

TRAINING

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RESOURCES

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CASE STUDIES

# FOOTSTEPS

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FARMING FOR THE FUTURE

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# FOOTSTEPS

## FARMING FOR THE FUTURE

*God saw all that he had made, and it was very good (Genesis 1:31).*

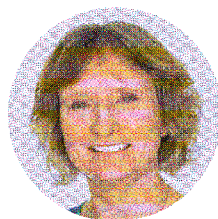
When I was studying agriculture I remember being impressed by the level of order and balance in the natural world. I was fascinated by the way each living thing is made up of multiple parts and millions of cells, all working together to sustain life.

However, plants and animals are also heavily dependent on the environment around them for survival. For example, a maize plant needs air, water, nutrients and sunlight. If it does not have these in the right balance – or if something eats it – it will not grow.

Because all of creation is connected, if one part is harmed – for example, through deforestation – it can cause problems both locally and globally. Our use of the natural world must promote, not compromise, its ability to provide for all living creatures, now and in the future.

In this edition of *Footsteps* we consider what this means for farming, especially in the context of climate change and environmental degradation (page 3). We discuss the importance of farming with nature, rather than against it (pages 12 and 20), and learn how farmers in Asia are making the most of their limited water resources (page 6). Other important strategies include tree regeneration (page 8), sustainable mechanisation (page 16) and on-farm trials (page 14).

The natural world is extraordinary, diverse and beautiful. Through it, God provides for our needs and the needs of every other living creature (page 5). As we gain a greater understanding of how everything fits together, we can adopt new, sustainable strategies alongside tried-and-tested techniques. This will allow us to improve agricultural productivity while at the same time protecting the environment on which we all depend.



A stylized, handwritten signature in black ink that reads 'Jude'.

*Jude Collins – Editor*

📷 Cover photo: Joy in Nigeria grows different types of crops using sustainable agricultural techniques taught by Tearfund partner Rurcon. Photo: Tom Price/Tearfund



By Neil Rowe-Miller

# THE FUTURE OF FARMING

*In the context of climate change, environmental degradation and loss of biodiversity, farmers have a difficult job. Their farms must provide food for a growing global population, while at the same time protecting and restoring the environment. These seem like big challenges, but fortunately there are effective strategies that farmers can use to overcome them.*

We are already beginning to see the impact of climate change in the form of rising sea levels and more unpredictable weather. In some parts of the world, storms, floods and periods of drought are affecting the health of livestock and disrupting seasonal cropping patterns.

Some farmers are able to irrigate their fields during dry periods, but most small-scale farmers rely on rainfall for crop production and need to find other solutions.

Conservation agriculture is one such solution. It has three basic principles: minimal soil disturbance; permanent soil cover; and the use of more than one crop species, together or in rotation. These strategies help to keep the soil moist, fertile and full of air. Growing more than one type of crop reduces the risk of crop failure and limits any damage caused by pests and diseases. Overall, the result is healthier and more productive crops.

As well as helping farmers cope with changes in the climate, conservation agriculture releases fewer damaging greenhouse gases into the atmosphere than many other cropping systems. This is because undisturbed soil and healthy plants store carbon, and there is less use of nitrogen fertilisers and agricultural machinery.



📷 Kibe Kifle in Ethiopia shows his faba bean and barley crops grown using conservation agriculture techniques.  
Photo: Neil Rowe-Miller

## SUSTAINABLE INTENSIFICATION

The world's population has grown from 3.7 billion to 7.7 billion over the past 50 years, while arable farmland has increased by less than 20 per cent. Since this trend is likely to continue, sustainable intensification of production must be part of the future of farming. This means raising yields and incomes while maintaining healthy ecosystems on and around the farm.

One strategy, known as agroecology, attempts to copy the diversity of natural systems. This often results in increased productivity and means the farming

system is better able to cope with environmental challenges such as periods of drought or flooding.

Usually a mix of crops, trees and animals are supported together, making the most of available resources including soil, water and light. The recycling of nutrients also plays an important role: for example, animals eat plants and then their manure is added to the soil to help other plants grow.

Agroecology reduces the need for chemical pest control by including techniques that naturally manage insect populations. This may include planting



trees to provide a home for insects that feed on pests, and growing plants that attract pests away from the main crop.

### THE IMPORTANCE OF TREES

For generations, tree planting has been promoted as important for livelihoods and environmental improvement.

- Trees release oxygen into the atmosphere and absorb the greenhouse gas carbon dioxide.
- They reduce erosion by holding soil in place and protecting it from the sun, rain and wind.
- Trees catch rainwater and encourage it to soak into the ground.
- They provide shade which protects crops, animals and people from the sun.
- Trees are a source of food, medicines, firewood, fodder for livestock and timber for construction.



