# 4 Vegetation, Fauna and Humans

**Abstract**

In response to the variety of climatic conditions that exist, Namibia has a range of vegetation types, with savanna in the north east and deserts in the west and these play an important role in determining the nature and power of geomorphological processes. Wild and domestic animals may also have an important biogeomorphological role. Recently, the human impact has become significant and examples of deliberate and accidental geomorphological consequences of human activities are presented.

## 4.1 Vegetation and Fauna

One consequence of the present aridity of Namibia is that the vegetation cover is generally low—a closed cover is seldom encountered. A sample of different areas in southern Namibia showed that the average ground cover by vegetation was between 4.7 and 15.3 % (Strohbach 2001), while a more general survey for the whole country (Strohbach et al. 1996) showed the vegetation cover situation for October 1994, just before the main rains. Over 93 % of the country had less than 25 % vegetation cover. The only areas where the vegetation canopy is almost complete is in the woodlands of the north east, including the Caprivi Strip. Whatever the extent and nature of vegetation, it can play many roles in the development of landforms and landscapes for which the umbrella term of biogeomorphology is often used.

A useful measure of the degree of vegetation development in an area is its *biomass,* the total amount of living plant material above and below ground. Deserts in general have a low biomass, often 100 times less than that of an equivalent area of temperate forest. Water is the vital influence on plant growth, of course, and is responsible for this low biomass level. Most plant tissues die if their water content falls too low; the nutrients that feed plants are transmitted by water; water is a raw material in the vital process of photosynthesis; and water regulates the temperature of a plant by its ability to absorb heat and because water vapour lost to the atmosphere during transpiration helps to lower plant temperatures. However, water not only controls the volume of plant matter produced—it also controls their distribution within an area of desert; some areas, because of their soil texture, topographic position or distance from rivers or groundwater, have virtually no water available to plants, whereas others do. The widespread development of banded vegetation (tiger bush) reflects this (see Chap. 25).

In the drier parts of Namibia there are two general classes of vegetation: annuals or *ephemerals,* which have a short lifecycle and may form a fairly dense stand immediately after rain, and *perennials,* which may be succulent and are often dwarfed and woody. The ephemeral plants evade drought. Given a year of favourable precipitation such plants, which include grasses such as *Stipagrostis*, will develop vigorously and produce large numbers of flowers and fruit. This replenishes the seed content of the desert soil. The seeds then lie dormant until the next wet year, when the desert blooms again (see Fig. 3.3).

The perennial vegetation adjusts to the aridity by means of various avoidance mechanisms. Most desert plants are *xerophytes.* They possess drought resisting adaptations: transpiration is reduced by means of dense hairs covering waxy leaf surfaces, by the closure of stomata to reduce transpiration loss and by the rolling up or shedding of leaves at the beginning of the dry season. Some xerophytes, the *succulents*, impound water in their structures. Namibian examples include various types of aloes, euphorbias and commiphoras. Another way of countering drought is to have a limited amount of mass above ground and to have extensive root networks below ground. It is not unusual for the

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**Fig. 4.1** Nebkha dunes near Gobabeb

roots of some desert perennials to extend downwards more than ten metres. Some plants are woody in type—an adaptation designed to prevent collapse of the plant tissue when water stress produces wilting. Another class of dryland plant is the *phreatophyte*. These have adapted to the environment by the development of long tap roots which penetrate downwards until they approach the assured water supply provided by groundwater. They commonly grow near stream channels, springs or on the margins of lakes and can act as a focus for sand accumulation and nebkha formation (Fig. 4.1). A common phreatophyte in Namibian rivers is the tamarisk (*Tamarix usneoides*).

The pattern of vegetation in Namibia at a gross scale reflects the rainfall pattern (see Chap. 3). Thus plant life is at its lushest and most prolific in the north east and progressively shorter and sparser in the west and south. The dry woodlands of the north-east are in the highest rainfall part of the country (500–700 mm) and merge with the tree savanna of the north-central area. They are characterised by *Baikea plurijugia*, *Burkea africana, Guibourtia coleosperma* and *Pterocarpus angolensis.* Savanna has variable proportions of trees (e.g. acacias, mopane, etc.), shrubs and grass. Indeed, savannna covers about two thirds of Namibia. The camelthorn savanna (300–400 mm rainfall) of the central Kalahari is an open savanna with *Acacia erioloba* as the dominant tree. Common shrubs include *Acacia hebeclada, Ziziphus mucronata, Tarconanthus camphoratus, Grewia flava, Ozoroa paniculosa* and *Rhus ciliata*. The thornbush savanna (400–500 mm rainfall) is the dominant vegetation type in the central part of the country. Characteristic species include *Acacia reficiens, A. erubescens* and *A. fleckii*. The mopane savanna (50–500 mm rainfall) is a distinct vegetation type dominated by *Colophospermum mopane*, which occurs in tree and shrub forms, in the north-west of the country. In the south of the country is the extensive Nama Karoo biome. This has a varied assemblage of plant communities that range from deciduous shrub vegetation to perennial grasslands and succulent shrubs. In the Namib Desert, except along the ephemeral rivers, vegetation is extremely limited, though in wetter years even the driest parts of the desert can sometimes support a short-lived grass cover. The lack of vegetation in the desert is one reason why there are extensive areas of moving sand and dunes.

