# A Combination of Approaches to Conserve Soil and Water

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*ECHO publications referenced in this document include ECHO Development Notes (EDN), East Africa Notes (EAN), Technical Notes (TN), and ECHO East Africa Symposium (EEAS) presentations. Technical Notes and EDN issues can be found by clicking on the "Publications" tab on ECHO's networking site, ECHOcommunity.org (https://www.echocommunity.org/); East Africa documents and presentations are found by following the "East Africa Center" tab on the main menu.*

## Introduction and History

ECHO recently worked to introduce watershed management in a highly eroded area in communities near ECHO's East Africa Impact Center, and also did the same with Church World Service and MAP International in Karamoja, NE Uganda. The principles and methods used were from East African experiences of the Regional Soil Conservation Unit/SIDA and the World Agroforestry Center (ICRAF), both centered in Nairobi, Kenya. In this issue of EAN, we share what ECHO has gleaned from these outreach initiatives and we demonstrate the approaches used in East Africa which are somewhat different from those of Asia as described on www.ECHOcommunity.org (https://www.echocommunity.org/) under the title, "Sloping Agriculture Land Technology (SALT)."

## Principles

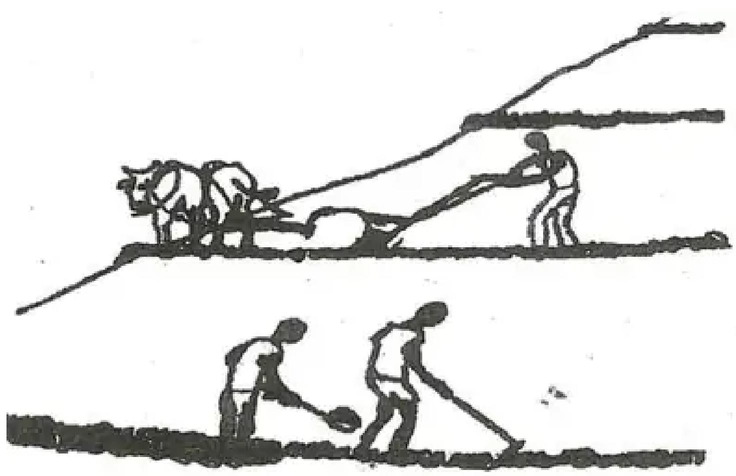
In many areas, soil erosion exceeds 20 tons per hectare each year. Unchecked erosion leads to the formation of gullies, ravines and canyons in agricultural lands, thus making farms un-farmable. However, with proper and timely remedies, farmers can reduce this erosion to zero on their homesteads. An effective approach includes creating natural barriers to soil and water run-off such as contour bunds planted with trees and grasses, combined with conservation agriculture to totally enhance previously degrading farms.

In East Africa, soil conservation techniques that are promoted by the SIDA (Swedish)-funded Regional Land Management Agency (RELMA) and the World Agroforestry Center (ICRAF) differ from the sloping agricultural land technology (SALT) approach proposed by Mindanao Baptist Rural Life Center in the Philippines (*TN* 72 (http://edn.link/salt)). The modified approach includes creation of ditches along the contours by throwing soil below (fanya chini) or above (fanya juu) the contours. The ditches create permeable cross slope barriers with living vegetation, slowing the flow of water and soil down the slope. Other less common alternatives are also promoted across Africa, including some which require more effort to construct. These include bench terraces, micro-catchments such as v- shaped basins below individual trees, semi-circular bunds around trees or planting basins, 'zai' holes, 'mazengo pits', uncultivated grass strips, lines of stone or lines with crop residues. All of these approaches can be enhanced by also using conservation agriculture (CA) methods (see *EAN* 1 (http://edn.link/jaecz9) for more information).