📷 Learning tree regeneration techniques in East Timor. Photo: World Vision Australia

- They provide a home for many types of birds, animals and insects, some of which are important for pollination and pest control.

Over the past 30–40 years, a new approach to reforestation has emerged in the form of farmer-managed natural regeneration. This strategy promotes the effective management of naturally occurring trees and shrubs. It is now

used in many countries to restore unproductive land and improve agricultural livelihoods.

### THE ROLE OF WOMEN

Women play a key role in agriculture and are often among the first to adopt new techniques. However, they are frequently ignored when decisions are being made and may have little power in the communities where they live.

It is crucial that women are fully involved in any farming initiatives, and governments and NGOs should be challenged to include women in positions of leadership. The voices of both women and men must be heard and respected if communities are to make wise decisions for the future.

### TIME TO ACT

It is important that we act now to restore damaged land, enhance biodiversity and help reduce the impact of climate change. This needs farmers, development agencies, governments and researchers to work together and learn from each other. Sustainable farming practices that have already been widely adopted, such as the ones mentioned above, have all involved mutual learning of this kind.

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## SOME DEFINITIONS

### Climate change

Changes to normal weather patterns caused by human activities.

In the mid-1800s humans began to burn fossil fuels such as coal, oil and gas. Burning fossil fuels produces energy, but it also releases 'greenhouse gases' such as carbon dioxide, methane and nitrous monoxide into the air.

Naturally occurring greenhouse gases form a layer around the earth that traps heat and keeps the planet warm. However, human activities mean that there are now more of these gases in the atmosphere than there should be, and too much heat is being trapped. This is causing the planet to heat up, resulting in environmental damage and more unpredictable weather.

### Ecosystem (ecological system)

A community of living things that interact with each other and with the non-living things in their environment (eg earth, water, air). If something is added to or taken away from an ecosystem – eg a species change or a rise in temperature – it can affect the natural balance of the interactions and harm or destroy the ecosystem.

### Biodiversity (biological diversity)

The variety of living things in a given place. If an ecosystem is biodiverse, small changes will have less of an impact on its stability.

Healthy soils are very biodiverse. They contain billions of organisms that break down organic material, releasing nutrients that are essential for all plants and animals.



# BIBLE STUDY

## VARIETY OF LIFE

*The Bible repeatedly celebrates the variety and beauty of creation, from Genesis 1 where 'God saw that it was good', through to Revelation where four creatures representing nature's diversity – birds, humans, wild and domestic animals – worship the Lord (Revelation 4:6–8).*

Read through **Psalm 104**, slowly and thoughtfully. What are the images that come to mind when you read it? Hold these images in your head for a moment and praise God for his diverse and beautiful creation.

The psalm speaks of God's majesty and power. It also reveals to us our place in the world and reminds us of our responsibility to look after all that God has made.

### POWER

God's greatness, splendour, wisdom and majesty are revealed in the design and shaping of a huge and varied universe. 'The heavens declare the glory of God; the skies proclaim the work of his hands' (Psalm 19:1).

As we spend time enjoying God's amazing creation, our wonder turns to praise and we are inspired to worship the creator of all things (Psalm 104:33–34).

### PROVISION

'May the glory of the Lord endure forever; may the Lord rejoice in his works' (Psalm 104:31).

As God delights in all he has made, he creates the conditions for all of creation to flourish. He designs the foundations and boundaries of the earth (Psalm 104:2–9) and provides everything that is essential for life: water, food and shelter (Psalm 104:10–21).

His motivation is love. Psalm 36:5–6 says, 'Your love, Lord, reaches to the heavens, your faithfulness to the skies. Your righteousness is like the highest mountains, your justice like the great deep. You, Lord, preserve both people and animals.'

### PRESENCE

God is not remote, but active. Acts 17:28 says, 'For in him we live and move and

have our being'. God provides for all life, including humanity, through the life-giving power of his Spirit (Psalm 104:30).

### OUR PLACE

Humans are part of God's diverse world, not separate from it. We are among the 'creatures' the earth is full of (Psalm 104:11–24). Our welfare is tightly bound together with the welfare of other species.

We are also called apart for a special role within creation. We are made in the image of God and we have a duty to look after and care for all that God has made (Genesis 1:26–28; Psalm 8).

These are two equal truths to be held in balance. If we fail to understand that we are part of creation, we might put ourselves above it and abuse it. If we do not understand our special calling within creation, we may see ourselves as incapable of making any positive difference.



