

# Comparing constructed contour banks with Vetiver System

Erosion is a dynamic process that cannot be permanently controlled by static measures such as retainer walls, banks, gabions etc. which can all be destroyed by extreme weather events and earthquakes. Vetiver System is a natural dynamic system totally unaffected by the above. It is highly suitable for nearly all areas in Kenya, to mitigate damage of floods and droughts. The system supports withstands the heaviest tropical storms without losing its integrity. It supports water infiltration, protecting slopes, also on infrastructure.

The constructed system of soil conservation was designed in the 1930s for low rainfall areas in the USA that had been over-cultivated and had started to 'blow'. They were designed to handle 300-500mm of *annual* rainfall (with low intensity rains), and not intended for the tropics! **The constructed system for soil or moisture conservation has no place in the tropics**, for a start it is un-natural, soil structures cannot withstand tropical storms and have to be rebuilt at great cost to the farmer. Over time they cause more erosion than they prevent. Constructed banks 'sit' on the ground they are made on, they are not anchored like vetiver hedges and consequently can be easily breached and destroyed. And, reinforcing contour banks by planting vetiver hedges *on top* of them can only be described as totally nonsense. Below table summarises reasons why the constructed system does not work in tropical, subtropical and semi-arid areas, and why Vetiver hedges offer the best alternative; combining its excellent performance for soil & water conservation with its added values warrants its promotion on-farm.

Constructed contour bank ('fanya juu')

Vetiver semi-permeable hedge

Earth bank, or bund  
5 meters

Over time, the bank "melts"

Vetiver grass  
30 centimeters

Over time, a natural terrace forms

Runoff Rain

Earth banks

Waterway

Runoff Rain

Vegetative hedges

Left: the bank was broken; right: below this, a gully develops.