In response to farmers' preferences, African methods differ from SALT methods in a number of ways, perhaps because of the lower total rainfall and the occurrence of sudden deluges which prevail in Africa:

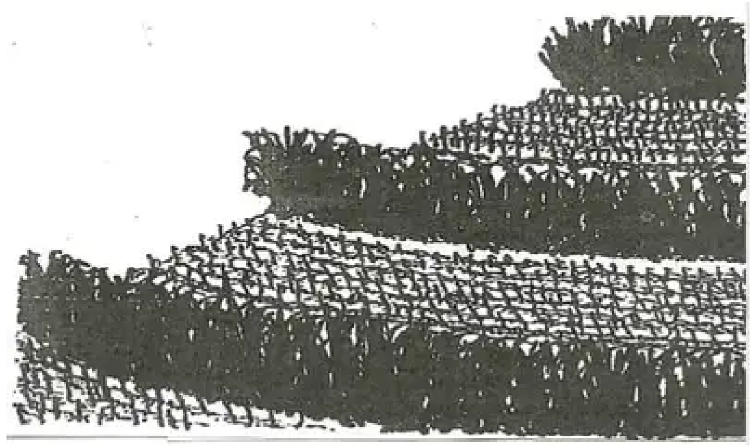
(a) Vertical Intervals (the distances between contours) are recommended in the range of 1.5 to 2 m, instead of the 1 m recommended in the SALT link; this is due to African farmers' reluctance to 'lose land' to contour ridges.

(b) On more level ground, rather than using vertical intervals to measure the distance between hedgerows/contours, people use 'horizontal intervals' between hedgerows which are not less than 10 m and do not exceed 25 m. The Conservation Farming Unit in Zambia recommends horizontal intervals of 10 m by 10 m between Faidherbia albida trees planted within hedgerows/contours, instead of the 5 m strips between tree rows recommended in the SALT link.



(/resources/e08537c9-b69c-4a43-ad53-1bacff749957)(c) Ditches are dug along the contours, 0.5m wide, 0.25 – 0.5 m deep, to catch excessive rainfall and soil. If contours are vulnerable to flooding/overflowing from fields above, (i) cut-off drains are dug at the top boundary of the farms, and (ii) contour ditches are subdivided into sections like long bathtubs not exceeding 20 m in length by backfilling the ditch with a half-meter earth dam within the ditch to prevent water from moving laterally along the ditch. By contrast, the SALT system does not recommend ditch digging, but rather encourages direct sowing of trees and grasses in two rows along the contour lines, and the planting of perennial crops on every third interval between the contours.

(/resources/7a487e5b-1b03-4063-a3d9-10cbce692390)(d) The earth from the ditches is formed into bunds which are then inter-planted with fodder grasses and trees (see below for some suggested species). In this way, the



end result resembles SALT contours. Normal cropping is done in the intervals between the contours/hedgerows.

(e) Line-levels or water rings are used to rapidly and accurately measure contours. With SALT, an A-frame (that takes more time to cover large areas) is recommended.

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**Case Study 1.** Watershed management near ECHO's Impact Center. In July 2012, ECHO opened its East Africa Impact Center under the direction of the author, who is a long-term agricultural development worker in northern Tanzania. Degraded lands surround the Impact Center, both on a seed farm on the opposite side of the road, and in villages surrounding the center. Degradation has been caused by severe water and wind erosion, population pressure and resultant land distribution into small plots, and climate change, which have all contributed to declining crop yields and increasing poverty. The idea of an Impact Center not having any clear impact on close-by neighbors was abhorrent to ECHO staff, and thus ECHO initiated a low-cost training outreach to the seed farm and nearby villages to try to arrest this situation. It has seemed like too little too late, but perhaps very timely in opportunity; torrential rains on two successive afternoons in April 2013 created an unprecedented flood which roared down the slopes of the 12 villages in the catchment. Waters accumulated into a 100m wide river which flowed across local small farms and the seed farm, carrying away hundreds of tons of soil per hectare in the space of an hour.

