

# Veld that can mitigate a variable climate

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Only that part of the rainfall that infiltrates into the soil and is then used by the desired grazing plants, will contribute to efficient feed

production and therefore efficient rainfall. This is the only part of the water cycle that leads to forage production. The rest is lost to runoff, deep drainage, or evaporation from the soil surface. The amount of rain measured in the rain gauge is therefore not all that matters. It is the water that ends up in the soil and that is used by advantageous plants to produce feed. This embodies efficient rainfall.

Research conducted in the arid and semi-arid regions of South Africa since the 1980s has shown that the better

the condition of the veld, the higher and more stable the rate of forage produced and the better the quality of the feed. It also markedly improves the veld's drought tolerance and its profitability.

Prof Hennie Snyman, professor emeritus of rangeland science at the University of the Free State, conducted pioneering research in South Africa regarding the relationship between the condition and hydrology (water balance) of veld. He was recently named one of the world's top 2% scientists by Stanford University in the United States. The research he performed in the central Free State (Table 1), is supplemented by other research in South Africa.

- In the case of good veld, approximately 3,5% of rainwater was lost annually due to runoff. In other words, water that did not infiltrate into the soil. Put differently, an average of 19mm of the annual average rainfall of 530mm was lost from good veld. In the case of average veld, almost twice as much of the yearly rainfall washed away (5,6% or 30mm), and rainwater runoff in poor



veld was almost three times as much (8,7% or 46mm). Hence, the poorer the condition of the veld, the more water is lost and the drier the soil becomes.

The data can also be approached from another angle. Every millimetre of rain that falls on one hectare of land represents 10 000 litres of water. Thus, a 46mm loss in annual rainfall (as is the case with poor veld in the central Free State) constitutes a loss of 460 000 litres of water/ha/year that is not available for feed production.

A 1 000ha farm will therefore lose 46 million litres of rainwater every year.

The central Free State is relatively flat. Losses due to runoff should therefore be significantly higher in areas with steeper slopes.

**Table 1: The hydrological and production characteristics of veld in different conditions in the central Free State (1977 to 1996)**

(H A Snyman, 1999 & 2008)

(Average annual rainfall of 530mm)

	VELD CONDITION		
	GOOD	AVERAGE	POOR
% of rainfall lost to runoff	3.5%	5.6%	8.7%
% of rainfall portioned to deep drainage	0.5%	0.2%	0.1%
Basal soil cover	8.3%	6.9%	2.9%
Annual loss of topsoil	0.41 t/ha	1.20 t/ha	3.55 t/ha
Relative annual carbon loss from the upper 300mm soil (kg/ha/year)	0	2659	5225
Relative annual nitrogen loss from the upper 300mm soil (kg/ha/year)	0	180	331
Water use efficiency (kg feed/ha/mm water produced)	2.5	1.6	0.8
Dry matter production (kg/ha/year)	1238	768	368
Variability of dry matter production (kg/ha/year)	313 tot 2678	200 tot 1633	15 tot 889
Crude protein production (kg/ha/year)	141	97	32

- The amount of rainwater that replenishes the groundwater (also called deep drainage) is twice as much in good veld than in average veld (0,5 versus 0,2% of annual rainfall), and five times more than in poor veld (0,1%). Therefore, the better the veld's condition, the better the amount of water that replenishes the underground source.

- Approximately 17% more soil is covered with plants in good veld (expressed as the percentage of soil covered by the basal parts of the plants). Similarly, good veld covers roughly 65% more of the soil than the plant cover on poor veld.

The deterioration of the veld exposes more soil to the atmosphere, leading to significantly more water being lost through evaporation. The water that evaporates directly from the soil surface constitutes a loss of rainwater to the livestock producer, as it is not absorbed by plants and therefore does not contribute to veld production.

- In good veld 0,41tons/ha/year of topsoil is lost to

erosion, in the case of average veld 1,2tons/ha/year is lost, while a whopping 3,55tons/ha/year is lost from poor veld. To put this in perspective – one hectare of soil that is 1mm deep, with a bulk density of 1,5g/cm<sup>3</sup>, weighs around 15 tons. Thus, roughly 0,02mm of soil had been lost each year in good veld, or 0,36mm over the 18 years of research. In the case of poor veld, the loss amounted to approximately 0,24cm of topsoil per year, or 4,3mm over 18 years.

Paul Harvey once said that “*man, despite his artistic pretensions, his sophistication, and his many accomplishments, owes his existence to a six-inch layer of topsoil and the fact that it rains.*”

- In addition to the valuable topsoil that is lost, poor veld also loses substantial amounts of carbon (organic matter) and nitrogen from the soil every year. Carbon is one of the most crucial elements determining the soil’s water-holding capacity.
- Water use efficiency (WUE) is the amount of water a plant uses to produce one gram of forage. Veld in good condition produces twice as much forage per millimetre of water than average veld, and around four times more forage per millimetre of water than poor veld, even though the same amount of rain is measured in the rain gauge for all three veld conditions.
- The protein content of poor veld is lower than that of good veld. Good veld produces two to four times more crude protein per hectare than veld in medium and poor conditions.
- The year-on-year variation in veld production also differs substantially, with good veld’s worst production not much lower than the best production off poor veld. The drier the year, the greater the difference in the feed produced by good and poor veld.

More frequent forage shortages are experienced from poor veld than good veld. The research of Dr Mias van der Westhuizen confirms this (see Table 2). The incidence of artificial droughts, therefore, increases as the condition of the veld deteriorates. An artificial drought is brought about by a shortage of grazing due to the poor condition of the veld and not limited rainfall.

- The icing on the cake is that veld in good condition yields better profit margins per hectare than veld in poorer condition. In a 1987 study, Moore and Odendaal compared the profitability of veld under different conditions. For every R100 profit per hectare on good veld, the profit generated from average and poor veld only amounted to R64/ha and R18/ha, respectively.

**Table 2: The probability of feed shortages given different veld conditions**

(M van der Westhuizen, 2020)

	PROBABILITY OF FEED SHORTAGES GIVEN DIFFERENT VELD CONDITIONS			
	EXCELLENT	GOOD	FAIR	POOR
Central Free State (550mm)	5%*	10%	48%	99%
Kuruman (420mm)	22%*	33%	56%	87%
Upington (200mm)	27%*	45%	69%	98%

**\*This figure represents the inherent climatological risk for drought**

The “take-home” message is thus, the better the condition of the veld, the higher and more stable the forage produced, and the better the quality of the fodder, and its drought tolerance, all of which eventually led to increased profitability. Good veld is the best insurance against the temperamental nature of a variable climate. ■

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