### QUESTIONS FOR GROUP DISCUSSION OR PERSONAL REFLECTION

- Why did God create the world?
- Why do you think there is so much variety in the natural world?
- How can we live in a way that reflects God's desire for all creation to flourish? Is there anything that we need to do differently?

*Adapted from an A Rocha Bible study called 'What a wildly wonderful world'. Used with permission.*

Email: [international@arocha.org](mailto:international@arocha.org)  
[www.arocha.org](http://www.arocha.org)

📷 'In the beginning God created the heavens and the earth... and God saw that it was good' (Genesis 1:1, 9).  
Photo: Tom Price/Tearfund







By Ramesh Babu

# EVERY DROP MATTERS

*In 2013, the fields around Meghawakhurd village in northern India were dry and unproductive. Several years of drought had resulted in a severe lack of water and many families were abandoning their farms and moving to the city to look for work.*

Those who remained in the village were struggling to survive. They spent most of their time cutting and selling firewood 25 kilometres away.

A farmer-owned, long-term approach was needed to properly manage the water catchment area and allow the farmers to make their land productive again.

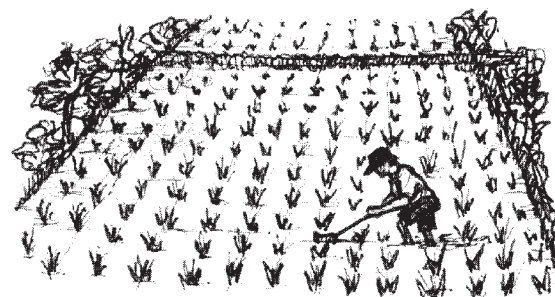
## LOCAL SOLUTIONS

Steep slopes and deforestation meant that rainwater was quickly running off the fields and out of the area. This was

causing the soil to erode and dry out. The farmers needed to slow the water down, create some water stores and encourage more water to soak into the soil. After discussions facilitated by Tearfund's partner EFICOR, they decided to do the following:

- use rocks to create banks along the contours of the land to stop the water running down the slope
- dig drainage channels and ponds to catch some of the water
- plant local varieties of grass and trees, including legumes, to hold the soil in place, improve soil fertility and trap rainwater.

With the help of a government farm adviser, the farmers developed a trial plot. This allowed them to test several



System of Rice Intensification

different water-saving technologies including a rice intensification system and intercropping.

## SYSTEM OF RICE INTENSIFICATION

This is a low-input way of growing rice which results in better yields and more profit for families. The technique uses 25–50 per cent less water than standard rice cultivation methods.

Below are the main steps.

1. Plant seeds in un-flooded seed beds fertilised by manure and compost.
2. Transplant seedlings when they have two or three leaves (between 8 and 12 days old) instead of after one month.
3. Plant single seedlings about 25cm apart, rather than in bunches. This uses fewer seeds and reduces competition for nutrients, space and light. Seedlings develop stronger roots and more shoots.
4. Instead of continuously flooding fields, provide just enough water to maintain moisture around the roots. This encourages more extensive root systems, reduces root degeneration and lowers methane emissions (methane gas contributes to climate change).



Once dry and barren, Meghawakhurd village is now green and the fields are productive. Photo: EFICOR



5. To avoid compacting the soil, control weeds using a mechanical hand tool. This keeps the soil full of air and improves plant growth.

6. Use organic manure and compost to maintain soil fertility.

Ten million small-scale farmers in more than 55 countries are now experiencing improved yields by using this system.

### INTERCROPPING

For centuries, farmers have grown crops in combination with each other. Compared to the more modern approach of growing one crop in large fields (monocropping), this technique has many advantages and is often used in conservation farming.

- Planting crops that vary in height and root structure makes the most of available water, light and nutrients in the soil, increasing overall yield.
- Crops that flower at different times support populations of insects important for pollination and/or pest control.
- Plants vary in their susceptibility to pests, diseases and drought so if one crop is affected, the other crops are likely to remain healthy.

- Diseases and pests can spread rapidly in a monoculture. Intercropping interrupts this spread.

- While one crop is being cut, useful insects and animals can hide in the plants of the remaining crop or crops. In a monoculture, many pest-eating insects are lost because the whole field is harvested at the same time.

- Most of the soil is covered by crops so there are fewer weeds, rainwater soaks into the soil and the risk of soil erosion is reduced.

- Carefully chosen companion plants can increase the yield of the main crop. They may do this by adding nutrients to the soil, providing shade or structural support, or by attracting pests away from the crop.

- Intercropping increases resilience and improves livelihoods because families are not relying on one harvest and one crop. They can adapt to climate change by trialling and growing different combinations of crops. Growing several edible plants together can improve family nutrition.

