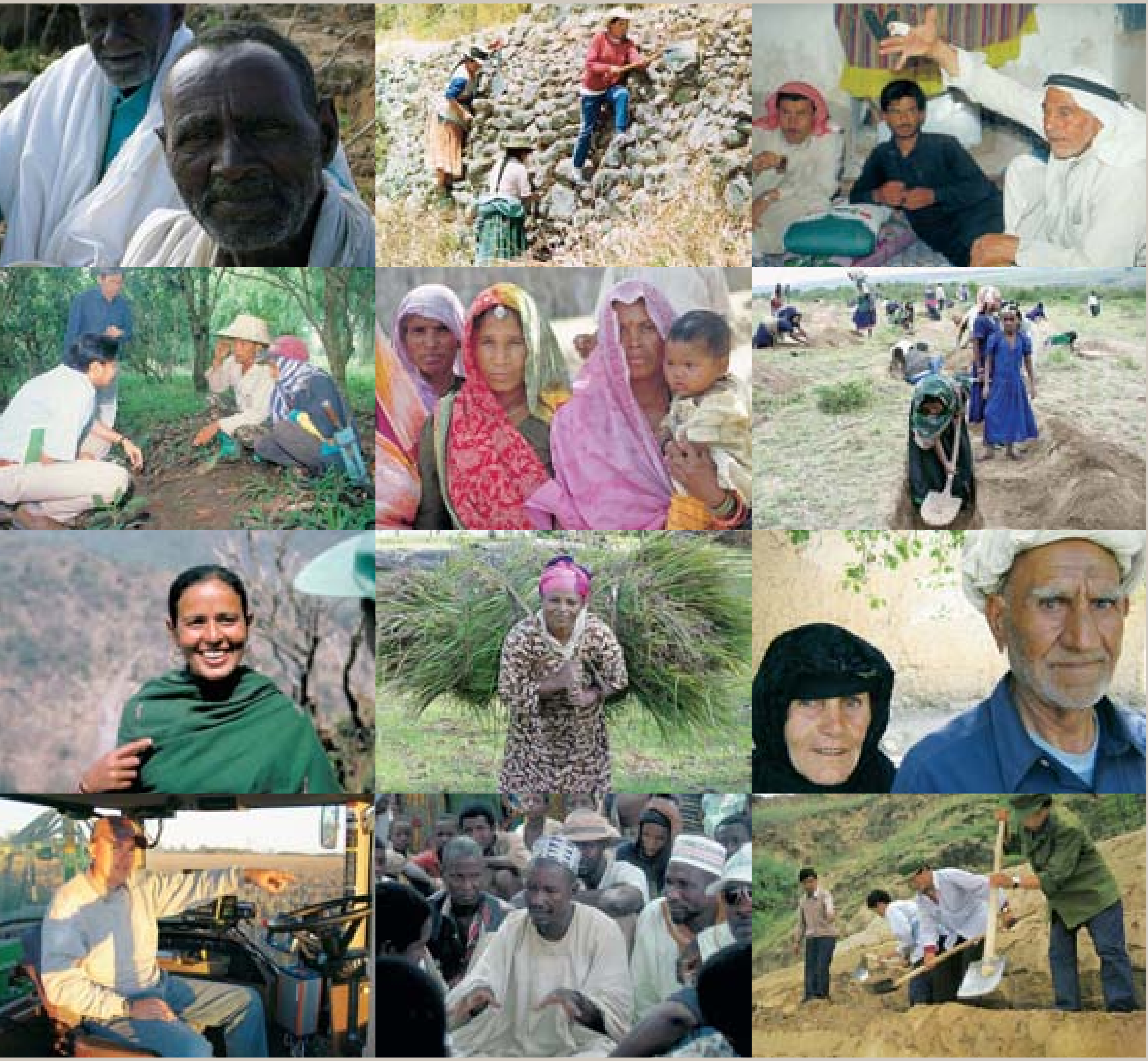
where the land is greener

case studies and analysis of soil and water conservation initiatives worldwide

WOCAT

World Overview of Conservation Approaches and Technologies



land users leading the way in making the land greener

left: A two-year old, well established NVS on a 35% slope: the NVS here have developed into forward sloping terraces. Note that contour ploughing is practiced between the strips. (Agustin Mercado, Jr)
right: These recently established NVS are clearly laid out along the contour. (Bony de la Cruz)

Natural vegetative strips

Philippines

Within individual cropland plots, strips of land are marked out on the contour and left unploughed in order to form permanent, cross-slope barriers of naturally established grasses and herbs.

