Fanya juu terraces
Kenya - Fanya Juu

Terrace bund in association with a ditch, along the contour or on a gentle lateral gradient. Soil is thrown on the upper side of the ditch to form the bund, which is often stabilised by planting a fodder grass.

Fanya juu (‘throw it upwards’ in Kiswahili) terraces comprise embankments (bunds), which are constructed by digging ditches and heaping the soil on the upper sides to form the bunds. A small ledge or ‘berm’ is left between the ditch and the bund to prevent soil sliding back. In semi-arid areas, fanya juu terraces are normally constructed on the contour to hold rainfall where it falls, whereas in subhumid zones they are laterally graded to discharge excess runoff. Spacing is according to slope and soil depth (see technical drawing). For example, on a 15% slope with a moderately deep soil, the spacing is 12 m between structures and the vertical interval around 1.7 m. The typical dimensions for the ditches are 0.6 m deep and 0.6 m wide. The bund has a height of 0.4 m and a base width of 0.5-1 m. Construction by hand takes around 90 days per hectare on a typical 15% slope, though labour rates increase considerably on steeper hillsides because of closer spacing of structures. The purpose of the fanya juu is to prevent loss of soil and water, and thereby to improve conditions for plant growth. The bund created is usually stabilised with strips of grass, often napier (Pennisetum purpureum), or makarikari (Panicum coloratum var. makarikariensis) in the drier zones. These grasses serve a further purpose, namely as fodder for livestock. As a supportive and supplementary agroforestry measure, fruit or multipurpose trees may be planted immediately above the embankment (eg citrus or Grevillea robusta), or in the ditch below in drier areas (eg bananas or pawpaws), where runoff tends to concentrate. As a consequence of water and tillage erosion, sediment accumulates behind the bund, and in this way fanya juu terraces may eventually develop into slightly forward-sloping (or even level) bench terraces. Maintenance is important: the bunds need annual building-up from below, and the grass strips require trimming to keep them dense. Fanya juu terraces are associated with hand construction, and are well suited to small-scale farms where they have been used extensively in Kenya. They first came into prominence in the 1950s, but the period of rapid spread occurred during the 1970s and 1980s with the advent of the National Soil and Water Conservation Programme. Fanya juu terraces are spreading throughout Eastern African, and further afield also.

**Classification**

**Land use problems:**
- Low and erratic rainfall, soil erosion, surface sealing, water loss through runoff, low soil fertility as well as shortage of land and thus a need to conserve resources. (expert’s point of view)
- Low and erratic rainfall. Soil erosion. Soil sealing. Water losses through runoff. Low fertility and land shortage. (land user’s point of view)

<table>
<thead>
<tr>
<th>Land use</th>
<th>Climate</th>
<th>Degradation</th>
<th>Conservation measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual cropping</td>
<td>subhumid</td>
<td>Soil erosion by water: loss of topsoil / surface</td>
<td>Structural</td>
</tr>
<tr>
<td>rainfed</td>
<td>semi-arid</td>
<td>erosion, Water degradation: aridification</td>
<td></td>
</tr>
</tbody>
</table>

*Location: Eastern Province*

*Region: Eastern Province*

*Technology area: 3000 km²*

*Conservation measure: structural*

*Stage of intervention: mitigation / reduction of land degradation*

*Origin: Developed through land user’s initiative, traditional (>50 years ago)*

*Land use type: Cropland: Annual cropping*

*Climate: subhumid, semi-arid, tropics*

*WOCAT database reference: TKEN005en*

*Related approach: Catchment approach (KEN01)*

*Compiled by: Not registered*

*Date: 1995-06-27*

*Contact person: Donald Thomas, Ministry of Agriculture, Nairobi, Kenya;*
### Stage of intervention
- Prevention
- Mitigation / Reduction
- Rehabilitation

### Origin
- Land users initiative: traditional (>50 years ago)
- Experiments / Research
- Externally introduced
- Agricultural advisor
- Land user