The rain catchment extends from the slopes of Monduli Mountain to the Mt Meru foothills which make up the village lands. Soils are deep, volcanic and highly fertile, but also highly erosive. During the dry season from June through November, high cattle populations ply the roads in search of water, pulverizing roadbeds and fields. During the rains, unchecked water from fields channels into roads, causing gullies and ravines that ultimately require new road routes to be carved from nearby fields.

In the 1990s, a SIDA-funded soil conservation and agroforestry project helped to arrest soil erosion by establishing contour ditches with grass and hundreds of thousands of trees on a large percentage of the small farms. At that time, village by-laws were created to enforce contour establishment, limit post-harvest grazing of contours, and promote zero-grazing. Hundreds of thousands of multipurpose trees were planted, which have transformed the area even until today. However, subsequent years of drought and local leadership changes diminished adherence to by-laws. The contours have not been extended, have not been repaired, and now are severely compromised. Trees have been harvested but not replanted. Tree hedgerows, which reduced wind erosion and provided dispersed shade (especially during the dry season), have not been re-established. As a result, dust storms that were rarely witnessed previously now occur throughout the year within three to four weeks after the last rain. The government seed farm has also experienced reduced productivity in the last decade, despite high use of fertilizers, herbicides and pesticides. Adoption of more sound practices is hampered by post-harvest grazing on unfenced land by animals from adjacent villages. Few post-harvest organic residues remain in the fields except for inedible weeds, and soil compaction from herds and tractors makes it more difficult to use conservation agriculture [CA] methods. Livestock routes transect the farm; they are the main route to Ngaramtoni, the key livestock marketing town on the west side of Arusha.

(/resources/12c81735-3620-4f70-856e-dc9ac4f41b10)Since 2007, the district agricultural office and the northern zonal research institute have promoted conservation agriculture (CA) through Farmer Field Schools among some smallholder-subsistence farmers in the area. Some of these farmers have been better able to utilize available rains, and have experienced successful harvests during years when other farmers in the area have had no appreciable harvest. The knowledge of these FFS farmers is a valuable resource to share with neighboring farmers and with the managers of the seed farm.

ECHO has begun a training initiative in the three wards (Olkokola, Mwandet, Orturmet) above and surrounding the seed farm. The goals are to revive village by-laws and re-train community leaders in establishing contours with trees, fodder and thatching grass, and to introduce or scale up conservation agriculture practices. Meetings with village leadership and a number of NGOs in the area resulted in a consensus that the situation is serious and needs to be addressed. Village leaders are now being trained in soil conservation and agroforestry techniques, with the addition of CA technologies which were not emphasized in the 1990s. Meetings between ECHO and the management of the seed farm have resulted in creation of a farm plan for transition to CA; the management's renewing of contours, hedgerows, and fences; and trialing the use of Faidherbia albida in hedgerows. The seed farm has begun to produce green manure/cover crop legume seeds for ECHO to distribute in the region. The farm manager is determined to be a leader in this movement and to discontinue many conventional agricultural practices that have detrimentally affected the farmland.

It is hoped that training and mentoring ECHO's neighbors will result in renewed by-laws, new energy to establish more soil and water conservation measures, and conservation agriculture adoption. This would improve watershed management and food security and would decrease poverty levels of neighboring farm families.

# Step-by-Step Instructions: The Catchment Approach

In some areas, successful soil and water conservation cannot be achieved without whole community involvement and multi-community involvement as villages and farmers work together to slow the water coming from fields and hills above.

## Start from the Top

Forests or woodlots planted on hilltops can very effectively reduce surface runoff down the hills. Contour establishment always needs to start from the highest point in the catchment and then work downwards. The aim is to harvest and retain the water and soil, which otherwise are shed into the drainage system or farming catchment. Contour ridges with trees and grasses, combined with CA, can reduce erosion and channel water into the ground to extend the growing period late into the dry season. Water from roads can be channeled into fields to increase water infiltration. Without contours at the top of the catchment, water will accumulate further downhill and will break and destroy any soil conservation structures attempted at lower levels. If starting from the highest point is impossible due to lack of community consensus, farmers 'downstream' are forced to establish large diversion ditches at the top boundaries of their farms to prevent the torrential floods from their neighbors' fields above from entering their fields.