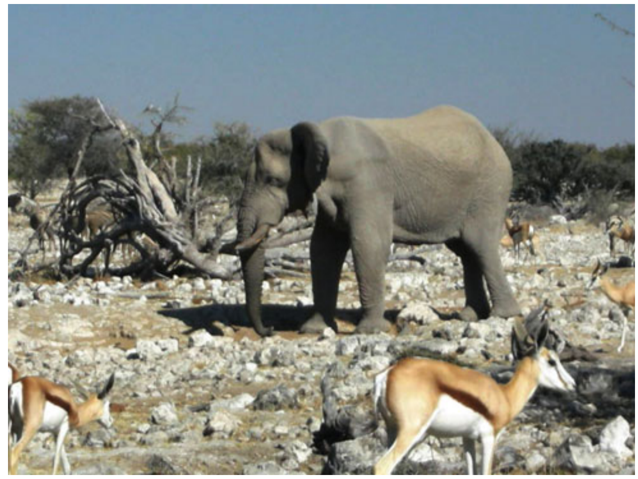

**Fig. 4.2** Large herbivores at Okakuejo, Etosha, have probably contributed to pan excavation

The coastal fringe also has extensive lichen fields within the fog belt (Schieferstein and Loris 1992), and these may contribute to geomorphic processes, through enhancing rock weathering and reducing the erosion of desert pavement surfaces. Lichens are able to grow under very dry conditions, and can utilise moisture in fog. Whilst they grow very slowly, and are often small and inconspicuous, they can cover large areas of the land surface. Lichens are effective at trapping dust and protecting fine grained sediment from erosion by wind and runoff.

Namibia, especially in the past, prior to modern-day hunting, was the home of many large mammals, and these have contributed to landscape development through a range of biogeomorphological processes such as trampling (Boelhouwers and Scheepers 2004) and the excavation of pans and river floodplains (e.g. by elephant wallowing) (Ramey et al. 2013) (Fig. 4.2). Animal tracks, produced by both wild and domesticated animals, are an important landscape component in some areas (Fig. 4.3). Smaller organisms, such as termites and ants, have contributed to the formation of various types of patterned ground (see Chap. 25), while in the Walvis Bay lagoon the feeding of flamingos creates round mounds in the coastal muds.

## 4.2 The Human Impact

Humans have lived in southern Africa for several million years, and the latest episode in the history of the Namibian landscape is their impact on its geomorphology. Humans


**Fig. 4.3** Google Earth image of animal tracks in the Otjinjange Valley, northern Namibia. Scale bar 0.10 km (© 2012 Google Image, Google)

modify the landscape in a whole range of ways and their actions have intensified over the past 300 years or so, leading some to champion the term Anthropocene for this latest period of time (Goudie 2013). The extent of human influence on geomorphology over the Anthropocene has been impressive, even in a relatively sparsely populated country like Namibia. For example, humans have excavated large holes in connection with mining activity, as is the case with the uranium mine at Rössing and the diamond mines along the southern coastline (Fig. 4.4). Material excavated in one place may be deposited elsewhere, and waste from the coastal diamond mines affects the intertidal zone and subtidal reefs (Pulfrich et al. 2003) and, as at Elizabeth Bay, can cause beach accretion (Smith et al. 2002). Other deliberate landform modification includes attempts to stop flooding in Walvis Bay by the construction of a flood retention dam across the Kuiseb River, and attempts to stop dune movement and sand encroachment on Walvis Bay's suburbs by erecting sand fences (Le Roux 1974). Humans also affect the landscape accidentally by changing vegetation cover by, for example, the use of fire (Sheuyange et al. 2005), by deforestation (Seely and Klintenberg 2011) and by introducing grazing by domestic stock (Bester 1998/9; Kuiper and Meadows 2002). There are now over 7 million cattle, sheep and goats in Namibia. These factors may cause accelerated soil erosion and rill and gully formation (Strohbach 2000; Eitel et al. 2002) as well as bush encroachment. Desert surfaces, including those covered by lichens, are easily disturbed by off road driving, and this can produce unsightly scars and break up the desert pavement surface, exposing underlying fine materials to wind attack and dust storm generation (Eckardt and White 1997). Other dust storms can


**Fig. 4.4** Google Earth image of diamond workings north of the Orange River mouth. Scale bar 1 km (©2012 Terra Metrics, Digital Globe, Google)