Natural vegetative strips (NVS) are narrow live barriers comprising naturally occurring grasses and herbs. Contour lines are laid out with an A-frame or through the 'cow's back method' (a cow is used to walk across the slope: it tends to follow the contour and this is confirmed when its back is seen to be level). The contours are then pegged to serve as an initial guide to ploughing. The 0.3–0.5 m wide strips are left unploughed to allow vegetation to establish. Runoff flowing down the slope during intense rain is slowed, and infiltrates when it reaches the vegetative strips. Eroded soil collects on and above the strips and natural terraces form over time. This levelling is assisted by ploughing along the contour between the NVS – through 'tillage erosion' – which also moves soil downslope.

The vegetation on the established NVS needs to be cut back to a height of 5–10 cm: once before planting a crop, and once or twice during the cropping period. The cut material can be incorporated during land preparation, applied to the cropping area as mulch, or used as fodder. This depends on whether the farmer has livestock or not, on personal preference, and on the time of cutting. If the grass is applied as mulch or incorporated, the technology can be considered to be an agronomic, as well as a vegetative, measure.

NVS constitutes a low-cost technique because no planting material is required and only minimal labour is necessary for establishment and maintenance. Some farmers had already practiced the technology for several years before the intervention of the ICRAF (The World Agroforestry Centre) in 1993. ICRAF came to realise that farmers here preferred NVS to the recommended 'contour barrier hedgerows' of multipurpose trees – which land users viewed as being too labour intensive. When farmers became organised into 'Landcare' groups, NVS began to gain wide acceptance.

Land users appreciate the technique because it effectively controls soil erosion and prevents loss (through surface runoff) of fertilizers applied to the crop. As an option, some farmers plant fruit and timber trees, bananas or pineapples on or above the NVS. This may be during establishment of the contour lines, or later. The trees and other cash perennials provide an additional source of income, at the cost of some shading of the adjacent annual crops.

Location: Misamis Oriental and Bukidnon, Philippines
Technology area: 110 km^2
SWC measure: vegetative
Land use: cropland
Climate: humid
WOCAT database reference: QT PHI03
Related approach: Landcare, QA PHI04
Compiled by: Jose Rondal, Quezon City, Philippines & Agustin Mercado, Jr, Claveria, Misamis Oriental, Philippines
Date: October 1999, updated June 2004

Editors' comments: Contour grass strips within cropland can be found worldwide: the difference in this example is that the grass/herb mixture isn't planted – hence the name. Natural vegetative strips are also preferred here to 'contour barrier hedgerows' of densely planted multipurpose trees – a research recommendation that farmers view as too labour demanding.

Classification

Land use problems

Loss of topsoil through sheet erosion and rills, leading to rapid soil fertility decline. In turn soil fertility decline results in the need for increasing levels of fertilizer inputs to maintain crop yield. However, these fertilizers are often washed away by surface runoff – a vicious circle.

Land use

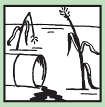
annual crops: maize, vegetables

Climate

humid

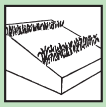
Degradation

water erosion: loss of topsoil, gully

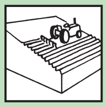


chemical: fertility decline

SWC measures



vegetative: narrow grass barriers



agronomic: contour plough, mulching (supp.)

Technical function/impact

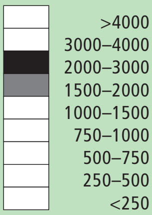
main:
- control of dispersed runoff
- reduction of slope angle
- reduction of slope length

secondary:
- increase of infiltration
- increase in soil fertility
- improvement of ground cover

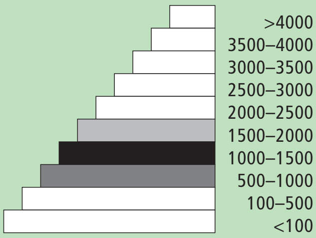
Environment

Natural environment

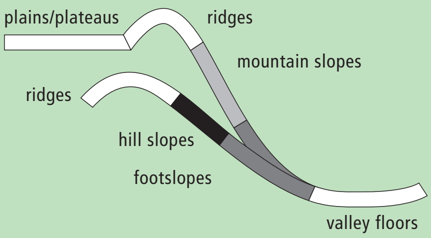
Average annual rainfall (mm)



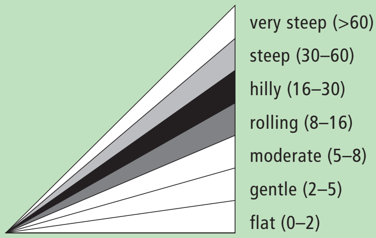
Altitude (m a.s.l.)



