

Hydrological Qualification of Environmental Restoration

A case study in the Baviaanskloof, South Africa

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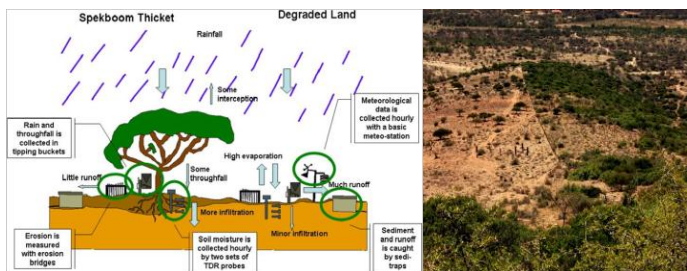
History of Land degradation

The Baviaanskloof in South Africa is highly degraded. The PRESENCE network is guiding the process that should cut through the negative circle of further degradation and at the same time ensure that all the inhabitants can support their Livelihoods. The introduction of Payment for Ecosystem Services (PES) is one of the strategies followed to stimulate local actors towards better land management and ecology restoration activities that should result in new sources of income.

One of the services is to improve the water availability and quality by reducing the peak flows and increasing the base flow by better land management, by among others replanting Spekboom trees to restore the original subtropical thicket. The quantity and values of these services to downslope water users have to be investigated before payment system can be set in place. **The here presented research is focussed on the quantification of effective precipitation; its infiltration and runoff.**

The Monitoring Plot

The monitoring site is located at a fence line contrast between land, which is still grazed and land, which does not experience grazing for the last 25 years and has many clumps of large Spekboom thicket.

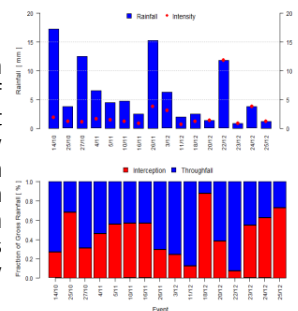


- Rainfall & interception dynamics (6 tipping buckets)
- Soil moisture profiles (6 tube & 4 handheld TDR)
- Runoff events (18 Gerlach troughs over six locations)
- Erosion rates (mobile erosion bridge)

Results

1) High Interception Rate and Low Runoff

Recent findings from the monitoring site shows that Spekboom has a high canopy storage. This affects the percentage of interception. Mediterranean shrubs are known to be great interceptors with 25% intercepted rainfall, but Spekboom actually intercepts 33%. This means that 67% of the rain will finally reach the soil to infiltrate. It is not clear how important the stemflow is in this process, since different data sets give different results. From the water that reaches the soil, runoff from Spekboom shrubs is minor in respect to degraded land, decreasing with approximately 60%.



The Benefits of Spekboom

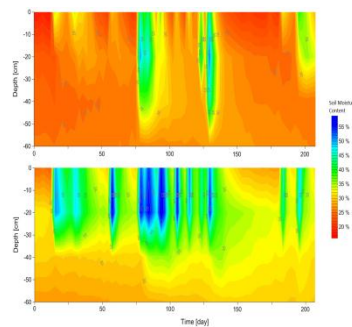
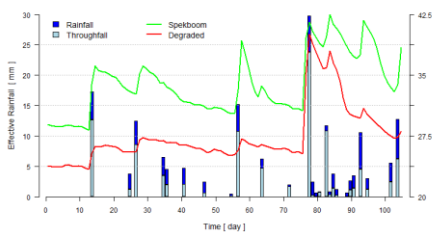
The plant that is used to restore the landscape of the Baviaanskloof has been carefully chosen. Spekboom (*Portulacaria afra*) is a succulent, forming dense evergreen shrublands. Besides its positive effect on water resources, it also meets with other key criteria, that are unique for Spekboom:



- It is an indigenous species, already covering extensive areas in the Baviaanskloof;
- It is relatively fast growing and easy to propagate;
- It stands harsh environments, like rocky ground and droughts;
- It is a favourable plant for game browsing;
- Due to special carbon pathways, the plant is a major carbon sequester;
- The canopy provides much shade and nutrients (litter fall) for other species to germinate.

2) Soil Moisture and Stream flow

Soils underneath Spekboom have a higher water content than the degraded soils. Data from handheld TDR probes show a three times wetter profile when Spekboom is present. Moreover, degraded soil shows typical flushing events, in which the soil is only flushed during a rainfall, while soils do not remain wet. With a substantial lower runoff and a wetter soil profile, it can be concluded that less water is directly lost resulting in lower down stream peak flows.



Parameter	Spekboom	Degraded	Difference
Gross Rainfall	100 %	100 %	0 %
Interception	33 %	5 %	+ 28 %
Effective Rainfall	67 %	95 %	- 28 %
Runoff	7 %	39 %	- 32 %
Infiltration	60 %	56 %	+ 4 %

Conclusions and Practical Implications

From this preliminary data, it is shown that high interception rates decrease runoff substantially. Despite this high interception rate, more water is taken up by the soil and captured within the local natural eco-system. Environmental restoration thus improves the local water balance and reduce down stream peak flows. Hopefully these results will trigger more system analysis of ecological restoration over the world, therewith giving extra input to carry out more restoration projects and acquiring funds for them.



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