**Table 4.1** Dams in Namibia with a capacity >5 million m$^3$

| Dam name | River | Date | Capacity (million m$^3$) |
|---|---|---|---|
| Dreihuk | Hom | 1978 | 15.49 |
| Friedenhau | Kuiseb | 1972 | 6.72 |
| Hardap | Fish | 1962 | 294.59 |
| Naute | Loewen | 1972 | 83.58 |
| Oanab | Oanab | 1990 | 34.51 |
| Olushandja | Kunene | 1990 | 42.33 |
| Omdel | Omaruru | 1984 | 41.29 |
| Omatako | Omatako | 1981 | 43.49 |
| Omatjenne | Omatjenne | 1933 | 5.06 |
| Otivero Main | White Nossob | 1984 | 9.81 |
| Otivero Silt | White Nossob | 1984 | 7.79 |
| Von Bach | Swakop | 1970 | 48.56 |
| Swakoppoort | Swakop | 1978 | 63.49 |

*Source* Analysed from data in http://www.namwater.com.na (accessed 13th January, 2013)


**Fig. 4.5** Google Earth image of small linear dunes formed in the lee of old mining buildings at Bogenfels Ghost Town. Scale bar 0.10 km (© 2013 GeoEye, Google)

be generated from exposed mine tailings, as at Rosh Pinar (Křibek et al. 2014). River channels and river sediment loads are being substantially modified by dam and reservoir construction (see Table 4.1) and inter-basin water transfers. For example, the construction of the Von Bach and Swakoppoort dams across the Swakop in the 1970s caused that river's streamflow to be reduced by c 40 % (Marx 2009). Sediment from mining activities can also alter stream channels and their composition (e.g. Taylor and Kesterton 2002). Sand dunes and sand movement can also be affected by human constructions, and this is well illustrated at Bogenfels Ghost Town in the southern Namib, where linear dunes have accumulated in the lee of old buildings (Fig. 4.5). Some of the conservation issues associated with the human impact are discussed in Chap. 26.

## References


Bester FV (1998/9) Major problem—bush species and densities in Namibia. Agricola 1–3

Boelhouwers J, Scheepers T (2004) The role of antelope trampling on scarp erosion in a hyper-arid environment, Skeleton Coast, Namibia. J Arid Environ 58:545–557

Eckardt F, White K (1997) Human induced disruption of stone pavement surfaces in the Central Namib Desert, Namibia: observations from Landsat Thematic Mapper. Int J Remote Sens 18:3305–3310

Eitel B, Eberle J, Kuhn R (2002) Holocene environmental change in the Otjiwarongo thornbush savannah (Northern Namibia): evidence from soils and sediments. Catena 47:43–62

Goudie AS (2013) The human impact on the natural environment, 7th edn. Wiley, Oxford

Kříbek B, Majer V, Pašava J, Kamona F, Mapani B, Keder J, Ettler V (2014) Contamination of soils with dust fallout from the tailings dam at the Rosh Pinah Area, Namibia: regional assessment, dust dispersion modeling and environmental consequences J Geochem Explor (in press)

Kuiper SM, Meadows ME (2002) Sustainability of livestock farming in the communal lands of southern Namibia. Land Degrad Dev 13:1–15

Le Roux PJ (1974) Drift sand reclamation of Walvis Bay, South West Africa. Int J Biometeorol 18:121–127

Marx VL (2009) Impact of upstream reservoirs on the alluvial aquifer of the Swakop River, Namibia. Diploma thesis, Albert-Ludwigs University, Freiburg

Pulfrich A, Parkins CA, Branch GM, Bustamante RH, Velásquez CR (2003) The effects of sediment deposits from Namibian diamond mines on intertidal and subtidal reefs and rock lobster populations. Aquat Conserv: Mar Freshw Ecosyst 13:257–278

Ramey EM, Ramey RR, Brown LM, Kelley ST (2013) Desert-dwelling African elephants (*Loxodonta africana*) in Namibia dig wells to purify drinking water. Pachyderma 53:66–72

Schieferstein B, Loris K (1992) Ecological investigations on lichen fields in the central Namib 1: distribution patterns and habitat conditions. Vegetatio 98:113–128

Seely MK, Klintenberg P (2011) Case study desertification: Central-northern Namibia. Tropical For 8: doi: 10.1007/978-3-642-19986-8_31

Sheuyange A, Oba G, Weladji RB (2005) Effects of anthropogenic fire history on savanna vegetation in northeastern Namibia. J Environ Manage 75:189–198

Smith G, Mocke G, van Ballegooyen R, Soltau C (2002) Consequences of sediment discharge from dune mining at Elizabeth Bay, Namibia. J Coast Res 18:776–791

Strohbach BJ (2000) Soil erosion—causative factors, extent and prevention. Agro-Info 6:8–14

Strohbach BJ (2001) Vegetation survey of Namibia. J Namibia Sci Soc 49:93–119

Strohbach BJ, Calitz, AJ, Coetzee ME (1996) Erosion hazard mapping: modelling the vegetative cover. Agricola 8:53–59

Taylor MP, Kesterton RG (2002) Heavy metal contamination of an arid river environment: Gruben River, Namibia. Geomorphology 42:311–327