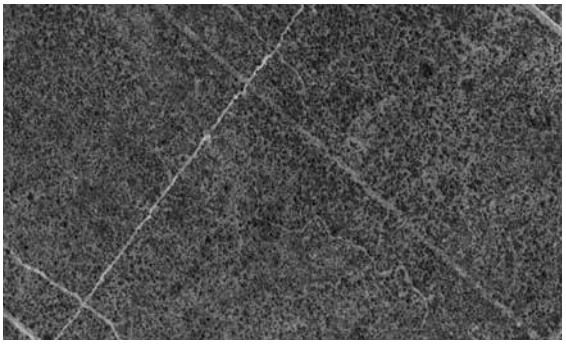
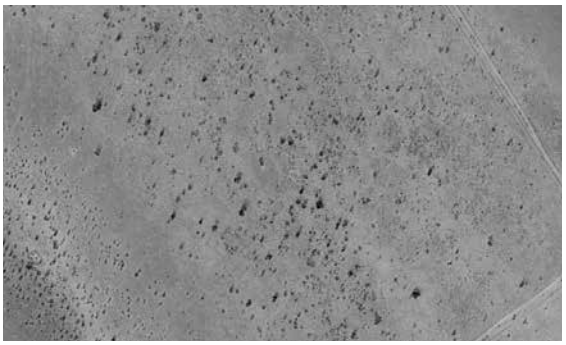
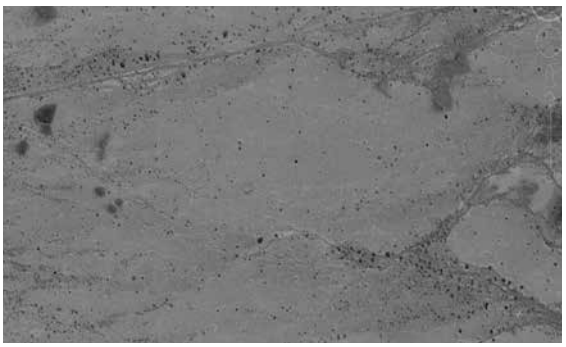
FO	***Forest***	*Symbol* *R = 225* *G = 230* *B = 204* *Hex = #E1E6CC*
Level: 1	**Parent**: -	
Definition	Land spanning more than 0.5 hectare with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use.	
Criteria	**Metrics:** • Surface area greater than 0.5 hectare • Canopy cover greater than 10% • Trees higher than 5 meters (or able to reach this height in that area) • Riverine forests and tree corridors with a width of more than 20 meters **Mandatory features:** • Trees meeting the criteria stated above **Optional features:** • Deadwood • Grass • Bush/shrubs **Character:** • Natural • Planted • Semi-Natural **Typical land uses to be found in this class:** • Timber and non-timber harvesting • Tourism • Conservation **Layers / strata:** • Grass and herbs • Shrubs (understory) • Trees (canopy layer) **Vegetation period / season:** • No leaves May – July (not for all tree species) • With leaves Aug – April **Physical / chemical parameters:** • N/A **Other temporal aspects:** • Ever green or deciduous • Includes areas that are temporarily deforested and are naturally regenerating.	

	Geographical indications: Where can this class mostly be found in Namibia? • Mostly North-eastern Namibia
Excludes	• "Fake" forests (e.g. Quiver tree Forest, Petrified Forest, Deadwood) • Orchards • Botanical gardens
Reference data	• Forest Inventory (MEFT) • Forest cover (MEFT) • Land cover for Zambezi region (MEFT)
Possible sub-classes	• N/A
Examples	 Source: Ministry of Environment, Forestry and Tourism
Literature	FAO (2020)

8.5 Savannah and shrubland

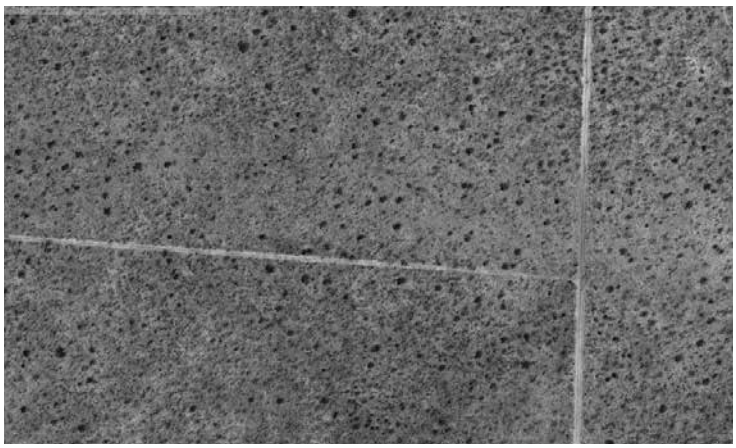
SH	**Savannah and shrubland**	*Symbol* *R =90* *G = 163* *B = 87* *Hex* = #5AA357
Level: 1	**Parent**: -	
Definition	Area dominated by low, short, or high, woody, self-supporting, single- or multi-stemmed plants branching at or near the ground, with a graminoid layer Plant canopy cover 4 - 75%.	
Criteria	**Metrics:** • Canopy cover 4 - 75% • Surface Greater than 2 hectares **Mandatory features:** • Shrubs, trees, and grass meeting the criteria stated above • Soil **Optional features:** • Deadwood	

	Character: • Natural • Semi-natural **Typical land uses to be found in this class:** • Grazing • Conservation • Tourism • Non-timber harvesting (e.g. charcoal production) **Layers / strata:** • Sand / Soil (lower layer) • Grass, Shrubs (mid layer) • Trees (upper layer) **Vegetation period / season:** • Varies between subtypes **Other temporal aspects:** • Grass layer might change to bare soil from June-October or in drought years **Geographical indications: Where can this class mostly be found in Namibia?** • Widespread through central and northern Namibia
Excludes	• Orchards • Botanical gardens
Reference data	• Forest Inventory (MEFT) • State Forest Land Cover • Regional Land Cover • Soil maps
Possible sub-classes	• Woodland Savannah • Tree/shrub Savannah • Karooid Shrubland

Examples	 Source: Google Earth  Source: Google Earth  Source: Google Earth  Source: Google Earth
Literature	(Strohbach and Petersen 2007, Strohbach 2013a)

8.5.1 Woodland savannah

SH01	***Woodland savannah***	*Symbol* *R= 94* *G = 128* *B = 0* *Hex = #5E8000*
Level: 2	**Parent**: Savannah and shrubland	
Definition	Surface Greater than 2 hectares Dominated by trees higher than 10 metres Shrub- and graminoid layer present, but subdominant Total canopy cover between 10% and 75%	
Criteria	**Metrics:** • Surface area greater than 2 hectares • Canopy cover between 10% and 75% • Trees higher than 5 meters • Shrub layer (greater than 1m height) present, but subdominant **Mandatory features:** • Trees meeting the criteria stated above • Soil **Optional features:** • Deadwood • Grass • Bush/shrubs • Water **Character:** • Natural • Planted • Semi-natural **Typical land uses to be found in this class:** • Grazing • Timber and non-timber harvesting • Tourism • Conservation **Layers / strata:** • Sand / Soil (lower layer) • Grass, Shrubs (mid layer) • Trees (upper layer) **Vegetation period / season:** • No leaves May – July • With leaves Aug – March **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A	

	Geographical indications: Where can this class mostly be found in Namibia? • Mostly North-eastern Namibia
Excludes	• "Fake" forests (e.g. Quiver tree Forest, Petrified Forest, Deadwood) • Orchards • Botanical gardens
Reference data	• Forest Inventory (MAWF) • State Forest Land Cover
Possible sub-classes	• Semi-closed woodland savannah • Semi-open woodland savannah • Desert woodland
Examples	 Source: Google Earth  Source: B. Strohbach
Literature	(Strohbach and Petersen 2007, Strohbach 2013a)

8.5.1.1 Semi-open woodland savannah

SH0101	***Semi-open woodland savannah***	*Symbol* *R = 197* *G = 255* *B = 51* *Hex = #C5FF33*
Level: 3	**Parent**: Woodland savannah	

