

CLIMATIC EFFECTS

on soils and pastures

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A farm is the result of the entire ecosystem, namely the soils occurring, the terrain and topography, the climatic regime (including possible moisture supplied by irrigation) and therefore the range of crops and/or natural vegetation that will grow and thrive under those conditions. In South Africa, the variety of natural ecological zones occurring leads to a great variety of farming enterprises, from the sub-tropical coastal zones to the summer rainfall highveld, the Western Cape region and a number of specialised production regions that take advantage of the natural resources and favourable economic factors.

However, across much of South Africa, a combination of climatic restrictions and unfavourable soils means that the most suitable land use, and therefore the main economic farming activity, will be livestock production, usually under rain-fed conditions. This has led to South Africa being one of the leading livestock producers in Africa, as well as being a significant player on the international scene. One problematic aspect in livestock production, however (as in most farming enterprises) is climatic uncertainty. The prevailing climatic regime across most of the South African interior is summer rainfall, usually fairly erratic, followed by a dry winter period, often with a significant temperature drop.

Farmers have adapted to these conditions by adjusting their practices to the prevailing climate

and soils so that they adhere to a sensible, sustainable carrying capacity (Figure 1), either for small stock or large stock units. This means that in higher rainfall areas, where the natural grazing can be expected to be of better quality and be more productive, the grazing capacity will be higher, meaning that more livestock can comfortably be kept on a specific piece of land without harm to the animals or to the environment. This situation can further be adjusted if some sort of planted pasture (often under irrigation) is available as a supplementary, more reliable, source of fodder.

to the higher potential areas in the east, where less than five hectares are required per animal.

When climatic conditions are unfavourable, such as in a drought period, the quality and quantity of the grazing will naturally deteriorate, so that livestock farmers have to make a choice between selling some livestock to avoid overgrazing or to make arrangements (if possible) to utilise other fodder sources in order to not put undue pressure on the natural vegetation resources. If this is not done, the inevitable result will be over-utilisation of the vegetation, which will have a

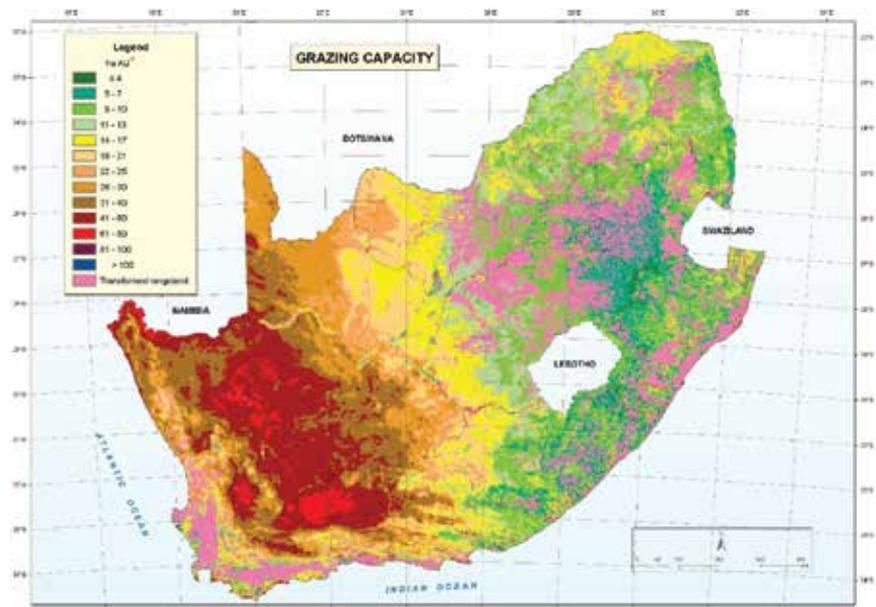


Figure 1: Generalized grazing capacity map of South Africa

The map shows the variation in grazing capacity across South Africa, from the drier areas in the western interior (where 40 hectares or more is required for each large stock unit),

number of consequences to the local ecosystem.

The first result will be that the vegetation cover on the surface will become sparser, and eventually

disappear in places, leading to a bare soil surface. This bare soil can then be adversely affected by either the action of the livestock walking on the surface, or the impact of rainfall, or both. Two types of soil erosion are possible (Figure 2). The first of these is **wind erosion**, whereby bare topsoil that has been exposed is transported and removed by wind action. Such action may cause soil particles to be transported for a considerable distance, and will be especially prevalent in areas with a sandy soil texture, especially fine sand grades. The other type of erosion is **water erosion**, whereby bare soil is affected by water flowing on the soil surface. The water can then detach soil particles, which are removed by the water and deposited lower down in the topography, usually eventually ending up in water bodies (streams, rivers, pans, dams or even the sea) where they are permanently lost. The effect of both of these types

concentrated water flow, which can cause the establishment of rills, and eventually gullies (dongas).

