# Landscape Literacy: Addressing Critical Ecohydrology Issues within their Drainage Ecosystem Context

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Through the Southern African Science Service Centre for Climate Change and Adaptive Land Use (SASSCAL) a project has been instigated that fortuitously integrates conventional site-based grazing management and research (Snyman 2005) with drainage ecosystem ecology in order to address rangeland dehydration issues that affect most valuable rangelands in most rangelands globally. What is often overlooked in conventional rangeland management is the fact that any landscape incision, be it a track, an animal path or major road culvert provides the nickpoint for accelerating headward incision and rangeland dehydration that can occur in even the best managed veld (Cooke and Reeves 1976; Pringle and Tinley 2003; Pringle, Zimmerman et al. 2011). Landscape Literacy (Task 41 of Southern African Science Service Centre for Climate Change and Adaptive Land Use (SASSCAL)) aims to study these issues in more detail with case studies in Namibia (at least as a starting point). The impetus of this work is the downward spiralling Rain Use Efficiency of Namibian rangelands in both commercial and communal lands where landscape incision ("nickpoints") accelerate the flow of water out of local landscapes into an induced "canal" system (Pringle, Zimmerman et al. 2011).

If climate change projections are accurate –even as tentatively expressed as they are currently – extremes of dry and flooding are likely. Adaptation (acting locally to be prepared for changes) will be critical. In such circumstances it is important that existing breached base levels are restored and landholders, Government, road grader operators, miners and other land users are made aware that their activities can have an extreme negative impact on the drainage ecosystem in which they live or work. That is, existing breaches of drainage ecosystems need to be re-plugged or filtered (depending on issues of energy of flows and cost-effectiveness). As importantly, conventional land management practices that incise the landscape need to be halted so that there aren't ever expanding nickpoint initials for further accelerated rangeland draining. Let's get raindrops into the soil as close to where they land as possible. Clearly, good grazing management can enhance local infiltration of raindrops, but in some cases even the healthiest rangelands can be destroyed by gullies that draw water to them in an inexorable downward spiral.

Sometimes grazing management is not enough to restore breached catchment ecosystems. What isn't widely appreciated is that gully heads obey the laws of physics and while they are often prominent in historically severely degraded areas, they can equally etch into and drain locally very healthy veld (Tinley 1977). Cattle are a major culprit of landscape incision and gully (donga) development because they have a habit of traversing land in single file when not grazing. This is particularly so where cattle graze year round without any recovery period. Thus the location of watering points that are visited regularly can be a key component of landscape incision; cattle are particularly efficient at grazing for least effort – along the drainage alley (Pringle, Watson et al. 2006). However, in well managed rangelands where landscapes have ample recovery time between grazing periods, cattle paths recover between grazing episodes (Purvis 1986). It is fortuitous then that the Polytechnic of Namibia (PoN) and the Integrated Rural Development and Nature Conservation (IRDNC) are partners in this research given their common interests in landscape scale management issues. While the PoN will develop educational materials and processes for use in both landholder and "expert" fields, IRDNC will be at the forefront of linking grazing management strategies to rangeland rehydration in communal areas (as well as contributing to the educational materials). In the latter case, the culprits (cattle) may well be a key part of the solution in levelling gully heads and preparing soil surfaces ready to respond to rain. This approach was already taken during the first fieldwork of this project when various restoration activities were conducted by 41 PoN students at farm Krumhuk. These included the construction of:

(1) a kraal around a large gully head, into which cattle were herded for two successive nights to trample down and smoothen the steep gully walls while fertilizing the soil (Figures 1 and 2);
(2) strategically placed filters in rills and gully heads, comprising branches of thorn bushes tied down with wire secured to nearby trees or steel posts hammered into the ground (Figure 3);
(3) suspended filters across pinch points in gullies where fierce water flow can be calmed down as it lifts the hanging branches while flowing underneath without ripping them off the wire (Figure 4).

In addition, a patch of thick bushes was cleared from a critical position at the head of an alluvial fan to encourage runoff water to once again spread out over a large grassy plain instead of rushing down a gully, now partially blocked by a dense filter. The damage caused by grader drivers who divert water runoff on tracks down steep spoon drains was also demonstrated, while the correct procedures for track construction were explained for minimising disruption of water flow across the landscape.

We are very keen to collaborate with other groups looking to rehydrate rangelands and maintain quickly declining natural grasslands in previously seasonally inundated landscapes. There are already plans to seek funding for a group of Australian Aboriginal cattlemen to visit Herero and other counterparts to see how cattle and rangelands are managed.

Figure 1. A pick is used to break down steep gully heads to avoid injury of cattle.

Figure 2. Cattle further smoothen gully heads while preparing a seed bed and fertilizing the soil.

Figure 3. A filter of thorn bushes was tied down at a gully head.

Figure 4. A filter is suspended from wire tied across a gully.

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