### Main causes of land degradation:
Direct causes - Human induced: over-exploitation of vegetation for domestic use, other human induced causes, Agricultural causes
Indirect causes: poverty / wealth

### Main technical functions:
- control of dispersed runoff: retain / trap
- reduction of slope angle
- reduction of slope length
- increase of infiltration
- increase / maintain water stored in soil

### Secondary technical functions:

### Environment

#### Natural Environment

<table>
<thead>
<tr>
<th>Average annual rainfall (mm)</th>
<th>Altitude (m a.s.l.)</th>
<th>Landform</th>
<th>Slope (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 4000 mm</td>
<td>&gt; 400</td>
<td>plateau / plains</td>
<td>flat</td>
</tr>
<tr>
<td>3000-4000 mm</td>
<td>3000-4000</td>
<td>ridges</td>
<td>gentle</td>
</tr>
<tr>
<td>2000-3000 mm</td>
<td>2000-2500</td>
<td>mountain slopes</td>
<td>moderate</td>
</tr>
<tr>
<td>1500-2000 mm</td>
<td>1500-2000</td>
<td>hill slopes</td>
<td>rolling</td>
</tr>
<tr>
<td>1000-1500 mm</td>
<td>1000-1500</td>
<td>footslopes</td>
<td>hilly</td>
</tr>
<tr>
<td>750-1000 mm</td>
<td>500-1000</td>
<td>valley floors</td>
<td>steep</td>
</tr>
<tr>
<td>500-750 mm</td>
<td>&lt; 100</td>
<td></td>
<td>very steep</td>
</tr>
<tr>
<td>250-500 mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 250 mm</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Soil depth (cm)
- 0-20
- 20-50
- 50-80
- 80-120
- >120

Growing season(s): 180 days (Mar - Aug), 150 days (Oct - Feb)

Soil texture: medium (loam)

Soil fertility: medium, low

Topsoil organic matter: medium (1-3%), low (<1%)

Soil drainage/infiltration: good, medium

Soil water storage capacity: medium

### Human Environment

<table>
<thead>
<tr>
<th>Cropland per household (ha)</th>
<th>Population density: 100-200 persons/km²</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.5</td>
<td></td>
</tr>
<tr>
<td>0.5-1</td>
<td></td>
</tr>
<tr>
<td>1-2</td>
<td></td>
</tr>
<tr>
<td>2-5</td>
<td></td>
</tr>
<tr>
<td>5-15</td>
<td></td>
</tr>
<tr>
<td>15-50</td>
<td></td>
</tr>
<tr>
<td>50-100</td>
<td></td>
</tr>
<tr>
<td>100-500</td>
<td></td>
</tr>
<tr>
<td>500-1,000</td>
<td></td>
</tr>
<tr>
<td>1,000-10,000</td>
<td></td>
</tr>
<tr>
<td>&gt;10,000</td>
<td></td>
</tr>
</tbody>
</table>

Annual population growth: 2% - 3%

Land ownership: individual, not titled, individual, titled

Land use rights: individual

Relative level of wealth: average, which represents 50% of the land users; 60% of the total area is owned by average land users

Importance of off-farm income: 10-50% of all income: from local employment, trade and remittances - this depends very much on the location: the nearer a large town, the greater the importance of off-farm income

Market orientation: subsistence (self-supply), mixed (subsistence and commercial)

Mechanization: animal traction

Livestock grazing on cropland:
Implementation activities, inputs and costs

**Establishment activities**
- Digging planting holes for grass.
- Planting grasses.
- Creating splits of planting materials (of vegetatively propagated species)
- Manuring (of napier grass and fruit trees)
- Transporting
- Levelling and compacting bund.
- Layout (alignment and spacing) of terraces either on the contour
- Tilling soil to loosen for excavation
- Digging ditch/trench and throwing the soil upwards to make the bund