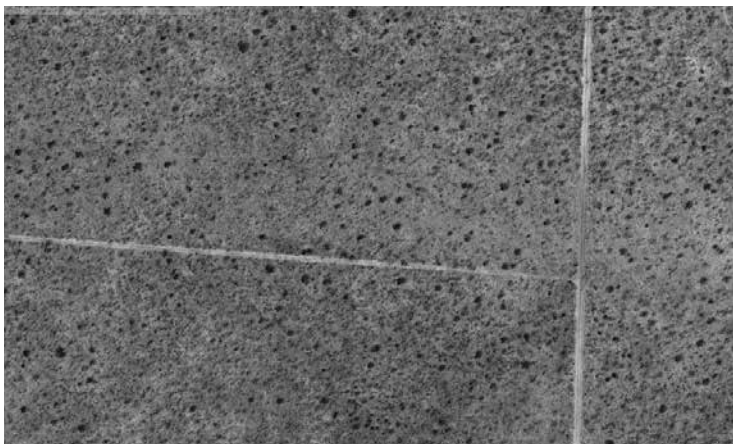
Definition	Surface Greater than 2 hectares Dominated by trees higher than 5 metres Shrub- and graminoid layer present, but subdominant Total canopy cover between 20% and 50%
Criteria	**Metrics:** • Surface area greater than 2 hectares • Total canopy cover between 20% and 50% • Trees higher than 5 meters • Shrub layer (greater than 1 metre height) present, but subdominant **Mandatory features:** • Trees meeting the criteria stated above • Soil **Optional features:** • Deadwood • Grass • Bush/shrubs • Water **Character:** • Natural • Planted • Semi-natural **Typical land uses to be found in this class:** • Grazing • Timber and non-timber harvesting • Tourism • Conservation **Layers / strata:** • Sand / soil (lower layer) • Grass, shrubs (mid layer) • Trees (upper layer) **Vegetation period / season:** • No leaves May – July • With leaves Aug – March **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Mostly North-eastern Namibia
Excludes	• Deforested areas • “Fake” forests (e.g. Quiver tree Forest, Petrified Forest, Deadwood) Orchards, Botanical gardens
Reference data	• Forest Inventory (MAWF) • State Forest Land Cover

Possible sub-classes	N/A
Examples	 Source: B. Strohbach
Literature	Strohbach and Petersen (2007), Strohbach (2013a)

8.5.1.2 Semi-closed woodland savannah

SH0102	***Semi-closed woodland savannah***	*Symbol* *R = 128* *G = 179* *B = 0* *Hex =#80B300*
Level: 3	**Parent**: Woodland savannah	
Definition	Surface greater than 2 hectares Dominated by trees higher than 5 metres Shrub and graminoid layer present, but subdominant Total canopy cover between 50% and 75%	
Criteria	**Metrics:** • Surface area greater than 2 hectares • Total canopy cover between 50% and 75% • Trees higher than 5 meters • Shrub layer (greater than 1 metres height) present, but subdominant **Mandatory features:** • Trees meeting the criteria stated above • Soil **Optional features:** • Deadwood • Grass • Bush/shrubs • Water	

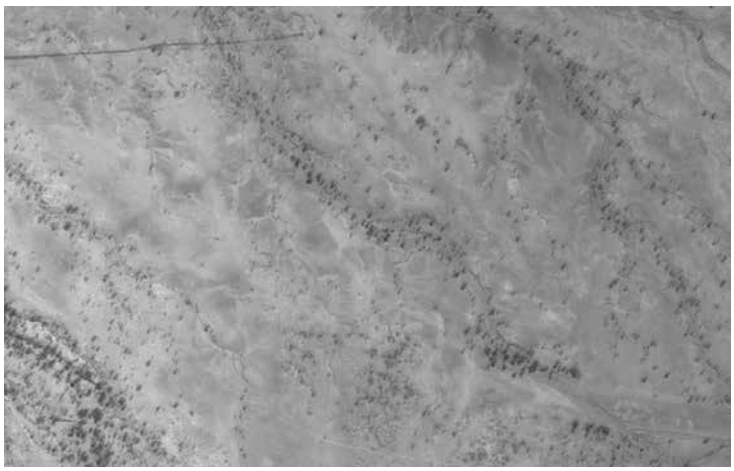
	Character: • Natural • Planted • Semi-natural **Typical land uses to be found in this class:** • Grazing • Timber and non-timber harvesting • Tourism • Conservation **Layers / strata:** • Sand / soil (lower layer) • Grass, shrubs (mid layer) • Trees (upper layer) **Vegetation period / season:** • No leaves May – July • With leaves Aug – March **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Mostly North-eastern Namibia
Excludes	• Deforested areas • "Fake" forests (e.g. Quiver tree Forest, Petrified Forest, Deadwood) • Orchards • Botanical gardens
Reference data	• Forest Inventory (MAWF) • State Forest Land Cover
Possible sub-classes	• N/A

Examples	 Source: Google Earth  Source: B. Strohbach
Literature	Strohbach and Petersen (2007), Strohbach (2013a)

8.5.1.3 Desert woodland

SH0103	***Desert woodland***	*Symbol* *R = 241* *G= 255* *B = 204* *Hex = #F1FFCC*
Level: 3	**Parent**: Woodland savannah	
Definition	Surface greater than 2 hectares Dominated by trees higher than 5 metres Shrub- and graminoid layer present, but sparse Total canopy cover below 20%	

Criteria	**Metrics:** • Surface area greater than 2 hectares • Total canopy cover below 20% • Trees higher than 5 meters • Shrub- and graminoid layer (greater than 1m height) present, but sparse **Mandatory features:** • Trees meeting the criteria stated above • Soil **Optional features:** • Deadwood • Grass • Bush/shrubs **Character:** • Natural • Semi-natural **Typical land uses to be found in this class:** • Grazing • Tourism • Conservation **Layers / strata:** • Sand / soil (lower layer) • Grass, shrubs if present (mid layer) • Trees (upper layer) **Vegetation period / season:** • N/A **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Mostly western Namibia, related to floodplains of large rivers
Excludes	• N/A
Reference data	• N/A
Possible sub-classes	• N/A

Examples	 Source: B. Strohbach  Source: Wikipedia
Literature	Strohbach (2021)

8.5.2. Mixed tree and shrub savannah

SH02	***Mixed tree and shrub savannah***	*Symbol* *R = 154* *B = 223* *G = 15* *Hex = #9ADF0F*
Level: 2	**Parent**: **Savannah and shrubland**	
Definition	Area dominated by low, short or high, woody, self-supporting, single- or multi-stemmed plants branching at or near the ground, with a graminoid layer. Plant canopy 5 - 50%, area greater than 5 hectares. Scattered trees up 5 metres high, with prominent mixture of dwarf shrubs, and shrubs not exceeding 2 metres high.	

Criteria	**Metrics:** • Surface area greater than 5 hectares • Canopy cover between 5% and 50% • It includes trees higher than 5 meters, with a prominent mixture of dwarf shrubs and shrubs • Shrub layer (less than 2 metres heigh) present **Mandatory features:** • Trees, shrubs, dwarf shrubs and herbaceous layers • Soil **Optional features:** • Deadwood • Grass • Bush/shrubs • Water **Character:** • Natural • Bare area may be visible **Typical land uses to be found in this class:** • Grazing • Tourism • Conservation **Layers / strata:** • Sand / Soil (lower layer) • Grass, Shrubs (mid layer) • Trees (upper layer) **Vegetation period / season:** • No leaves May – August (for trees and shrubs) • With leaves May – July (for dwarf shrubs) • With leaves September – May **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Mostly south-eastern Namibia
Excludes	• Forests • Orchards • Botanical gardens • Grasslands • Woodlands
Reference data	• Vegetation map of Namibia • Topographic map
Possible sub-classes	• N/A

Examples	 Source: B. Strohbach
Literature	Giess (1998), le Roux et al. (2009)