## Dig the Diversion Ditch

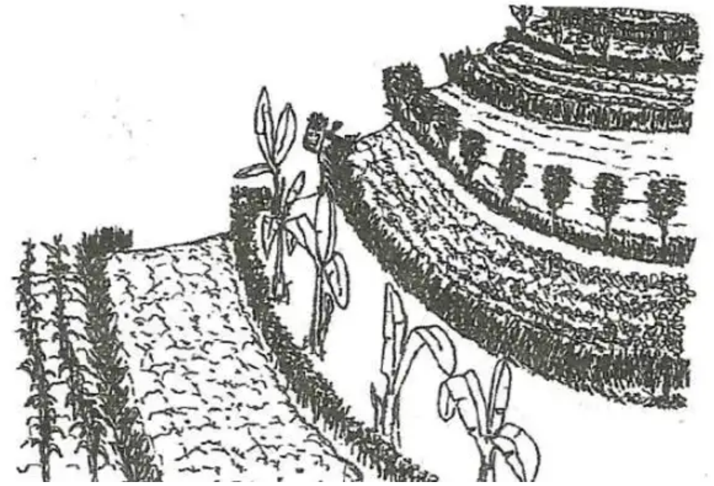
If necessary, diversion ditches should be dug on the top boundaries of farms, to collect or divert water from fields above. These ditches are deeper than the normal contour ditches so as to prevent more water from entering the field than can be harvested by the contour ditches below. The ditch diverts water from fields higher above the farm, rather than harvesting it. This ditch is normally 0.5 – 1 m deep and 1 meter wide, depending upon the amount of water which could possibly gather in a flooding rain from fields above. The ditch should be dug with a slight incline so that water does not collect, but rather runs slowly to either side of your field and ideally into a stream or ravine. The soil should be thrown downwards below the ditch; on this strip or bund, grasses and trees can be planted as described below, to hold the soil and stabilize the diversion ditch.

## Measuring Contours

Contours are made as level as possible perpendicular to the slope in order to harvest water and soil, so soil and water can neither move down the slope nor laterally within the ditch. As measurements are made for a contour, holes can be marked with a hoe, or small sticks placed as markers. An easy means of measuring contours is using a 'water ring'. See instructions below for how it is constructed and used. Once the level line of markers/holes is made, the top contour is dug. The 'vertical interval,' that is, the vertical distance between the first and next contours, should be approximately 1.5 – 1.8 m which is the approximate range of height of most people. The next contour is measured below the first contour by reversing backward down the slope until your line of sight is level with the top contour. If the field is nearly level, it is wise to pace off 25 m between contours, so that in the event of flooding, water will not have a chance to accumulate from too big an area. Contours on more level ground are effective if planted with trees and grasses to act as wind breaks to prevent soil erosion.

It may be wisest to dig each contour separately, before measuring and digging the next succeeding contour, so that measurements remain accurate. If fields are large and contours long, it is sometimes useful to use an ox - drawn plow to loosen the soil by passing two or three times along the contour ditch before using picks and shovels to dig the ditches. Proceed down the slope, measuring and digging contours, until the entire field is contoured; the process is continued down to the bottom of the field where the final contour is established.