	<b>Constructed contour banks</b>	<b>Vetiver hedges</b>
<b>Farmers' cost/benefit: labour, expertise, land, soil &amp; water, crops</b>	<p><b>ESTABLISHMENT</b></p> <ul style="list-style-type: none"> <li>- requires (training on) proper contour measuring (use of hand-level or A-frame), possibly by an engineer to get levels correct, and banks to spill into safe outlet</li> <li>- is laborious, time consuming, particularly hard when the subsoil is compact/dry: it needs earth moving equipment, and labour &amp; plants to vegetate the banks.</li> </ul> <p><b>MAINTENANCE</b> MUST be done: over time the banks 'melt' and need reconstruction; this is too costly and laborious for subsistence farmers, and a constant source of expense.</p> <p><b>WATER</b></p> <ul style="list-style-type: none"> <li>- neither 'fanya juu' or 'fanya chini' can retain as much moisture for the crop as Vetiver hedges; with heavy rains the banks divert excess water off the farm, and soil is carried along with that. Excess water is not given a chance to soak into the soil for benefit of the crop</li> <li>- if in excess, water is held in 'puddles' (if 'fanya chini'), out of reach for the crop</li> <li>- accumulation from heavy rains causing structures to break; contours typically are not exact, top of constructed banks never stays 'level', always a low point for water to top over and destroy the whole system → crop damage, gullies, topsoil loss.</li> </ul> <p><b>SPACE</b></p> <ul style="list-style-type: none"> <li>- earthen structures are altogether wider than Vetiver hedges (taking space)</li> <li>- farmers rarely allow the spacing required; once filled up, increasing height is required else erosion will re-occur</li> <li>- drains also require (farm) space</li> <li>- drainage requires consent of neighbouring farmers to have diversion banks run through their farms to a <i>safe</i> outlet</li> <li>- sharp contour bends are a nuisance for animal or mechanic contour ploughing.</li> </ul> <p><b>FERTILITY</b> is taken away from the crop, to construct, as less fertile sub-soil is often hard (fertile topsoil is more easily available).</p> <p><b>SIDE-EFFECTS</b> of banks are that they harbour crop destroying rodents.</p>	<p><b>ESTABLISHMENT</b></p> <ul style="list-style-type: none"> <li>- relatively easy in rain-fed farm condition (with reasonable rainfall no watering needed); no engineer needed to address the drainage</li> <li>- no need to exactly follow contours, hedges cannot break (straighter lines, easier contour ploughing)</li> <li>- propagation takes time and planning initially (a constraint*), but when a hedge is well established, planting material can be removed from there.</li> </ul> <p><b>MAINTENANCE</b> decreases with time: established hedges (gaps filled!) are pruned from 8-12 months.</p> <p><b>Fodder production requires regular pruning</b> (every 4-8 weeks), otherwise twice yearly.</p> <p><b>WATER</b></p> <ul style="list-style-type: none"> <li>- semi-permeable Vetiver hedges will become increasingly effective over time: <ul style="list-style-type: none"> <li>i) slowing down water, <b>accumulating and re-distributing water above the hedge</b></li> <li>ii) <b>withstanding extreme water flow</b>: stems bend, massive root system ensures anchorage</li> <li>iii) allowing water to pass through the hedge at slower speed, spreading it out over the slope</li> <li>iv) creating a terrace by gradually decreasing the slope → decreased velocity between hedgerows → <b>more infiltration above and below the hedge → higher yield, less vulnerable to drought</b></li> <li>v) breaking through hard pans, further enhancing infiltration along the entire length of the hedge.</li> </ul> </li> </ul> <p><b>SPACE</b></p> <ul style="list-style-type: none"> <li>- no drains (space) required: excess water passing the hedge at slower speed, thus also enhancing infiltration below the hedge</li> <li>- where farms are very small in size (e.g. in Kisii) the hedges can be established on farm boundaries instead of following contours</li> <li>- hedge width is 1-1½m; crops can be planted closely along the hedge, as roots grow only down.</li> </ul> <p><b>BY-PRODUCTS and SIDE-EFFECTS</b></p> <ul style="list-style-type: none"> <li>i) mulch, windbreak, better farm micro-climate</li> <li>ii) harbouring predator insects to improve the balance in no-till situations</li> <li>iii) hedges repel rodents, results in fewer snakes</li> <li>iv) pulling 'Chilo' stem borer away from maize</li> <li>v) off-farm: fodder, handicraft, thatch, ropes, pest-proof mattress stuffing, and selling Vetiver slips!</li> </ul>
<b>Water-shed cost / benefit:</b>	<p><b>EXCESS WATER</b></p> <ul style="list-style-type: none"> <li>- accumulated from earthen structures into drainage, when allowed to speed down 'unchecked', exacerbates gully formation and <b>flash floods</b>, damage to infrastructure</li> <li>- needs safe outlet, often waterway construction: the most vulnerable part of the system (usually running straight down, prone to gully erosion - must never be cultivated or will erode faster</li> <li>- not given a chance to infiltrate, it will not contribute to aquifer recharge.</li> </ul>	<p><b>INCREASED INFILTRATION:</b></p> <ul style="list-style-type: none"> <li>- groundwater recharge → better spring flow, wetlands restoration → improved stream/river flow</li> <li>- reduced sheet erosion and gully formation</li> <li>- reduced excess water runoff causing flash floods, crop and infrastructure damage</li> <li>- reduced sediment flow downstream → improved aquatic conditions, sediment reduction in riverbeds, reservoirs, lakes, dams, and where applicable reduced sediment flow to coastal marine ecology</li> </ul>
<b>Critical conditions for adoption</b>	<ul style="list-style-type: none"> <li>- contour measuring skills &amp; instruments</li> <li>- planting material for the banks</li> <li>- initial labour investment is constraint</li> </ul>	<ul style="list-style-type: none"> <li>- understanding how VS works and correctly apply it (spacing max.15cm) to form a tight hedge</li> <li>- multiplication, establishment (design) and maintenance: know how on gap filling, pruning, ..</li> </ul>

\*: In Ethiopia in some cases a constructed ridge/ditch is made as temporary measure: to collect water assist Vetiver establishment. After establishment of Vetiver these structures are redundant and can be ploughed over for farming.