8.5.3 Encroached shrubland

SH03	***Encroached shrubland***	*Symbol* *R = 194* *G = 244* *B = 12* *Hex = #C2F40C*
Level: 2	**Parent**: **Savannah and shrubland**	
Definition	Surface area greater than 5 hectares, dominated by a uniform dense shrub component, canopy cover greater than 75%, shrub component usually one or a few woody species with low biodiversity.	
Criteria	**Metrics:** • Surface area greater than 5 hectares • Canopy cover greater than 75% • Possible intermittent trees higher than 5 meters (at a density not more than 1%) • Dominant shrub layer (up to 2 metres high) present, usually only one or few species. **Mandatory features:** • Dense shrubs usually consisting of one or few species • Soil • Clear signs of vegetation disturbance **Optional features:** • Deadwood • Grass • Bush/shrubs • Water **Character:** • Semi-natural • Disturbed savannah	

	Typical land uses to be found in this class: • Grazing • Tourism • Conservation • Wood harvesting for charcoal production **Layers / strata:** • Sand / Soil (lower layer) • Grass (mid layer, • Shrubs (upper layer) **Vegetation period / season:** • No leaves May – July • With leaves September – March **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Throughout Namibia except in the Namib
Excludes	• Forests • Orchards • Botanical gardens • Grassland • Woodland • Savannah
Reference data	• Vegetation map of Namibia • Topographic map
Possible sub-classes	• N/A
Examples	 Source: C. Lindeque
Literature	Giess (1998)

8.5.4 Savannah and desert transition

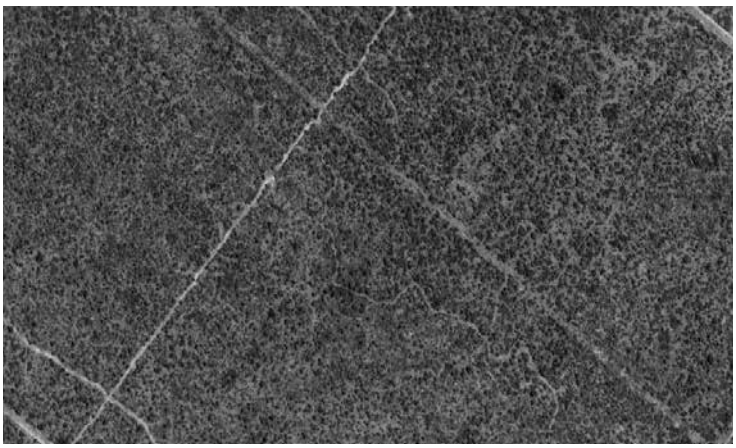
SH04	***Savannah and desert transition***	*Symbol* *R = 255* *G = 255* *B = 201* *Hex = #FFFFC9*
Level: 2	**Parent**: Tree/shrub savannah	
Definition	Surface area greater than 5 hectares, with canopy cover less than 40%, significant of sparse vegetation but with the characteristics of the savannah transitioning to the desert, adjacent to the Namib Desert.	
Criteria	**Metrics:** • Surface area greater than 5 hectares • Canopy cover less than 40% • Dominant shrub layer (up to 2 metres high) present, with possible scattered trees **Mandatory features:** • Shrubs and grass • Soil **Optional features:** • Deadwood • Grass • Bush/shrubs • Euphorbia and ephemeral plants • Water **Character:** • Natural • Sparse vegetation **Typical land uses to be found in this class:** • Grazing • Tourism • Conservation **Layers / strata:** • Sand / Soil (lower layer) • Grass (mid layer, • Shrubs (upper layer) **Vegetation period / season:** • No leaves May – July • With leaves September – March **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • In western Namibia, along the Namib.	

Excludes	• Forests • Orchards • Botanical gardens • Grassland • Woodland • Savannah • Deserts
Reference data	• Vegetation map of Namibia • Topographic map • Atlas of Namibia
Possible sub-classes	• N/A
Examples	 Source: Shigwedha
Literature	Giess (1998)

8.5.5 Tree/shrub savannah

SH05	***Tree/shrub savannah***	*Symbol* *R = 55* *G = 73* *B = 56* *Hex = #374938*
Level: 2	**Parent**: Savannah and shrubland	
Definition	Land spanning more than 2 hectares with trees higher than 5 meters and a prominent shrub component higher than 1 metre. A graminoid layer is generally present. Total canopy cover is more than 10 %.	

Criteria	**Metrics:** • Surface area greater than 2 hectares • Canopy cover between 10% and 50% • Trees higher than 5 meters (or able to reach this height) • A prominent shrub and grass component to it **Mandatory features:** • Trees meeting the criteria stated above • Shrubs meeting the criteria above • Soil **Optional features:** • Deadwood • Grass • Bush/shrubs • Water **Character:** • Natural • Semi-natural **Typical land uses to be found in this class:** • Grazing • Tourism • Conservation • Non-timber wood harvesting **Layers / strata:** • Soil and grass (lower layer) • Shrubs (mid layer) • Trees (upper layer) **Vegetation period / season:** • No leaves May – July • With leaves Aug – March **Physical / chemical parameters:** • N/A **Other temporal aspects:** • Grass layer changes to bare soil from June-October **Geographical indications: Where can this class mostly be found in Namibia?** • Widespread in central and northern Namibia
Excludes	• Orchards • Botanical gardens
Reference data	• Irish: Biomes of Namibia (Irish 1994) • WWF Terrestrial Ecosystems of the World (Olson *et al.* 2001)
Possible sub-classes	• Broad-leaf savannah • Thornbush savannah • Mopane savannah

Examples	 Source: Google Earth
Literature	Le Roux *et al (*1988), Kangombe (2010), Strohbach (2014), (2017), (2019)

8.5.5.1 Broad-leafed savannah

SH0501	***Broad-leafed savannah***	*Symbol* *R = 88* *G = 116* *B = 89* *Hex = #587459*
Level: 3	**Parent**: ***Tree/shrub savannah***	
Definition	Land spanning more than 2 hectares with trees higher than 5 meters and a prominent shrub cover higher than 1 metre. Trees and shrubs are distinctly broad-leafed, deciduous, and non-thorny. A graminoid layer is generally present. Total canopy cover is more than 10 %.	
Criteria	**Metrics:** • Surface area greater than 2 hectares • Canopy cover between 10% and 50% • Trees higher than 5 meters (or able to reach this height) • A prominent shrub and grass component to it • Trees and shrubs are predominantly deciduous, non-thorny and broad-leaved **Mandatory features:** • Trees meeting the criteria stated above • Shrubs meeting the criteria above • Soil **Optional features:** • Deadwood • Grass • Bush/shrubs • Water **Character:** • Natural • Semi-natural	

	Typical land uses to be found in this class: • Grazing • Tourism • Conservation • Non-timber wood harvesting **Layers / strata:** • Soil and grass (lower layer) • Shrubs (mid layer) • Trees (upper layer) **Vegetation period / season:** • No leaves June – October • With leaves December – April **Physical / chemical parameters:** • On sandy soils (arenosols) (Kalahari) **Other temporal aspects:** • Grass layer changes to bare soil from June-October **Geographical indications: Where can this class mostly be found in Namibia?** • Widespread in eastern central and northern Namibia (Omaheke, Otjozondjupa Regions)
Excludes	• Orchards • Botanical gardens
Reference data	• Irish: Biomes of Namibia (Irish 1994) • WWF Terrestrial Ecosystems of the World (Olson *et al.* 2001)
Possible sub-classes	• N/A
Examples	 Source: M. Strohbach
Literature	Hüttich et al. (2009), Strohbach (2014)

8.5.5.2 Thornbush savannah

SH0502	***Thornbush savannah***	*Symbol* *R = 153* *G = 178* *B = 154* *Hex = #99B29A*
Level: 3	**Parent**: ***Tree/shrub savannah***	
Definition	Land spanning more than 2 hectares with trees higher than 5 meters and a prominent shrub cover higher than 1 metre. Trees and shrubs are dominantly fine-leafed, semi-deciduous and thorny (*Acacia*). A graminoid layer is generally present. Total canopy cover is more than 10 %.	
Criteria	**Metrics:** • Surface area greater than 2 hectares • Canopy cover between 10% and 50% • Trees higher than 5 meters (or able to reach this height) • A prominent shrub and grass component to it • Trees and shrubs are dominantly fine-leafed, semi-deciduous and thorny (*Acacia*) **Mandatory features:** • Trees and shrubs meeting the criteria stated above • Soil **Optional features:** • Deadwood • Grass • Bush/shrubs • Water **Character:** • Natural • Semi-natural **Typical land uses to be found in this class:** • Grazing • Tourism • Conservation • Non-timber wood harvesting **Layers / strata:** • Soil and grass (lower layer) • Shrubs (mid layer) • Trees (upper layer) **Vegetation period / season:** • Active growing period between December and April (rainfall dependent) **Physical / chemical parameters:** • N/A **Other temporal aspects:** • Grass layer changes to bare soil from June-October	