There are several intercropping methods:

**Row:** more than one crop grown at the same time, with at least one of the crops planted in a row.



Intercropping using a combination of millet and leguminous cow peas

## DEFINITIONS

### Water catchment area

An area of land with a common set of streams and rivers that flow into a larger body of water, such as a lake or ocean.

### Legume

Leguminous plants and trees improve soil fertility by capturing nitrogen from the air and adding it to the soil in a form that can be used by other plants. Examples include *Acacia*, *Leucaena* and *Moringa* species.

**Strip:** different crops in alternate strips, with rows big enough to allow harvesting with machinery.

**Relay:** a second crop planted on the same piece of land after the first crop has reached a certain stage of growth.

### HUB FOR LEARNING

Over the last few years Meghawakhurd has been transformed. Better water management combined with new farming techniques has encouraged many people to return to their farms. Groundwater level has increased by more than one metre and most of the farmers are able to grow two crops each year.

The trial plot in the village has become a hub for learning, attracting many visitors from neighbouring villages.

Ramesh Babu is Director of Programmes and designated Executive Director of EFICOR (Evangelical Fellowship of India Commission on Relief).

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By Tony Rinaudo



# RELEASING THE UNDERGROUND FOREST

*For people who rely on rain-fed agriculture, land degradation and the loss of soil fertility can be devastating. Farmer-managed natural regeneration uses simple, low-cost techniques to encourage the regrowth of trees from live stumps and from seeds in the ground. This results in the restoration of land and livelihoods.*

The skills associated with this practice have been used for generations. However, in the early-1980s they were revised and made popular again in response to serious land degradation in Niger. Vast areas of deforested land had become badly eroded resulting in failed crops and chronic hunger.

Attempts to plant trees and restore soil fertility had often failed because of extreme heat, limited water, freely

grazing livestock and lack of interest. Most farmers did not understand the benefits of trees and were preoccupied with trying to meet their immediate needs. A new approach was required: one that would empower farmers to restore their land, while at the same time improving agricultural production.

## LIVING STUMPS

Instead of planting trees, farmer-managed natural regeneration relies on regrowth from live stumps, roots and seeds already present in the soil: the underground forest. The living stumps of previously felled trees have mature roots that are able to reach nutrients and water deep in the ground. These roots also release stored energy as new shoots grow. This means that regrowth is usually faster, and more

successful, than the growth of newly planted seedlings.

Often in agricultural fields, tree regrowth is cut or burnt before each crop-planting season. With farmer-managed natural regeneration, as regrowth emerges the strongest, straightest stems are protected and the other stems are cut off. Land users decide which trees to keep, depending on the type of tree they want to grow and the location of the stumps. The basic techniques are easily learnt and passed on from farmer to farmer.

Animals are kept away from the regrowth until the young trees have grown to a point where grazing won't harm them any more. After that, livestock can be allowed to graze around the trees, fertilising the soil in the process.

The crop growing season can be a good time to regenerate trees because livestock is often penned or grazed elsewhere. On communal land, communities must decide together how best to keep animals away from young, vulnerable trees.

## TREES ON FARMS

Deliberately including and managing trees and shrubs on farmland has been shown to have many benefits. These include:

- reduced soil erosion because of deep roots and permanent soil cover
- improved soil structure and fertility
- better retention of rainwater in the soil and reduced risk of flooding

📷 Thanks to farmer-managed natural regeneration, this farmer in Malawi is now able to grow many different crops and trees, increasing his income and quality of life. Photo: Tony Rinaudo/World Vision Australia





- cooler soil making it easier for crops and grass to survive hot, dry spells
- habitat for a variety of wildlife, including insects and birds important for pollination and pest control
- lower wind speeds and less airborne dust
- cooling shade for humans and animals.

Different tree species can provide firewood, timber, natural medicines, fodder and food. Enterprises such as bee-keeping can also be developed. Some tree species – called legumes – take nitrogen from the air and add it to the soil. Others draw water up towards the surface, making it available for crops to use.

### FLEXIBILITY

Farmers and land users can practise farmer-managed natural regeneration in a number of different ways. They have the freedom to choose which trees they want to conserve, and when and how to prune. The result can be as simple as growing a few trees for firewood, or the techniques can be used to restore large areas of forest.

When the land is individually owned, tree regeneration is best managed by the land user or owner. On communal land, the whole community should be involved. This ensures that everyone understands the importance of looking after the trees, and everyone shares the benefits.