## Establishing Plants on Contours



(/resources/f8cd2003-8962-4266-865f-91e7a77c67f1)Grass for fodder or thatch may be planted in single rows along a contour, or in several rows along the contour. The latter is better where farmers need more grass, to replace the crop residues that once were fed to livestock post- harvest but now are needed for mulch in CA farming. If fodder grasses become excessive, they too can be slashed and used as mulch in the crop land between the contours/hedgerows; it is unlikely that too much fodder grass can be grown on contours. Good species to plant include Elephant (Napier) grass (*Pennisetum purpureum*), *Setaria* spp., Guatemala grass (*Tripsacum laxum*), Guinea grass (*Panicum maximum*) or thatching grasses such as Vetiver grass and climbing perennial legumes [Desmodium spp., Glycine spp.] to hold the soil and to provide improved mixed legume/grass fodder for animals. Consider interplanting fodder grasses with leguminous, climbing fodders, which will increase soil fertility and provide a good mixture of fodder for livestock. Also consider planting legumes or multipurpose trees within the ditch or half-way up the bund slope, to secure the bunds from washing out during torrential rains, to reduce erosion from water and wind, and to add soil fertility from leaf fall. Especially in the dry season, tree survival is enhanced by the water and fertile soil runoff that accumulate in the ditches.

The types of trees that a farmer decides to plant will depend upon his or her needs and climate, but consider combining species that are useful for mulch, lumber, fodder, fruits and nuts. Choose indigenous species where possible, to reduce vulnerability of trees to pests and to enhance local fauna and flora.

Good African indigenous lumber species can be planted at 10 m intervals, including *Cordia africana*, *Markhamia lutea* and *Albizia* spp. Good exotic species which do not compete with adjacent crops include *Grevillea robusta*, *Tectona grandis* (teak), and *Olea capensis* (loliondo). These trees should be pruned and trained to grow erect, to add value as timber as they mature and also so that they do not compete for light with nearby crops.

Species useful for fodder can be planted at 1 – 2 m intervals between the lumber species; good options include African indigenous species such as Sesbania sesban and Cajanus cajan (pigeon pea). Pigeon pea and sesbania do not persist for long, but they establish quickly and provide useful fodder, or pulses for human food, while other fodder trees are more slowly establishing. Exotic species that are good to plant on contours include *Leucaena* spp., *Gliricidia*, *Calliandra* spp., *Flemingia*, *Morus alba*, *Bauhinia* spp., *Desmodium rensonii*, or *Moringa oleifera* (the latter is also used for human food). Fodder species can be continually cut back for fodder or mulch, to prevent shading or competition with nearby crops. Any type of fruit- or nut-bearing trees can be planted in the ditches or along the bunds; consider, for example, banana, citrus fruit, guavas, papayas, and macadamia nuts.

*Faidherbia albida* is a very special tree to include. It is often termed 'the fertilizer tree', because it sheds its abundant leaves before the planting season. The leaves provide a natural fertilizer for crops growing underneath, reducing the need for fertilizers by half. Faidherbia has no shade during the growing season, but provides shade during the dry season—so it helps to conserve moisture, reduce solar baking of the soil, and reduce wind erosion at a time of the year when these are most needed.

## Maintaining Contours

In areas where flash floods are common, be sure to create a continuous vegetative barrier along the contour bunds. Where gaps occur, re-plant with grasses. To the best of your ability, ensure that contours will not break, because if water breaks through the upper contours, it will likely break through all the successive contours below. If water breaks through during a severe rain, repair the bunds well in advance of the next rain.

If the contour ditches are too long, they may gather too much water and break through at the weakest points. One solution is to fill in the contour ditch at 20 m distances with a half meter barrier, to prevent water from moving sideways within the ditch toward a weak point along the contour. If there are low points where water may overflow the contour bund, the bunds should be built higher and ditches dug deeper so as to retain all the water if possible. Once contours are well established with vegetation, they will require less work to maintain and the hillside will stabilize. At this point, the average amount of soil loss per acre can be reduced from ten tons per acre to none at all! As you combine soil and water conservation, agroforestry and conservation agriculture on your farm, your soils will improve and become high in organic matter, producing good crops year after year. A good inheritance will be created for your children and your children's children.