	Geographical indications: Where can this class mostly be found in Namibia? • Widespread in central and northern Namibia (Oshikoto, Otjozondjupa, Erongo, Omaheke, Khomas and Hardap Regions)
Excludes	• Botanical gardens
Reference data	• Irish: Biomes of Namibia (Irish 1994) • WWF Terrestrial Ecosystems of the World (Olson *et al.* 2001)
Possible sub-classes	• N/A
Examples	 Source: B. Strohbach
Literature	Strohbach (2002), (2017), (2019), Strohbach and Jankowitz (2012), Strohbach *et al.* (2019)

8.5.5.3 Mopane savannah

SH0503	***Mopane savannah***	*Symbol* *R = 211* *G = 222* *B = 212* *Hex = #D3DED4*
Level: 3	**Parent**: ***Tree/shrub savannah***	
Definition	Land spanning more than 2 hectares with trees higher than 5 meters and a prominent shrub cover higher than 1 metre. The tree and shrub layer is dominated by *Colophospermum mopane* (Mopane / Omusati). A graminoid layer is generally present. Total canopy cover is more than 10 %.	
Criteria	**Metrics:** • Surface area greater than 0.5 hectares • Canopy cover between 10% and 50% • Trees higher than 5 meters (or able to reach this height) • A prominent shrub and grass component to it • The tree and shrub layers are distinctly dominated by *Colophospermum mopane* (Mopane / Omusati) **Mandatory features:** • Trees and shrubs meeting the criteria stated above • Soil	

	Optional features: • Deadwood • Grass • Bush/shrubs • Water **Character:** • Natural • Semi-natural **Typical land uses to be found in this class:** • Grazing • Tourism • Conservation • Non-timber wood harvesting **Layers / strata:** • Soil and grass (lower layer) • Shrubs (mid layer) • Trees (upper layer) **Vegetation period / season:** • Semi-deciduous to deciduous **Physical / chemical parameters:** • Often soils with higher pH (but not exclusively) **Other temporal aspects:** • Grass layer changes to bare soil from June-October **Geographical indications: Where can this class mostly be found in Namibia?** • Widespread in north-western Namibia – Kunene, Omusati, parts of Oshana, Oshikoto regions. also parts of Zambezi Region.
Excludes	• N/A
Reference data	• Irish: Biomes of Namibia (Irish 1994) • WWF Terrestrial Ecosystems of the World (Olson *et al.* 2001)
Possible sub-classes	• N/A
Examples	 Source : V. Marufu

Literature	Le Roux *et al.* (1988), Kangombe (2010)

8.5.6 Karooid shrubland

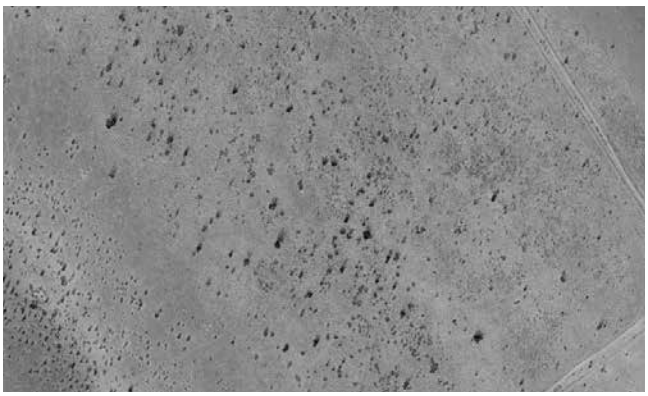
SH06	***Karooid shrubland***	*Symbol* *R = 107* *G = 107* *B= 71* *Hex = #6B6B47*
Level: 2	**Parent**: Savannah and shrubland	
Definition	Land spanning more than 2 hectares dominated by shrubs lower than 1 metre height, and with less than 1 % tree cover. It does not include land that is predominantly under urban land use.	
Criteria	**Metrics:** • Surface area greater than 2 hectares • Total canopy cover more than 4% • Shrub component is less than 1 metre in height **Mandatory features:** • Shrubs meeting the criteria above • Soil **Optional features:** • Deadwood • Grass • Trees • Water **Character:** • Natural • Semi-natural **Typical land uses to be found in this class:** • Grazing / browsing • Tourism • Conservation **Layers / strata:** • Sand / Soil (lower layer) • Shrubs (mid layer) • Trees (upper layer) **Vegetation period / season:** • Depending on rainfall patterns **Physical / chemical parameters:** • N/A **Other temporal aspects:** • Two distinct forms – Summer rainfall predominant, but far south-western areas have winter rainfall and thus a winter growing season.	

	Geographical indications: Where can this class mostly be found in Namibia? • Southern Namibia, transition between savannah and deserts in western Namibia
Excludes	• N/A
Reference data	• Irish: Biomes of Namibia (Irish 1994) • WWF Terrestrial Ecosystems of the World (Olson *et al.* 2001)
Possible sub-classes	• Nama-Karoo • Succulent Karoo
Examples	 Source: https://www.shutterstock.com/image-photo/trail-winding-through-namaqualand-veld-late-1781613104
Literature	Burke (2001b,2005a), Dorendorf (2011), Strohbach and Jankowitz (2012), Mbeeli (2018)

8.5.6.1 Nama-karoo shrubland

SH0601	***Nama-karoo shrubland***	*Symbol* *R = 173* *G = 173* *B = 133* *Hex = #ADAD85*
Level: 3	**Parent**: Karooid shrubland	
Definition	Land spanning more than 2 hectares dominated by non-succulent shrubs less than 1 meter height, and a total canopy cover of more than 4 %.	

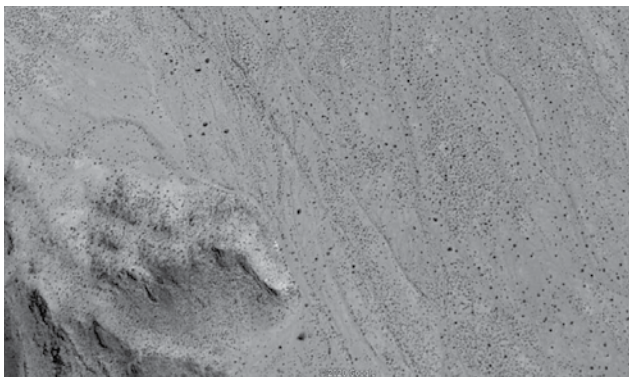
Criteria	**Metrics:** • Surface area greater than 2 hectares • Canopy cover between 4% and 50% • Shrub component dominated by non-succulent plants, less than 1 metre in height • Tree cover less than 1% **Mandatory features:** • Shrubs meeting the criteria stated above • Soil **Optional features:** • Grass • Trees **Character:** • Natural • Semi-natural **Typical land uses to be found in this class:** • Grazing / browsing • Conservation • Tourism **Layers / strata:** • Soil / grass if present (lower layer) • Shrubs (mid layer) • Trees (upper layer – if present) **Vegetation period / season:** • No leaves May – December • With leaves Jan – April **Physical / chemical parameters:** • Predominantly summer rainfall area (December to April) **Other temporal aspects:** • Main growing season between February and May. **Geographical indications: Where can this class mostly be found in Namibia?** • Central and southern Namibia, desert/savanna transition
Excludes	• N/A
Reference data	• Irish: Biomes of Namibia (Irish 1994) • WWF Terrestrial Ecosystems of the World (Olson *et al.* 2001)
Possible sub-classes	• N/A

Examples	 Source: Google Earth  Source: B. Strohbach  Source: B. Strohbach
Literature	Burke (2001b,2005a), Dorendorf (2011), Strohbach and Jankowitz (2012), Mbeeli (2018)

8.5.6.2 Succulent karoo

SH0602	***Succulent karoo***	*Symbol* *R= 214* *G = 214* *B = 194* *Hex = #D6D6C2*
Level: 3	**Parent**: Karooid shrubland	
Definition	Land spanning more than 2 hectares dominated by succulent plants lower than 1 meter and a canopy cover of between 4 and 50 percent.	