### MANY BENEFITS

In Niger, farmer-managed natural regeneration has grown to cover more than 5 million hectares. As the land has become green with trees, crop yields have increased benefiting 2.5 million people. In 2005, when a third of Niger's population suffered from famine, sale of firewood and other forest products meant that farmers practising natural regeneration were able to avoid tragedy and did not need to rely on famine relief.

Typically, farmer-managed natural regeneration costs about 40 USD per hectare to implement. However, once introduced, the cost is only that of the land user's labour which in Niger is around 14 USD per hectare. After 20 years, farmers in Niger were growing

an extra 500,000 tons of grain every year and annual incomes rose by up to 1,000 USD per household. By comparison, a study of three West African countries found that 160 million dollars had been spent on tree planting and only about 20,000 hectares of plantations remained: a cost of 8,000 USD per hectare.

### COMMITMENT

Success is most likely if there is a high level of commitment. Many farmers feel that the presence of trees on their land is unhelpful. However, as understanding increases, so does the desire to grow trees. If most people in a community are working towards achieving the same goals, greater progress will be made.

*Tony Rinaudo is the Principal Natural Resources Adviser for World Vision Australia. In 2018 he was awarded the Right Livelihood Award in recognition of his work which has led to farmer-managed natural regeneration being used in at least 27 countries.*



## CASE STUDY CHILDREN LEADING THE WAY

**By Sarah McKenzie**

***Through poetry, dance and drama, school children in Kenya are learning about trees and the environment, including farmer-managed natural regeneration. They are then sharing this knowledge with their families.***

Kibe is a student in one of the schools. She says, 'Using farmer-managed natural regeneration has brought many blessings in our home. We now have enough firewood from the pruned branches to last us the whole term. This means I no longer have to miss classes to fetch firewood from the forest which is five kilometres away.'

Kibe's headteacher adds, 'I was planning to cut down the shrubs growing on the school compound to make the area tidy. I then received some training from

World Vision and, instead, our school has become a site where farmers come to learn tree regeneration techniques. We are very proud as a school to be part of this.'

Local farmer Nancy is also delighted to be involved. She says, 'I went to a meeting in Ngusero primary school and I started to use natural regeneration techniques. Very quickly, excellent grass started to grow under the pruned trees.

'Because the grass is better, milk production from my five cows has increased from 10 litres to 32 litres each day. I now sell milk to the Mogotio cooperative society and I was awarded a prize for being one of their most consistent suppliers. I am able to pay the school fees for my children without panic and I am a leader in my community. Farmer-managed natural regeneration has changed my life.'



Schools in Kenya are teaching children how to prune and manage trees. Photo: Sarah McKenzie

*Sarah McKenzie is Farmer-Managed Natural Regeneration Manager in World Vision Australia's Climate Action and Resilience team.*



# FARMER-MANAGED NATURAL REGENERATION: STEPS TO SUCCESS

*Farmer-managed natural regeneration allows living stumps, roots and seeds in the ground to grow and flourish, restoring land and livelihoods.*

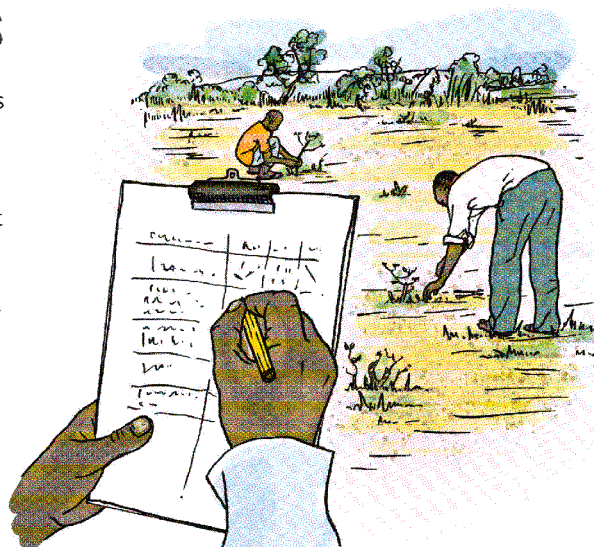
## 1 NEEDS ASSESSMENT

With the participation of all community members, assess the local environmental and agricultural situation. Discuss current challenges and future goals. This will help everyone decide if farmer-managed natural regeneration could be useful and, if so, the best approach to take. If possible, visit a community where the techniques are already being used to learn from their experiences.



## 2 SELECT STUMPS AND SEEDLINGS

- Survey the land for sprouting stumps or seedlings and identify which species are present.
- Work out which species are preferred based on required use. Use the template below to help collect this information.
- Select and protect the stumps to be regenerated.
- Where there are no obvious stumps, protect the land from grazing livestock and fire, allowing plants to emerge from roots and seeds in the soil.
- Where there is bush encroachment, select useful trees and cut out the rest.