## Using Conservation Agriculture for Planting Crops between Contours

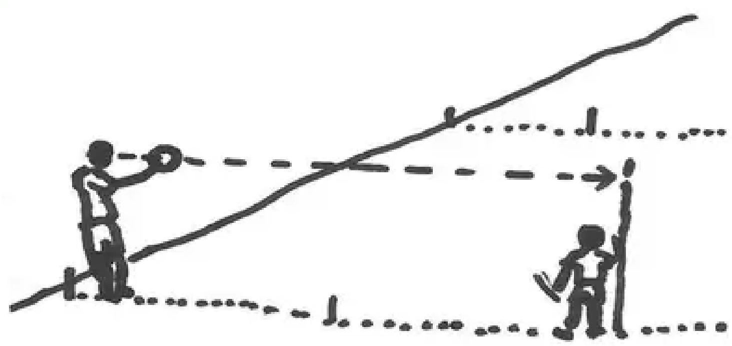
Conservation agriculture encourages minimum tillage, mulch or green manure/cover crops over the soil, and good spacing of crops. These practices also play a significant role in reducing water and soil runoff. The CA method of farming is particularly effective at reducing soil erosion and increasing crop production in drylands.

Conservation tillage practices enhance and contribute to the sustained use of agricultural land by combining minimum soil disturbance, crop rotation, and cover crops for soil cover and to increase fertility. e practices. Organic matter in the soil increases due to decomposition and mixing processes by soil organisms, renewing fertility in a low-cost and sustainable way. The CA methods also increase soil moisture retention, which is important as rainfall has become more erratic and inadequate for good crops during some years. Reduction of tillage operations and the mulch cover provided by crop residues and cover crops help to suppress weed growth and can significantly increase production while reducing labor inputs.

# Using a Water Ring to Measure Contours

The water ring is an effective and easy way to measure contours. It is made from a 0.5 m section of clear plastic tubing half-filled with water and joined by tape. The water ring is an alternative to the commonly used 'line-level', a spirit-filled level suspended on a 10m long string held tightly between two measured sticks, or for the A-frame level described in a *TN* entitled, "A-Frame Level (http://edn.link/tn-55)." A water ring is actually easier and faster to use than either of these better-known tools, and can be used both to measure level contours along a slope, and to measure the standard distance between contours. The tool normally costs less than $0.50 to make, so it is as inexpensive as an A-frame and cheaper than a line level.

## Calibrating the Water Ring

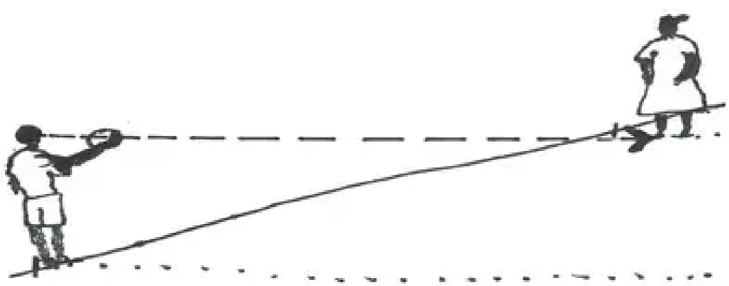


(/resources/2df1fc58-88a9-400f-8bc4-afbcb94a6583)Stand erect on a level floor and hold the ring on your thumb suspended as far as your extended arm will allow (distance improves accuracy). Ask your co-worker to stand erect approximately 10 m away from you. Raise the water ring up to your eye level until the two water levels at each part of the water ring are in line with each other and your eye. Project this level height onto your co-worker's body to determine which part of her/his body is level with your eyesight. If your partner is too short, you should have her/him hold a taller stick and make a mark where your eyes and the water levels meet.

## Using the Water Ring to Measure Level Contours

A water ring works well to measure both level contours and the distance between contours. Use the point where the water levels converge and then project this line onto the body of your co-worker or measuring stick; this is the measure by which to determine level points along the contours in the field. As both of you stand erect in the field, pace off distances and jab a hoe or stick into the soil to make the marks along which the contour ditch will be dug. Have your co-worker travel 10 to 15 paces across the slope, then move up or down the slope until your eyes are level with the mark that you previously determined to use (on her/his body or measuring stick). At each point that is determined to be level with where you are standing, have your co-worker dig small holes or place sticks. Later you can estimate a straight line which is to be dug between these holes or sticks to form a contour bund. Dig ditches along the measured distance between the holes or sticks, throwing the soil downhill. Ditches are normally dug 50 cm deep and 50 cm wide with a U-shape as the base.