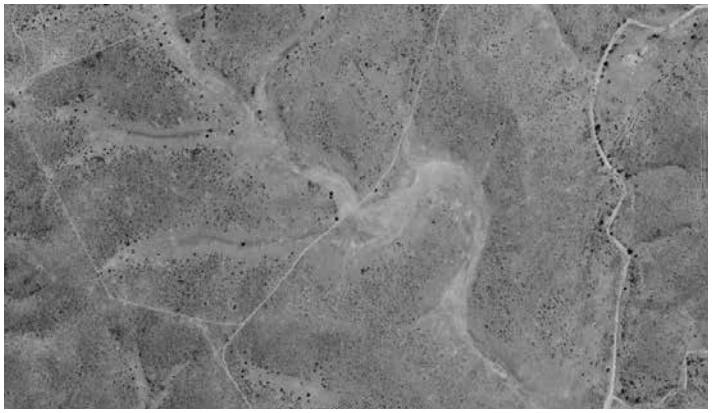
Criteria	**Metrics:** • Surface area greater than 2 hectares • Canopy cover less than 50% • Shrub component is less than 1 metre in height **Mandatory features:** • Succulent plants dominating, more than 4% cover • Soil **Optional features:** • Grass • Rocks and stones **Character:** • Natural • Semi-natural **Typical land uses to be found in this class:** • Conservation • Tourism • Grazing / browsing **Layers / strata:** • Sand / Soil / Grass if present (lower layer) • Shrubs (mid layer) **Vegetation period / season:** • Active growing period June - October **Physical / chemical parameters:** • Predominantly winter rainfall area (June to August) **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Far south-western Namibia (//Kharas Region)
Excludes	• N/A
Reference data	• Irish: Biomes of Namibia (Irish 1994) • WWF Terrestrial Ecosystems of the World (Olson *et al.* 2001)
Possible sub-classes	• N/A

Examples	 Source: Google Earth  Source: L. Spielman
Literature	Burke (2004b, 2017)

8.6 Grassland

GR	***Grassland***	*Symbol* *R= 240* *G = 242* *B =209* *Hex = #F0F2D1*
Level: 1	**Parent**: -	
Definition	Area typically dominated by indigenous herbaceous graminoids (grasses) with less than 4% tree and shrub cover and between 20 to 100% grass cover.	
Criteria	**Metrics:** • Grass cover between 4% and 100% • Trees / shrubs canopy covers less than 4% • Surface greater than 2 hectares **Mandatory features:** • Grass • Soil **Optional features:** • Shrubs, trees • Deadwood • Water	

	Character: • Natural • Semi-natural **Typical land uses to be found in this class:** • Grazing • Conservation • Water harvesting • Tourism **Layers / strata:** • Sand / soil (lower layer) • Grass (mid layer) • Shrubs and trees if present (upper layer) **Vegetation period / season:** • Possibly dry or no grass June – October • Generally, with grass between November – May **Other temporal aspects:** • Can be classified as annual and perennial **Geographical indications: Where can this class mostly be found in Namibia?** • Zambezi flood plain, Kavango flood plain, east flowing omiramba in the Omaheke, upper catchments of rivers in Otjozondjupa and Khomas Hochland, Desert fringes (//Kharas to Kunene), central Namibia
Includes	• N/A
Excludes	• Botanical gardens
Reference data	• Agro-Ecological Map
Possible sub-classes	• Natural grassland • Manmade grassland

Examples	 Source: B. Strohbach  Source: Google Earth
Literature	Strohbach (2008, 2013a, 2013b, 2017, 2019)

8.6.1 Natural grassland

GR01	***Natural grassland***	*Symbol* *R = 121* *G = 176* *G = 12* *Hex = #79B00C*
Level: 2	**Parent**: Grassland	
Definition	Surface area greater than 5 hectares, area dominated by indigenous graminoid layer with a cover of 4-100%. Tree and shrub cover is less than 4%. Borderlines of grassland is completely natural with irregular geometry.	

Criteria	**Metrics:** • Surface area greater than 5 hectares • Graminoid cover greater than 4% • Tree and shrub cover less than 4% **Mandatory features:** • Variety of indigenous grass species • Soil **Optional features:** • Grass • Bush/shrubs • Euphorbia and ephemeral plants • Water **Character:** • Natural • Herbaceous dominated vegetation **Typical land uses to be found in this class:** • Grazing • Tourism • Conservation **Layers / strata:** • Sand / soil (lower layer) • Grass (mid layer, **Vegetation period / season:** • Dry leaves May – August • Green leaves September – April/May **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Throughout Namibia, except desert areas.
Excludes	• Forests • Orchards • Botanical gardens • Woodland • Savannah • Desert
Reference data	• Vegetation map of Namibia • Topographic map • Atlas of Namibia
Possible sub-classes	• N/A

Examples	 Source: M. Coetzee
Literature	Giess (1998)

8.6.2 Manmade grassland

GR02	***Manmade grassland***	*Symbol* *R = 194* *G = 227* *B = 204* *Hex = #C2E3CC*
Level: 2	**Parent**: Grassland	
Definition	Surface area greater than 5 hectares, area dominated by indigenous graminoid layer with a cover of 4-100%. Tree and shrub cover is less than 4%. Boundaries are perfect straight or round. It is normally formerly bush controlled area, and it stand the risk of re-encroachment if not maintained in an open grass state.	
Criteria	**Metrics:** • Surface area greater than 5 hectares • Graminoid cover greater than 4% • Tree and shrub cover less than 4% **Mandatory features:** • Variety of indigenous grass species • Soil **Optional features:** • Grass • Bush/shrubs • Euphorbia and ephemeral plants • Water **Character:** • Natural • Herbaceous dominated vegetation	

	Typical land uses to be found in this class: • Grazing • Tourism • Conservation **Layers / strata:** • Sand / Soil (lower layer) • Grass (mid layer) **Vegetation period / season:** • Dry leaves May – August • Green leaves September – April/May **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Throughout Namibia, except desert areas.
Excludes	• Forests • Orchards • Botanical gardens • Woodland • Savannah • Desert
Reference data	• Vegetation map of Namibia • Topographic map • Atlas of Namibia
Possible sub-classes	• N/A
Examples	 Source: Agra
Literature	Giess (1998)

8.7 Wetland

WE	***Wetland***	*Symbol* *R = 191* *G = 232* *B = 255* *Hex = #BFE8FF*
Level: 1	**Parent**: -	
Definition	Wetlands are areas where water is the primary factor controlling the environment and the associated plant and animal life. They occur where the water table is at or near the surface of the land, or where the land is covered by water. These areas can have many pockets of bushes, non-perennial water surfaces. It can also contain grass. Presence of aquatic plants.	
Criteria	**Metrics:** • Minimum / maximum vegetation cover: 20% • Minimum surface: 4 hectares • Minimum period during which the soil must be wet in a normal year: 6 months **Mandatory features:** • Water • Aquatic plants • Other vegetation **Optional features:** • Grass **Character:** • Natural **Typical land uses to be found in this class:** • Conservation • Tourism **Layers / strata:** • Water and soil (lower layer) • Vegetation (upper layer) **Vegetation period / season:** • N/A **Physical / chemical parameters:** • Non-saline water (mostly inland wetland) • Saline water (mostly coastal wetland) **Other temporal aspects:** • N/A	

	Geographical indications: Where can this class mostly be found in Namibia? • Etosha Pan • Walvis Bay Lagoon • Sandwich Harbour • The Orange River Mouth
Excludes	• Rivers and marine water
Reference data	• National Inventory on Namibian Wetlands
Possible sub-classes	• Inland wetland • Coastal wetland
Examples	 Source: R. Walden
Literature	Kolberg (n.d)

8.7.1 Inland wetland

WE01	***Inland wetland***	*Symbol* *R= 166* *G = 166* *B = 255* *Hex = #A6A6FF*
Level: 2	**Parent**: Wetland	
Definition	Saltwater and freshwater wetlands not located within coastal watersheds.	