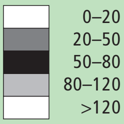
Landform



Slope (%)



Soil depth (cm)

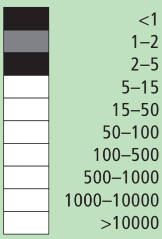


NB: soil properties before SWC

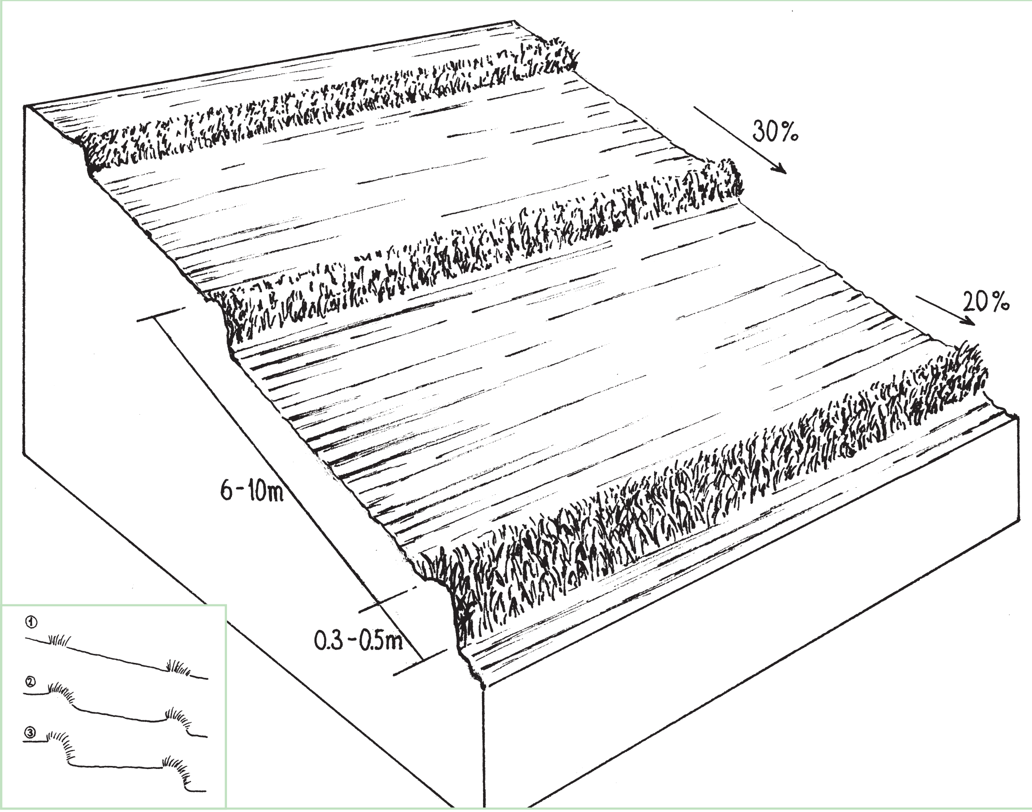
Growing season: 240 days, (May to December)
Soil fertility: mostly low, strongly acid and with high P fixing capacity
Soil texture: mostly medium (loam), some fine (clay)
Surface stoniness: mostly no stone, partly stony
Topsoil organic matter: mostly low (<1%), partly medium (1–3%), rapid organic matter mineralisation due to high temperature
Soil drainage: generally good except in depressions
Soil erodibility: medium to high

Human environment

Cropland per household (ha)



Land use rights: mainly individual, partly leased
Land ownership: mainly individual titled, partly individual not titled
Market orientation: mixed (subsistence and commercial)
Level of technical knowledge required: field staff/extension worker: moderate, land user: moderate
Importance of off-farm income: 10–50% of all income: carpentry, trade, business, labour for neighbouring farms with intensive agricultural activities (eg vegetable production)



Technical drawing
Spacing of natural vegetative strips depends on the slope. The insert shows the evolution of terraces over time through tillage and soil erosion, leading to accumulation of sediment behind the strips (steps 1–3).

Implementation activities, inputs and costs

Establishment activities

1. Layout of contours with the use of an A-frame (or cow's back method: see description) during the dry season before land preparation, placing wooden pegs along the contours.
2. Initial ploughing along the contour: leaving unploughed strips.

Duration of establishment: 1 year

Establishment inputs and costs per ha

Inputs	Costs (US$)	% met by land user
Labour (5 person days)	15	100%
Equipment		
- Animal traction (32 hours)	40	100%
- Tools (2): Plough and harrow	25	100%
- Stakes (pegs)	4	100%
TOTAL	**84**	**100%**

Maintenance/recurrent activities

1. Slashing grass by manual labour using machete (twice per cropping season; two cropping seasons per year).
2. Spreading the cut materials evenly in the alleys (between strips) as mulch and/or use as fodder for livestock.
3. Ploughing mulch into the soil during normal land cultivation.