## Using the Water Ring to Measure the Distance between Contours



(/resources/7d95c31b-b74d-4bd1-a344-fc999073a166)From the top-most ditch (or from the top boundary of your field if no diversion ditch is necessary), you can measure and determine where to place the next contour bund. The vertical distance between contour bunds should be approximately a person's height–1.5 to 1.8 meters. To measure it, ask your co-worker to stand at the top corner boundary of the field or at the diversion ditch. Then proceed to walk away down the slope until your eye level and the two water levels of the water ring converge at the topmost contour. This is where you should dig the next highest contour bund. Repeat this distance between successive contour ditches as you proceed down the slope of your farm.

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**Case Study 2.** Ekenywa village, Arusha, Tanzania: My neighbor who lives below our hillside farm is the village chairman. He recently stopped me and chided me that he no longer benefits from the soil runoff and water flooding down the hill above his farm. Fifteen years ago I constructed 11 contour ditches using a water ring and the 'fanya chini' approach (see earlier in article). I established the contours with fodder trees, grasses, fruit and other multipurpose trees. I have found that certain plants (including *Gliricidia sepium* and *Panicum maximum*) persist on the hedgerows better than others, due to their resilience to drought and moles. The latter are plagues to agriculture in the area, with their hundreds of miles of tunnels, some of which transect contours and cause need of repairs. We have used a local method of baited spring traps made from 15 cm sections of bamboo to reduce the moles. We also used to have to repair damage from aardvarks, which would dig “cellar holes” in the fields in a single night. We did not want to expel them because they were here before us. However, due to the build-up of small plots and the population pressure around us, we think they have left for good and moved on to other climbs.

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**Case Study 3.** Vanessa Reed, an ECHO intern working in Tepeth village, Karamoja, Uganda, shared the following: “Community meetings and awareness creation were carried out amongst the community of Tepeth. The women greatly welcomed the idea of FMNR [Farmer Managed Natural Regeneration]. We established a watershed restoration demo, and came up with action points concerning people who cut trees from other people’s fields. We pruned select indigenous trees bordering a gully. In subsequent community meetings, members agreed to protect the selected trees and expand FMNR practices within their own individual field gardens.

> “Soil conservation was enhanced by measuring contours with the water ring, and digging ditches along them, a new concept in the area. We planted grasses and multipurpose trees on the soil thrown down below the 13 contour ditches. Then we promoted conservation agriculture (another new concept) in fields of millet and groundnuts, between the contours. The plants on the contours and the mulch cover between the crops prevented soil erosion and held water that ran down from fields higher up the slope.
>
> “Many NGOs in the district distribute one or two types of trees that are of little use to the communities. By contrast, the women’s group we worked with established their own nursery with several varieties of multipurpose trees for food, fruit, fodder and firewood. Despite it being a dry year, the trees survived because of the increased water that was harvested in the contour ditches.
>
> “A series of check dams were established starting at the top of the gully and using locally available materials of sand, soil, and rock. However, the rains were significant this year, and water from fields higher up washed out the first check dams. Hopefully the community will learn from this how important it is to start watershed restoration from the top of the catchment. They clearly saw that field contours and conservation agriculture helped retain water in the fields and prevent water from flowing into the gulleys.”
>
> – Vanessa Reed, ECHO Uganda

# Conclusion

“A good man leaves an inheritance to his children’s children.” Proverbs 13:22 Renewing the earth for our children’s children is possible through efforts to manage water and soil conservation. New initiatives to reestablish old and tested ways are needed throughout the world. East African communities can lead by their example of consensus and cooperation, training and mentoring, which will result in renewed by-laws, new energy to establish more soil and water conservation measures, and conservation agriculture adoption. This will improve food security and decrease poverty, making for a better earth.