Criteria	**Metrics:** • Minimum / maximum vegetation cover: 20 % • Minimum surface: 8 hectares • Minimum period during which the soil must be wet in a normal year: 6 months **Mandatory features:** • Water • Aquatic plants • Other vegetation **Optional features:** • Grass **Character:** • Natural **Typical land uses to be found in this class:** • Conservation • Tourism **Layers / strata:** • Water and soil (lower layer) • Vegetation (upper layer) **Vegetation period / season:** • N/A **Physical / chemical parameters:** • Non-saline water • Saline water **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia** • Etosha, Cuvelai, Okavango Delta, Zambezi Region, Otjozondjupa Region
Excludes	• Water bodies
Reference data	• National Inventory on Namibian Wetlands
Possible sub-classes	• Permanent Wetlands • Seasonal Wetlands

Examples	 Source: https://www.andbeyond.com/advice/africa/botswana/okavango-delta/why-visit-the-okavango-delta/
Literature	Bethune (1991), Hines (1993), Clarke (1999), Kangombe (2010), Strohbach (2013a)

8.7.1.1 Permanent wetlands

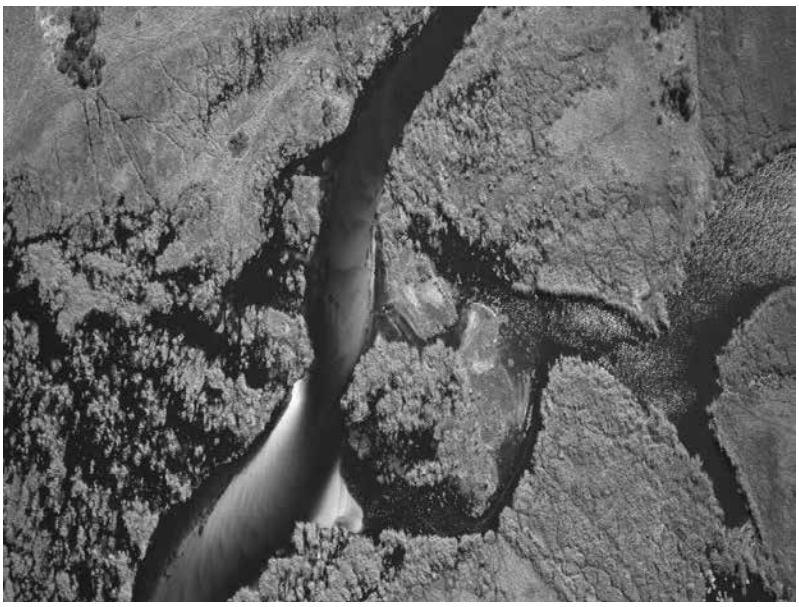
WE0101	***Permanent wetlands***	*Symbol* *R = 204* *G = 204* *B = 255* *Hex = #CCCCFF*
Level: 3	**Parent**: Inland wetland	
Definition	Saltwater and freshwater wetlands not located within coastal watersheds saturated or covered with water permanently.	
Criteria	**Metrics:** • Minimum / maximum vegetation cover: 20 % • Minimum surface: 8 hectares • Minimum period during which the soil must be wet in a normal year: 6 months **Mandatory features:** • Water • Aquatic plants • Other vegetation **Optional features:** • Grass **Character:** • Natural **Typical land uses to be found in this class:** • Conservation • Tourism	

	Layers / strata: • Water and soil (lower layer) • Vegetation (upper layer) **Vegetation period / season:** • N/A **Physical / chemical parameters:** • Non-saline water **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Etosha, Cuvelai, Okavango Delta, Zambezi Region, Otjozondjupa Region
Excludes	• Water bodies
Reference data	• National Inventory on Namibian Wetlands
Possible sub-classes	• N/A
Examples	 Source: https://www.namibian.com.na/public/uploads/images/60d3c391ee020/Wetlands.jpg
Literature	Bethune (1991), Hines (1993), Clarke (1999), Kangombe (2010), Strohbach (2013a)

8.7.1.2 Seasonal wetlands

WE0102	***Seasonal wetlands***	*Symbol* *R = 077* *G = 077* *B =255* *Hex = #4D4DFF*
Level: 3	**Parent**: Inland wetland	
Definition	Saltwater and freshwater wetlands saturated or covered with water on temporary basis and typically occur in low areas in woods and open fields.	

Criteria	**Metrics:** • Minimum / maximum vegetation cover: 20 % • Minimum surface: 8 hectares • Minimum period during which the soil must be wet in a normal year: 6 months **Mandatory features:** • Water • Aquatic plants • Other vegetation **Optional features:** • Grass **Character:** • Natural **Typical land uses to be found in this class:** • Conservation • Tourism **Layers / strata:** • Water and soil (lower layer) • Vegetation (upper layer) **Vegetation period / season:** • N/A **Physical / chemical parameters:** • Non-saline water **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Etosha, Cuvelai, Okavango Delta, Zambezi Region, Otjozondjupa Region.
Excludes	• Water bodies
Reference data	• National Inventory on Namibian Wetlands
Possible sub-classes	• N/A

Examples	 Source: https://www.travelnewsnamibia.com/news/wetland-treasures-namibia-bwabwata-okavango/
Literature	Bethune (1991), Hines (1993), Clarke (1999), Kangombe (2010), Strohbach (2013a)

8.7.2 Coastal wetland

WE02	***Coastal wetland***	*Symbol* *R = 166* *G = 166* *B = 230* *Hex = #A6A6E6*
Level: 2	**Parent**: Wetland	
Definition	Wetlands located within coastal watersheds and covered in permanent aquatic vegetation.	
Criteria	**Metrics:** • Minimum / maximum vegetation cover: less than 20% • Minimum surface: 8 hectares • Minimum period during which the soil must be wet in a normal year: year-round **Mandatory features:** • Water • Aquatic plants • Other vegetation **Optional features:** • Grass **Character:** • Natural	

	Typical land uses to be found in this class: • Conservation • Tourism **Layers / strata:** • Water (lower layer) • Vegetation (upper layer) **Vegetation period / season:** • Year-round **Physical / chemical parameters:** • Saline water **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Walvis Bay Lagoon,Sandwich Habour, Swakopmund salt works
Excludes	• Fresh water
Reference data	• National Inventory on Namibian Wetlands
Possible sub-classes	• N/A
Examples	 Source: C. Bergley
Literature	Kolberg (n.d)

8.8 Water body

WA	***Water body***	*Symbol* *R = 205* *G = 228* *B = 239* *Hex = #CDE4EF*

Level: 1	**Parent**: -
Definition	Significant accumulation of water on the surface. It includes lakes, ponds, puddles, rivers, dams, pans, etc. They can be either perennial or ephemeral. It excludes marine waters and swimming pools.
Criteria	**Metrics:** • Minimum surface 0.5 hectare (for non-linear elements, such as lakes) • Minimum length 100 meters (for linear elements, such as rivers) • In the event of presence of water or rain, min 6 months **Mandatory features:** • Water, running or standing **Optional features:** • Small islands **Character:** • Natural • Semi-natural • Artificial **Typical land uses to be found in this class:** • Tourism • Conservation areas • Fishing • RAMSAR sites (Etosha pan) • Salt mines • Sand mining **Layers / strata:** • Water • Soil for Ephemeral rivers **Vegetation period / season:** • N/A **Physical / chemical parameters:** • Saline pans • Non-saline **Other temporal aspects:** • Possibly dry during the dry season • Possibly dry during June – November • Possibly has water during December - June **Geographical indications: Where can this class mostly be found in Namibia?** • Throughout Namibia
Excludes	• Wetlands (Swamps, Marshes) • Marine water • Swimming pools
Reference data	• Atlas of Namibia, Hydrological Map of Namibia

Possible sub-classes	• River • Standing water body
Examples	 Source: Namwater
Literature	Mendelsohn et.al (2002), Christelis and Struckmeir (2011)

8.8.1 River

WA01	***River***	*Symbol* *R = 0* *G = 0* *B = 159* *Hex = #00009F*
Level: 2	**Parent**: Water body	
Definition	A natural water flowing from land towards a sea, lake, another river, underground water, or inland depression.	
Criteria	**Metrics:** • Minimum width 20 meters • Minimum length 5000 meters **Mandatory features:** • Running or standing water **Optional features:** • Small islands **Character:** • Natural • Possibly a channelled river, not following a natural course **Typical land uses to be found in this class:** • Tourism • Conservation areas • Fishing • RAMSAR sites (Kavango, Orange River mouth) • Sand mining **Layers / strata:** • Water • Soil	

	Vegetation period / season: • N/A **Physical / chemical parameters:** • Fresh water **Other temporal aspects:** • Possibly dry during the dry season • July – November (dry season) • December – May (wet season) • Usually dry during a drought year **Geographical indications: Where can this class mostly be found in Namibia?** • Throughout Namibia
Excludes	• Wetlands
Reference data	• River Atlas data • Topographic maps
Possible sub-classes	• Perennial river • Ephemeral river
Examples	 Source: Namwater
Literature	Mendelsohn et.al (2002), Christelis and Struckmeir (2011)

8.8.1.1 Perennial river

WA0101	***Perennial river***	*Symbol* *R = 134* *G = 180* *B = 188* *Hex = #86B4BC*
Level: 3	**Parent**: River	
Definition	Rivers with continuous flow throughout the year.	