**Template to use when choosing trees**

Priority needs	Contributions that trees could make to address these needs	Required tree characteristics	Available tree species that might be useful
eg fodder for livestock in dry season	<ul style="list-style-type: none"> <li>• edible leaves, bark and seed pods</li> <li>• improved grass growth under canopy</li> </ul>	<ul style="list-style-type: none"> <li>• fodder tree</li> <li>• open canopy for light shade</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Acacia</i></li> <li>• <i>Leucaena</i></li> <li>• etc</li> </ul>

Trees may be selected because they are good for firewood, fence posts, timber, fodder, fruit, nuts, shade, natural medicines, or a combination of these. Legumes may be chosen because of their ability to bring nitrogen from the air into the soil.



## THE THREE GOLDEN RULES OF PRUNING

While the act of pruning itself is not difficult, there are three important rules to keep in mind to prevent trees from becoming diseased or damaged.

**1. Use sharp tools.** Saws, secateurs, machetes, harvesting knives or axes may be used as long as they are sharp and provide a clean cut.

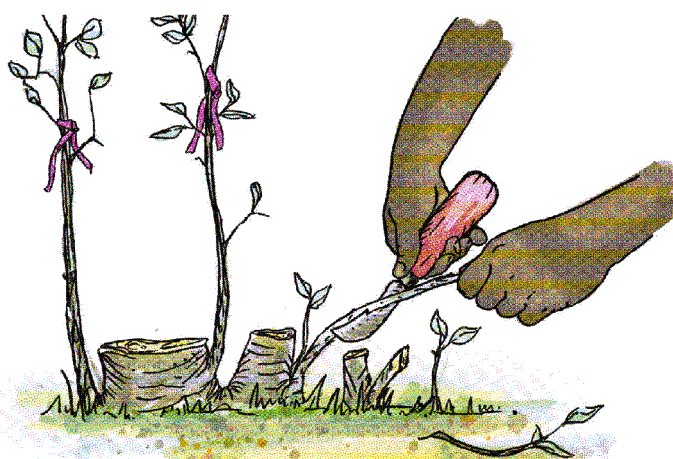
**2. Cut upwards not downwards.** This causes less damage to the bark and allows the tree to recover more quickly. It also reduces the risk of disease or insects entering the wound.

**3. Cut off side branches up to halfway up the trunk.** Pruning higher may make the stem too fragile to survive high winds or animals brushing against it.

### 3 PRUNE AND MANAGE

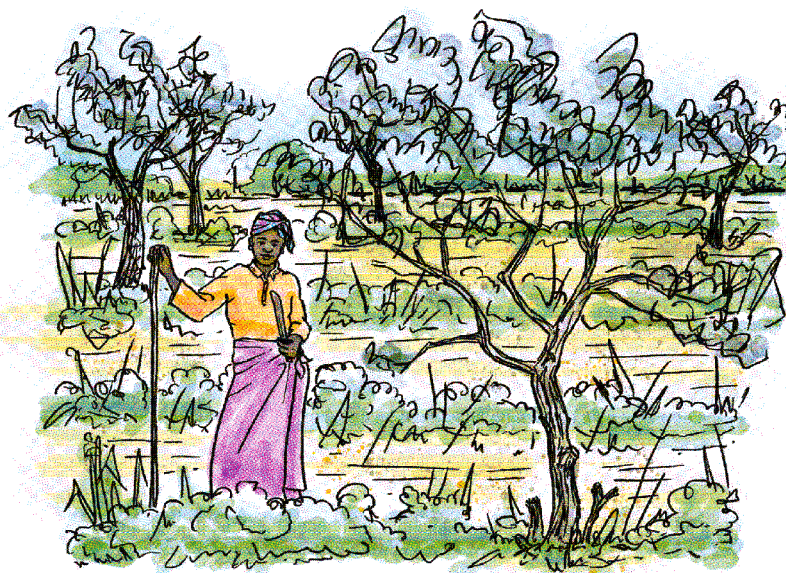
Correct pruning stimulates rapid growth and results in taller, straighter, more useful tree trunks. This is because the remaining stems have more space to grow.

- For each stump, select three to five of the tallest, straightest stems and remove the others.
- For each remaining stem, prune off side branches up to halfway up the trunk.
- Protect the stems from livestock, fire and competing vegetation or weeds.
- When a main stem is harvested, choose a younger stem to replace it.