We at ECHO challenge readers to share their feedback, experiences and questions on ECHO's forums concerning the technologies described above and in the following list of 'Best Practices'.

## Best Practices Summary:

- On sloping land, establish barriers along contours to minimize erosion; utilize microcatchments and water-holding structures such as contours, zai holes, or matengo pits to capture and hold rainwater for agricultural use.
- Build resilience through diversification, integrating crops, trees and animals into small farms in ways that cycle nutrients as efficiently as possible.
- Select and implement farming systems that incorporate multiple conservation agriculture principles.
- Build soil organic matter through the use of leguminous cover crops and/or trees.
- Cover the soil with crop residues, living mulches, and/or dispersed trees.
- Disturb the soil as little as possible, leaving organic mulches on the soil surface.
- Concentrate fertility close to crop plants.

## Links to information on farming systems

Foundations for Farming (also known as Farming God's Way)

- Foundations for Farming (http://foundationsforfarming.org/new/)
- Farming God's Way (http://www.farming-gods-way.org/)

Farmer Managed Natural Regeneration and Zai:

- Reij, C., G. Tappan, and M. Smale. 2009. Agroenvironmental transformation in the Sahel (http://edn.link/e3ce2t)
- World Agroforestry Center (http://www.worldagroforestry.org/)
- Kaboré D. and C. Reij. 2003. Conference Paper No. 10: The Emergence and Spread of an Improved Traditional Soil and Water Conservation Practice in Burkina Faso (http://edn.link/qqf24d). InWEnt, IFPRI, NEPAD, CTA conference, Pretoria:

Sloping Agricultural Land Technology (http://edn.link/salt)

Matengo pits (http://jambo.africa.kyoto-u.ac.jp/kiroku/asm_normal/abstracts/pdf/22-2/73-91.pdf)

FAO documents with broad implications for soil conservation, agroforestry and climate smart agriculture:

- Factors affecting organic matter (http://www.fao.org/3/a0100e/a0100e07.htm#bm07.1)

- The importance of organic matter (http://www.fao.org/3/a0100e/a0100e00.htm#Contents)
- Impact of climate change on forest management, & guidelines (https://news.trust.org/item/20130917085509-1lpan/?source=search)
- Conservation agriculture (CA) and sustainable agricultural mechanization (SAM) (http://www.fao.org/agriculture/crops/thematic-sitemap/theme/spi/scpi-home/managing-%20ecosystems/samandca/en/)
- Natural resource & environment (http://www.fao.org/nr/nr-home/) – climate smart agriculture sourcebook, globally important agricultural systems, and global framework for climate services.
- Video on forest and trees contribution (http://www.fao.org/news/audio-video/detail-%20video/en/?uid=9905&wmode=1)
- Series of books on improving governance for forest tenure, and tackling climate change with livestock. (http://www.fao.org/climate-change/resources/publications/)

ECHO Technical Notes

- Foundations for Farming (http://edn.link/m399k3) (*TN* 71)
- Farmer Managed Natural Regeneration (http://edn.link/tn65fmnr) (*TN* 65)
- Farmer Managed Agroforestry System (http://edn.link/tn60) (*FMAFS; TN 60*)
- Zai Pit System (http://edn.link/tn-78) (*TN* 78)
- Green Manure Crops (http://edn.link/tn-greenmanure) (*TN* 10)
- Soil fertility (http://edn.link/soil-fertility) (*TN* 57)
- Acid Soils of the Tropics (http://edn.link/acid-soils-tropics)(*TN* 48)
- Nutrient Quantity or Nutrient Access (http://edn.link/tn79) (*TN 79*)

EDN articles

- A Fresh Look at Life Below the Surface (http://edn.link/jwd4jm) (*EDN* 96)

http://edn.link/eancontour