Criteria	**Metrics:** • Minimum width 20 meters • Minimum length 5000 meters **Mandatory features:** • Running or standing water **Optional features:** • Small islands • Smooth, well-defined limits **Character:** • Natural • Semi-natural **Typical land uses to be found in this class:** • Tourism • Conservation areas • Fishing • RAMSAR sites (Kavango, Orange river mouth) • Sand Mining **Layers / strata:** • Water **Vegetation period / season:** • N/A **Physical / chemical parameters:** • Fresh water **Other temporal aspects:** • Might flow stronger during the rainy season **Geographical indications: Where can this class mostly be found in Namibia?** • Usually along the borders of Namibia (North-west – Kunene, South-Orange, North-East – Zambezi, Kwando; Chobe; Linyanti river systems, Kavango River)
Excludes	• Wetlands
Reference data	• River Atlas data • Topographic maps
Possible sub-classes	• Streams

Examples	 Source: Namwater
Literature	Mendelsohn (2002), BGR project (2001)

8.8.1.2 Ephemeral river

WA0102	***Ephemeral river***	*Symbol* *R = 151* *G = 197* *B = 163* *Hex = #97C5A3*
Level: 3	**Parent**: River	
Definition	Rivers flows sporadically depending on rainfall.	
Criteria	**Metrics:** • Minimum width 20 meters • Minimum length greater than 5 000 meters- • Minimum period during which the river flows in a hydrological year: minimum less than 1 day **Mandatory features:** • Water running (depending on the length, frequency, and duration of the rainy season) • Sand, mud (depending on the season) • No to little vegetation **Optional features:** • Small islands **Character:** • Natural • Semi-natural **Typical land uses to be found in this class:** • Grazing • Agriculture (Irrigation when it is dry) • Sand mining • Tourism • Conservation **Layers / strata:** • Water • Sand / mud	

	Vegetation period / season: • N/A **Physical / chemical parameters:** • Fresh water **Other temporal aspects:** • Dry at least during the dry season **Geographical indications: Where can this class mostly be found in Namibia?** • Swakop river, Ugab river, Kuiseb river, Kunene river, Omaruru river
Reference data	• Atlas river data • Topographic maps
Possible sub-classes	• Streams • Channels
Examples	 Source: Atlas of Namibia
Literature	Struckmeir et al. (2001), Mendelsohn et al. (2002), Goudie and Viles. (2015); Botes et.al. (2003), Pekel et.al (2016), Jacobson, et al. (1995).

8.8.2 Natural standing water body

WA02	***Natural standing water body***	*Symbol* *R = 63* *G = 152* *B = 201* *Hex = #3F98C9*
Level: 2	**Parent**: Water body	
Definition	Natural water body with standing water in the same area.	

Criteria	**Metrics:** • Minimum surface 0.5 hectares • Presence of water in a hydrological year, minimum 3 months **Mandatory features:** • Standing water **Optional features:** • Small islands **Character:** • Natural • Semi-natural **Typical land uses to be found in this class:** • Agriculture • Transportation • Fishing • Recreation **Layers / strata:** • Water **Vegetation period / season:** • N/A **Physical / chemical parameters:** • Non-saline water **Other temporal aspects:** • Possibly dry during the dry season **Geographical indications: Where can this class mostly be found in Namibia?** • Throughout Namibia
Excludes	• Wetlands, artificial water body
Reference data	• N/A
Possible sub-classes	• Perennial standing water body • Ephemeral standing water body
Examples	 Source: A. Lehmann

Literature	Struckmeir et al. (2001), Mendelsohn et al. (2002), Goudie and Viles. (2015); Botes et.al. (2003), Pekel et.al (2016), Jacobson, et al. (1995).

8.8.2.1 Perennial standing water body

WA0201	***Perennial standing water body***	*Symbol* *R = 38* *G = 166* *B = 255* *Hex =#26A6FF*
Level: 3	**Parent**: Natural standing water body	
Definition	In a hydrological year, the area is permanently covered by water.	
Criteria	**Metrics:** • Minimum surface 0.5 hectare • Presence of water should be all the time, throughout the year **Mandatory features:** • Standing water **Optional features:** • Small islands **Character:** • Natural • Semi-natural **Typical land uses to be found in this class:** • Tourism • Heritage site (Lake Otjikoto) • Agriculture **Layers / strata:** • Water **Vegetation period / season:** • N/A **Physical / chemical parameters:** • Fresh water **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Throughout Namibia	
Excludes	• Artificial water bodies	
Reference data	• N/A	
Possible sub-classes	• N/A	

Examples	  Source: https://www.namibia-accommodation.com/listing/lake-otjikoto-and-lake-guinas   Source: https://www.namibia-accommodation.com/listing/lake-otjikoto-and-lake-guinas
Literature	Goudie and Vlies (2014)

8.8.2.2 Ephemeral standing water body

WA0202	***Ephemeral standing water body***	*Symbol* *R = 209* *G = 224* *B = 242* *Hex = #D1E0F2*
Level: 3	**Parent**: Natural standing water body	
Definition	Seasonal or every second or third year, the water stands for at least a portion of the year and the area is covered by water.	
Criteria	**Metrics:** • Minimum surface 0.5 hectare • Presence of water every second or third year, water stands for at least a portion of the year **Mandatory features:** • Rocks • Soil **Optional features:** • Water, standing sporadic presence of water • Sand, mud (sporadic presence of mud) • No to little vegetation • Small islands	

	Character: • Natural • Semi-natural **Typical land uses to be found in this class:** • N/A **Layers / strata:** • Water • Sand / mud • Rocks **Vegetation period / season:** • N/A **Physical / chemical parameters:** • Fresh water **Other temporal aspects:** • Sporadic presence of water **Geographical indications: Where can this class mostly be found in Namibia?** • Throughout Namibia
Excludes	• Pans
Reference data	• Atlas of Namibia, Hydrological Map of Namibia
Possible sub-classes	• N/A
Examples	  Source: A. Lehmann, Ministry of Agriculture, Water and Land Reform, Directorate of Water Affairs
Literature	Hines (1993), Clarke (1999), Strohbach (2014, 2019)

8.8.3 Pans

WA03	***Pans***	*Symbol* *R = 255* *G = 235* *B =191* *Hex = #FFEBBF*
Level: 2	**Parent**: Water body	

Definition	Naturally unvegetated bare soil in depressions where water collected in the past or where water collects seasonally. It is not part of any recognisable drainage system but is usually an isolated feature out in the open. Pans can be dry, ephemeral, and mostly have a well-defined boundary marked by a change in vegetation or lack of vegetation.
Criteria	**Metrics:** • Minimum surface 1 hectare • Sporadic presence of water **Mandatory features:** • Water, standing (depending on the season) ephemeral definition • Bare soil (depending on the season) **Optional features:** • No to little vegetation **Character:** • Natural **Typical land uses to be found in this class:** • Tourism • Agriculture **Layers / strata:** • Water • Bare soil **Vegetation period / season:** • N/A **Physical / chemical parameters:** • Saline and fresh water • Saline soil **Other temporal aspects:** • Possibly dry during the dry season or all-year round **Geographical indications: Where can this class mostly be found in Namibia?** • Throughout Namibia
Excludes	• Etosha Pan
Reference data	• Topographic maps
Possible sub-classes	• N/A