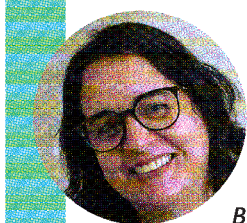
### 4 MAINTAIN AND USE

- Remove emerging new stems and prune side branches every few months. This will help the selected stems to grow more quickly. The prunings can be used or sold for firewood or fodder, depending on the species.
- Use trees for planned purposes; harvesting branches, portions of wood, fruit/nuts or the whole tree as necessary.



World Vision has published a manual for all who are interested in understanding farmer-managed natural regeneration better. Download free of charge from [www.fmnrhub.com.au](http://www.fmnrhub.com.au) or write to World Vision, GPO Box 9944, Melbourne, VIC 3001, Australia.





By Waneska Bonfim

# FARMING WITH NATURE

*Water and food are essential for life, but many people on our planet are thirsty and hungry. One of the reasons for this is the overuse of natural resources. In the semi-arid region of north-east Brazil, Diaconia is promoting farming that supports food production while restoring healthy ecosystems. This approach is called agroecology.*

Agroecology promotes agricultural practice that:

- enhances ecosystem health and biodiversity
- uses local, renewable resources
- makes the most of farmers' traditional knowledge and works with their priorities
- carefully incorporates new innovations and technologies to provide environmental, economic and social benefits.

The approach tries to ensure a fair wage for the producer and provide access to affordable, local produce for communities. Through advocacy and farmer representation, policymakers are urged to take into account the needs of farmers and the people who are benefiting from their products. This includes listening to producers and consumers, and including them in decision-making at all policy levels.

Agroecology promotes fair relationships between people, and between people and the environment in which they live. It focuses on the production of food by working with nature, not against it.

## CREATING AN OASIS

Maria José's 27-hectare family farm is in an area of Brazil that experiences long dry seasons and short, intense rains. Water has always been scarce, but climate change is resulting in even longer periods of drought and more unpredictable

rainfall. Widespread deforestation has made the situation worse, and the major river that flows through the area is beginning to dry up.

Despite these pressures, with Diaconia's support Maria has been able to transform her farm into a green oasis. She makes the most of limited resources by enhancing natural biodiversity and ensuring that water and nutrients are recycled and not wasted. Having a variety of income sources – crops, animals and forest products – has helped her to stabilise her family's income.

## NOTHING WASTED

'We used to get all our water from natural springs,' says Maria. 'But with the installation of a 16,000-litre cistern this has changed. We are now able to grow more food and make the most of the water we have.'

The cistern is filled by water that runs naturally down the slope when it rains. In addition, Maria has constructed stone banks along the contours of the land to slow the water down and encourage more of it to soak into the land. The family also reuses waste water from the sink and shower to water vegetables and other plants growing near the house.

Maria continues, 'We are protecting the springs by planting different species of trees and plants. We have drought-resistant bromeliads which have thick, fleshy leaves. These are good for feeding the animals as well as improving biodiversity and protecting the soil. It is these plants that keep the animals alive when there is a drought.'

📷 Maria has built stone banks to hold back rainwater and encourage it to soak into the soil, creating an area where she can grow many different types of trees and crops. Photo: Acervo Diaconia





Fodder plants and trees allow animals to graze in the shade. Their manure is collected and used to fertilise crops. Manure from cattle, goats and pigs is also added to a biodigester which produces gas for cooking. This means the family no longer burns wood and there is no smoke in the kitchen. The by-product from the biodigester is a valuable organic fertiliser.



📷 Livestock are an important part of Maria's farming system. Photo: Thomas Lohnes

Maria grows a mix of crops including maize, vegetables and fruit. She carefully harvests and stores seed from the most productive plants to sow the following year. A fruit pulp processing unit provides additional income for the family.

### MANY VISITORS

'I am grateful that today my family is a reference point for the community. We receive many visitors and we are encouraging our neighbours to farm in a sustainable way,' says Maria.

By making the most of available natural resources and appropriate technologies, Maria has been able to create a diverse and productive farm. In addition, the farm provides many environmental and social benefits to the surrounding area including more trees and better access to water. With the help of Diaconia, Maria has established a large water reservoir on her land which is used by the whole community.

.....  
*Diaconia is a non-profit organisation committed to promoting justice and social development in north-east Brazil.*

Email: [waneska@diaconia.org.br](mailto:waneska@diaconia.org.br)  
[www.diaconia.org.br](http://www.diaconia.org.br)

## A NEW TYPE OF RANCH

**Traditional cattle farms in Colombia, which occupy 80 per cent of agricultural land, often remove all the trees and bushes to grow grass.**

Over time, the soil loses its fertility, less grass grows and the cattle have to walk further to find enough to eat. Every step damages the soil and makes the situation worse. As the pasture dries up, the cows produce less milk and calves grow more slowly. When it

rains, the damaged soil is washed into the rivers.