**Establishment inputs and costs per ha**

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Costs (US$)</th>
<th>% met by land user</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour</td>
<td>270.00</td>
<td>100%</td>
</tr>
<tr>
<td>Equipment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- tools</td>
<td>20.00</td>
<td>100%</td>
</tr>
<tr>
<td>Agricultural</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- compost/manure</td>
<td>10.00</td>
<td>100%</td>
</tr>
<tr>
<td>- Grass splits</td>
<td>20.00</td>
<td>100%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>320.00</strong></td>
<td><strong>100.00%</strong></td>
</tr>
</tbody>
</table>

**Maintenance/recurrent activities**
- Gapping of grass
- Burning of Makarikari
- Manuring of napier grass.
- Maintaining grass strips weed-free and dense.
- Cutting grass strips to keep low and non-competitive, and provide
- Filling up low places on the bund and repairing breaches
- Building up bund

**Maintenance/recurrent inputs and costs per ha per year**

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Costs (US$)</th>
<th>% met by land user</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour</td>
<td>30.00</td>
<td>100%</td>
</tr>
<tr>
<td>Equipment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- tools</td>
<td>5.00</td>
<td>100%</td>
</tr>
<tr>
<td>Agricultural</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- compost/manure</td>
<td>3.00</td>
<td>100%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>38.00</strong></td>
<td><strong>100.00%</strong></td>
</tr>
</tbody>
</table>

Remarks:
Stoniness, slope, labour cost
These calculations are based on a 15% slope (with 830 running metres of terraces per hectare) with typical dimensions and spacing: according to table and drawing above. In some areas tools are supplied free - but this is normally just for demonstration plots and is not included in this calculation.

Assessment
Impacts of the Technology

Production and socio-economic benefits

- + + increased crop yield
- + + increased wood production
- + + increased farm income
- + + fodder production/quality increase

Production and socio-economic disadvantages

- + + loss of land
- + + increased labour constraints
- + + increased input constraints
- + + awkward to walk/carry burdens through the field

Socio-cultural benefits

- + + community institution strengthening
- + + improved conservation / erosion knowledge
- + + national institution strengthening

Socio-cultural disadvantages

Ecological benefits

- + + increased soil moisture
- + + improved excess water drainage
- + + reduced soil loss

Ecological disadvantages

Off-site benefits

- + + reduced downstream siltation
- + + reduced downstream flooding
- + + increased stream flow in dry season

Off-site disadvantages

Contribution to human well-being / livelihoods

Benefits /costs according to land user

<table>
<thead>
<tr>
<th>Benefits compared with costs</th>
<th>short-term:</th>
<th>long-term:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establishment</td>
<td>slightly negative</td>
<td>positive</td>
</tr>
<tr>
<td>Maintenance / recurrent</td>
<td></td>
<td>very positive</td>
</tr>
</tbody>
</table>

Acceptance / adoption:

30% of land user families (50000 families; 30% of area) have implemented the technology with external material support. Estimates.

70% of land user families (100000 families; 70% of area) have implemented the technology voluntary. There is moderate trend towards (growing) spontaneous adoption of the technology. There is some growing spontaneous adoption outside the area due to recognition of the benefits by farmers. This is especially so through women’s groups. Within the area specified, Machakos District, almost all cropland is terraced.

Concluding statements

Strengths and → how to sustain/improve

- Control runoff and soil loss → Ensure good design, maintenance of structures and adapt design to local conditions.
- Storage of water in soil for crops → Ensure good design, maintenance of structures and adapt design to local conditions.
- Maintenance of soil fertility → Ensure good design, maintenance of structures and adapt design to local conditions.
- Increased value of land → Ensure good design, maintenance of structures and adapt design to local conditions.

Weaknesses and → how to overcome

- Loss of cropping area for terrace bund → Site-specific implementation: only where fanya juu terraces are absolutely needed, i.e., agronomic (e.g., mulching, contour ploughing) and vegetative measures are not sufficient in retaining/diverting runoff.
- High amounts of labour involved for initial construction → Spread labour over several years and work in groups.
- Risk of breakages and therefore increased erosion → Accurate layout and good compaction of bund.
- Competition between fodder grass and crop → Keep grass trimmed and harvest for livestock feed.