Climate change is a phenomenon that is happening in many parts of the world, and is also evident in South Africa. While periods of drought and also excess rainfall (wet/dry and hot/cold cycles) occur naturally, there is some evidence that there will be a fundamental shift in climatic patterns across Southern Africa. Predictions are unclear, but it appears as if many areas will become warmer and drier. While this will have a distinct effect on crop production, it will obviously also seriously affect livestock production, since in many areas, grazing capacity will fall, possibly causing currently marginal livestock areas to become unsuitable. A further complication is the situation whereby a large proportion of the livestock numbers in South Africa are in rural areas, where a larger number of small-scale

where livestock numbers become concentrated and where soil erosion can start. Such areas, including livestock trails and bare soil patches, are easily observable on such sources as Google Earth. Finally, if pressures accumulate, action must be taken quickly. Once soil erosion starts, it is difficult to stop, and even more difficult to reverse.

What are some of the measures available to combat soil erosion? In terms of wind erosion, the establishment of windbreaks (vegetation or other structures roughly perpendicular to the prevailing wind direction) can help to reduce wind speed, and thus the severity of the situation. Often, though, the areas involved are large, and the only solution is to wait until a period of good rain offers the vegetation a chance for re-growth. For water erosion, if the situation is serious enough, some sort of support structure (contour,

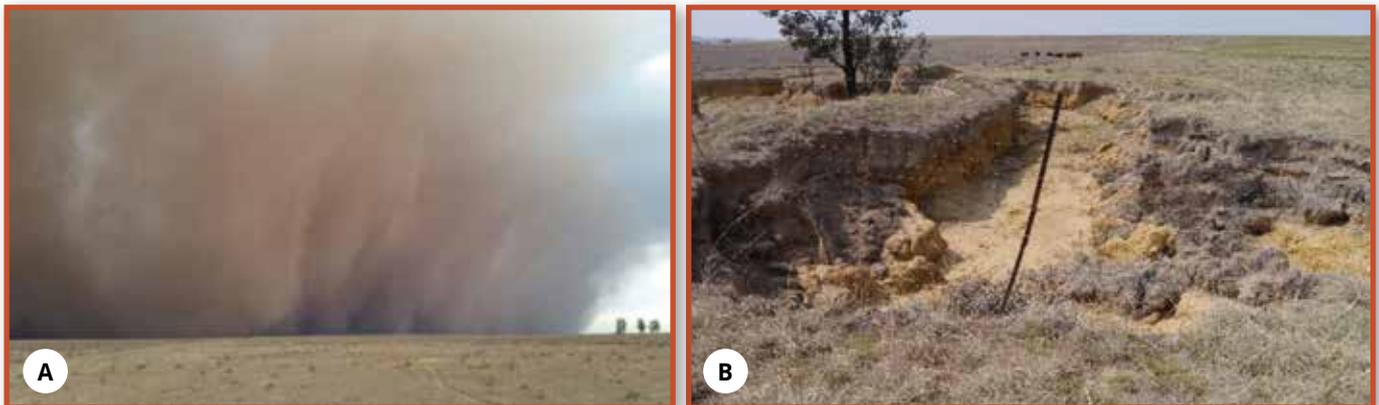


Figure 2: A dust storm in the Free State (a), showing severe removal of topsoil by wind; typical donga erosion from water flow (b), often exacerbated by livestock movement

of erosion is that the naturally occurring topsoil horizon (layer) is disturbed, and may be totally removed. This means that the original subsoil becomes exposed at the surface, which is much less favourable for vegetation (grazing) growth. Several problems may result. Firstly, the removed topsoil contained elevated levels of organic carbon, as well as any root materials and decaying vegetation that helps with vegetative growth when rainfall occurs. Secondly, the exposed subsoil horizon, in an unnatural position, may be subject to sealing, so that a hard, virtually impermeable crust is formed, which repels water, making vegetation growth extremely difficult. If these processes are left unchecked, areas with slightly lower micro-topography may lead to

stock owners often compete for natural grazing, often in communal areas. This situation, linked to cultural and other traditional values, can also have serious consequences if not planned and addressed in time.

So what can livestock farmers do to maximise their grazing potential, both currently and in the case of possible future climatic problems? Firstly, be aware of the prevailing natural resources (soil type, annual and seasonal rainfall and temperature figures and the prevailing carrying capacity). This will help to establish sustainable livestock numbers. Secondly, practice rotational grazing when possible. This will avoid pressure on existing vegetation. Special care should be given to access to water points (whether natural or not), as this is

wall, terrace or other structure) may be required, often in conjunction with a geotextile (surface covering to hold topsoil in place). The main solution, however, is to **maintain a vegetation cover**. If this is done, the roots will hold the topsoil together, the rainfall impact will be reduced, and water infiltration will be increased. A soil cannot easily erode if it is protected from above.

The South African environment is a favourable one for agriculture, and for livestock production, with varied resources and possibilities. However, natural climatic variability, along with future threats, means that all producers must be aware of their specific local land, and the need to protect it. **Soil is the basis of all life, including all agricultural production, so don't treat soil like dirt!**