Examples	 Source: P. Lambrecht
Literature	Le Roux et al. (1988), Goudie and Vlies (2014)

8.8.3.1 Saline pans (sabkha)

WA0301	***Saline pans (sabkha)***	*Symbol* *R = 197* *G = 232* *B = 231* *Hex: #C5E8E7*
Level: 3	**Parent**: Pans	
Definition	Highly saline unvegetated depressions, occasionally with temporary water ponding.	
Criteria	**Metrics:** • Minimum surface 1 hectare • Sporadic presence of water **Mandatory features:** • Water, standing (depending on the season) ephemeral definition • Bare soil (depending on the season) **Optional features:** • No to little vegetation **Character:** • Natural **Typical land uses to be found in this class:** • Tourism • Agriculture **Layers / strata:** • Water • Bare soil	

	Vegetation period / season: • N/A **Physical / chemical parameters:** • Saline and fresh water • Saline soil **Other temporal aspects:** • Possibly dry during the dry season or all-year round **Geographical indications: Where can this class mostly be found in Namibia?** • Throughout Namibia
Excludes	• Etosha Pan
Reference data	• Topographic maps
Possible sub-classes	• N/A
Examples	 Source: J. Wawira
Literature	Le Roux et al. (1988), Goudie and Vlies (2014)

8.8.3.2 Iishana

WA0302	***Iishana***	*Symbol* *R = 225* *G = 233* *B = 163* *Hex = #FFE9A3*
Level: 3	**Parent**: Pans	
Definition	Unvegetated depressions where water may collect or where endorheic rivers terminate, often defined by a rim of vegetation.	

Criteria	**Metrics:** • Minimum surface 1 hectares • Sporadic presence of water **Mandatory features:** • Water, standing (depending on the season) • Bare soil (depending on the season) **Optional features:** • No to little vegetation **Character:** • Natural **Typical land uses to be found in this class:** • Tourism • Agriculture **Layers / strata:** • Water • Bare soil **Vegetation period / season:** • N/A **Physical / chemical parameters:** • Saline and fresh water • Saline soil **Other temporal aspects:** • Possibly dry during the dry season or all-year round **Geographical indications: Where can this class mostly be found in Namibia?** • Throughout Namibia
Excludes	• Etosha Pan
Reference data	• Topographic maps
Possible sub-classes	• N/A

Examples	 Source: J. Mendelsohn
Literature	Le Roux et al. (1988), Goudie and Vlies (2014); Mendelsohn (2013)

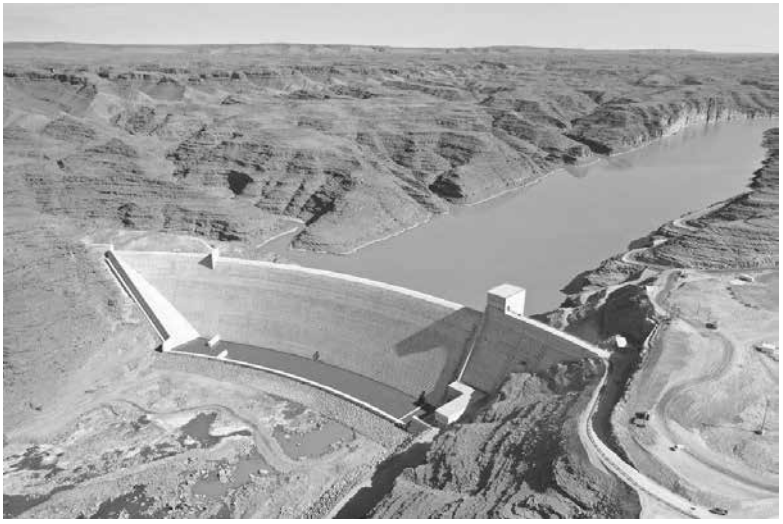
8.8.3.3 Vegetated pans

WA0303	***Vegetated pans***	*Symbol* *R = 255* *G = 241* *B = 197* *Hex = #FFF1C5*
Level: 3	**Parent**: Pans	
Definition	Surface area greater than 5 hectares with plant canopy cover up to 40%. It is periodically cover by shallow water which dries up soon after the rainy season. Vegetation mainly comprises herbaceous layers with dwarf shrubs less than 1 metre. Tree cover is less than 4%.	
Criteria	**Metrics:** • Surface area greater than 5 hectares • Plant covers up to 40% • Dwarf shrubs less than 1m in height **Mandatory features:** • Mixture of dwarf shrubs and grass • Pans are periodically covered with shallow water • Soil **Optional features:** • Grass • Bush/shrubs • Euphorbia and ephemeral plants • Water **Character:** • Natural • Herbaceous and dwarf shrub dominated vegetation	

	Typical land uses to be found in this class: • Grazing • Tourism • Conservation **Layers / strata:** • Sand / soil (lower layer) • Grass (mid layer) • Shrub (upper layer) **Vegetation period / season:** • Dry /no leaves May – August • Green/ leaves September – April/May **Physical / chemical parameters:** • N/A **Other temporal aspects:** • N/A **Geographical indications: Where can this class mostly be found in Namibia?** • Throughout Namibia, except desert areas.
Includes	• N/A
Excludes	• Forests • Orchards • Botanical gardens • Woodlands • Savannahs • Desert
Reference data	• Vegetation map of Namibia • Topographic map • Atlas of Namibia
Possible sub-classes	• N/A
Examples	 Source: B. Strohbach
Literature	Giess (1998)

8.8.4 Artificial water body

WA04	***Artificial water body***	*Symbol* *R = 181* *G = 213* *B = 189* *Hex: #B5D5BD*
Level: 2	**Parent**: Natural standing water body	
Definition	All man-made water bodies (dams, water canals).	
Criteria	**Metrics:** • Minimum surface 1 hectare • Minimum length 1000 metres for linear standing artificial water bodies • Sporadic presence of water **Mandatory features:** • Man-made infrastructure (dam wall and canal infrastructure) **Optional features:** • Sporadic presence of standing water, sand, mud • No to little vegetation **Character:** • Artificial **Typical land uses to be found in this class:** • Agriculture • Tourism • Hydropower **Layers / strata:** • Water • Sand / mud **Vegetation period / season:** • N/A **Physical / chemical parameters:** • Saline and fresh water **Other temporal aspects:** • Possibly dry during the dry season or all-year round **Geographical indications: Where can this class mostly be found in Namibia?** • Throughout Namibia	
Excludes	• Wetlands and pans	
Reference data	• Topographic Maps	

Possible sub-classes	• Dams • Canals • Waste water treatment ponds
Examples	 Source: https://www.namibweb.com/neckartal-dam-namibia.htm
Literature	De Wet (1991)

8.9 Marine water

MA	***Marine water***	*Symbol* *R = 180* *G = 215* *B = 234* *Hex: = #B4D7EA*
Level: 1	**Parent**: -	
Definition	Coastal sea waterbodies.	
Criteria	**Metrics:** • Salinity (range of 34.8 to 35.6) **Mandatory features:** • Saltwater • Tidal waves driven by moon cycle **Optional features:** • Small islands • Rocks • Guano platforms **Character:** • Natural	

	Typical land uses to be found in this class: • Maritime transport • Fisheries • Under Water /telecommunication cables • Aquaculture • Marine tourism • Military exercise • Exploration and exploitation • Research **Layers / strata:** • Water **Vegetation period / season:** • Algae (highly variably spatially and temporal) **Physical / chemical parameters:** • Saline water • Waves • Surface currents • Low oxygen water (not uniform across the ocean) • Wind driven upwelling (temporal) **Other temporal aspects:** • Tides **Geographical indications: Where can this class mostly be found in Namibia?** • West of the Coastline covering the Ecological Economic Zone area
Excludes	• Coastal wetlands, underwater surface, coastline
Reference data	• Global database (GEBCO), Bengula Current Convention Data
Possible sub-classes	• N/A
Examples	 Source: Ministry of Fisheries and Marine Resources
Literature	Sparks (1984)

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