Maintenance/recurrent inputs and costs per ha per year

Inputs	Costs (US$)	% met by land user
Labour (12 person days)	36	100%
TOTAL	**36**	**100%**

Remarks: Costs of establishing contours and maintenance by slashing are calculated by total length of NVS. This example is from a typical field with an 18% slope: at an NVS spacing of 5 m, the approximate total linear distance for one hectare is 2,000 m. In this example, the farmer has paid for everything him/herself (see section on acceptance/adoption). Note that the establishment cost is more or less equivalent to the cost of standard land preparation by ploughing. When 'enrichment planting' of the strips is carried out, extra cost for seedlings (of fruit trees for example) and associated labour for planting are incurred.

Assessment

Acceptance/adoption:
50% of the land users (2,000 families out of 4,000) who implemented the technology did so without incentives. The other 50% (a further 2,000) received free crop seeds, breeding animals (eg heifers or just simply technical assistance (eg laying out of contours). All are marginal farmers, who adopted NVS because of its cheapness, ease of maintenance and for environmental protection. A factor that helped was the formation of Landcare associations which have benefited their members in various ways. Non-landowners have not implemented the technology due to insecurity of tenure. There is a strong trend towards spontaneous adoption, especially where Landcare associations are in operation.

Benefits/costs according to land user

Benefits compared with costs	short-term:	long-term:
establishment	positive	very positive
maintenance/recurrent	positive	very positive

Impacts of the technology

Production and socio-economic benefits
- +++ fodder production/quality increase (or biomass as mulch)
- +++ very low inputs required
- ++ farm income increase
- + crop yield increase

Socio-cultural benefits
- +++ improved knowledge SWC/erosion
- ++ community institution strengthening
- ++ national institution strengthening (government line agencies and educational institutions)

Ecological benefits
- +++ soil cover improvement
- +++ soil loss reduction
- +++ soil structure improvement
- + increase in soil moisture
- + increase in soil fertility
- + biodiversity enhancement

Off-site benefits
- ++ reduced river pollution
- + reduced downstream flooding
- + increased stream flow in dry season

Production and socio-economic disadvantages
- − pest sanctuary
- − crop area loss, before NVS can evolve to fodder grasses
- − hinders some farm operations

Socio-cultural disadvantages
none

Ecological disadvantages
- −−− weed infestation due to seed dispersion and grass roots spreading from the NVS to nearby areas (especially with *cogon* grass: *Imperata cylindrica)*

Off-site disadvantages
none

Concluding statements

Strengths and ➜ how to sustain/improve

Easy to establish and maintain ➜ Strengthen farmers associations. Intensify information and education campaign.

Little competition with crops for space, sunlight, moisture and nutrient ➜ Ensure continued regular trimming of vegetative strips and use of these as fodder or mulch.

Low requirement of labour and external inputs ➜ Use only naturally growing grass species.

Effective in reducing soil erosion (by up to 90%) ➜ Adopt other supportive technologies like mulching, zero tillage/minimum tillage, etc.

Weaknesses and ➜ how to overcome

Effect on yield and income is not readily felt, since reduced erosion is not easily translated into increased income or yield ➜ Farmers should have supplementary sources of income (eg livestock). Education about what long-term sustainability means.

Reduction of productive area by approx 10% ➜ Optimum fertilization to offset production loss. Nutrients are conserved under NVS and this will result in the reduction of fertilizer requirement after some years.

Creation of a fertility gradient within the alley (soil is lost from the top of the alley and accumulates above the NVS where fertility then concentrates) ➜ Increased application of fertilizer on the upper part of alley.

Overall increase of production value is low ➜ Land users could ask for subsidy/assistance from Government: eg for fertilizers, establishment of nurseries, free seedlings (for higher value fruit trees).

Key reference(s): Garrity DP, Stark M and Mercado Jr A (2004) Natural Vegetative Strips: a bioengineering innovation to help transform smallholder conservation. pp 263–270 in Barker DH, Watson AJ, Sombatpanit S, Northcutt B and Maglinao AR *Ground and Water Bioengineering for Erosion Control and Slope Stabilisation.* Science Publishers inc. Enfield, USA ■ Stark M, Itumay J and Nulla S (2003) *Assessment of Natural Vegetative Contour Strips for Soil Conservation on Shallow Calcareous Soil in the Central Philippines.* World Agroforestry Centre (ICRAF), Nairobi, Kenya
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