Research conducted at the Colombian Centre for Research in Sustainable Systems of Agriculture (CIPAV) has found that when cows are able to graze high-protein fodder trees and bushes, there are many benefits for the animals, the farmers and the environment. The trees and bushes help catch rain so more water soaks

into the soil. They also absorb more carbon dioxide than grass pasture and are resilient to periods of drought. Trees improve soil quality and provide valuable shade. Cooler cows eat throughout the day, moving around and depositing their valuable manure more evenly.

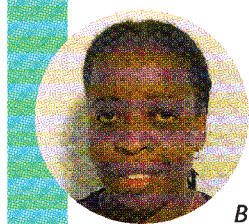
Cows farmed in this way produce more milk and calves grow faster, so are ready for slaughter sooner. The change in diet helps digestion so the cows produce less methane which is a major contributor to climate change. According to CIPAV, using this system cattle ranchers can produce the same amount of dairy, meat and timber products in half the land area, with no need for expensive irrigation, fertiliser or herbicides.

📷 Cattle grazing bushes and trees produce less methane than animals grazing on grass. Photo: Andrew Philip/Tearfund



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[www.cipav.org.co](http://www.cipav.org.co)





By Putso Nyathi

# ON-FARM TRIALS

*New technologies will only be successful if they are adapted to local conditions. Rather than technicians providing farmers with ready-made solutions that may or may not work, on-farm trials allow farmers to experiment and find solutions to their own, specific problems.*

This has many benefits:

- ideas and technologies are tested in on-farm conditions
- farmers choose to test things that they value, and feel they can do and afford
- people learn best by discovering for themselves, rather than being told or watching someone else
- the results will often be of more interest to other farmers than the results of researcher trials
- farmers own the process of testing and research.

Trials can be carried out individually or in a group.

1. Conduct trials on uniform soil with no anthills and away from trees. A 20m

x 20m area should be big enough for most trials.

2. Mark out plots of a similar size in an area of the field where they are likely to experience the same conditions. For example, if part of the field is likely to become waterlogged, avoid using this area.

3. Make sure all the plots are managed in the same way, except for the new idea or treatment being tested.

4. Include a control plot for comparison. This is usually normal farmer practice such as 'no mulch' in the example to the right.

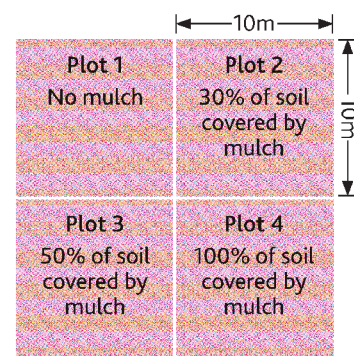
5. Keep it simple and avoid testing more than one thing at a time. In the example, the only thing being tested is the amount of mulch. Mulch is a layer of plant material put on the surface of the soil. It can help to improve crop yields by protecting the soil from erosion, adding organic matter to the soil and reducing the growth of weeds.

6. Look at the plots regularly and take measurements. Useful measurements

## A MULCHING EXPERIMENT

**Aim:** to test the effect of different levels of mulch on weed growth and crop yield.

Sow the same crop variety across all four plots at the same time, using the same sowing technique. The only change across the plots should be the level of mulch. Observe the crop for signs of moisture stress, water-logging, pests and diseases. Measure crop yield and weed density. Evaluate the results.



will depend on what is being tested. They might include plant growth, crop yield, presence of weeds and incidence of pests or diseases.

7. Evaluate the results. What differences are there between the plots? What has been learnt? What changes will you make in the future?

Non-field-based experiments, such as storage methods or livestock management, also follow the same basic guidelines. Start on a small scale, compare options with normal practice, select treatments, take measurements and evaluate the results.

*Putso Nyathi is a senior agronomist based in Nairobi.*

*Email: nyathip@gmail.com*

Testing different levels of mulch in Ethiopia. Photo: Louise Thomas/Tearfund







**CHILDREN'S ZONE**

# BEAUTIFUL WORLD

We live in a beautiful world. Step outside and have a look around. What can you see? Trees, plants, soil, sky, clouds, rain, sun, animals, insects, birds, people? All of these are part of God's amazing creation.

## LOOK CLOSER

Find a flower and look at it closely. What can you see inside? What colour is it? What does it smell like? Gently touch it – what does it feel like? What do you notice that you have not noticed before?

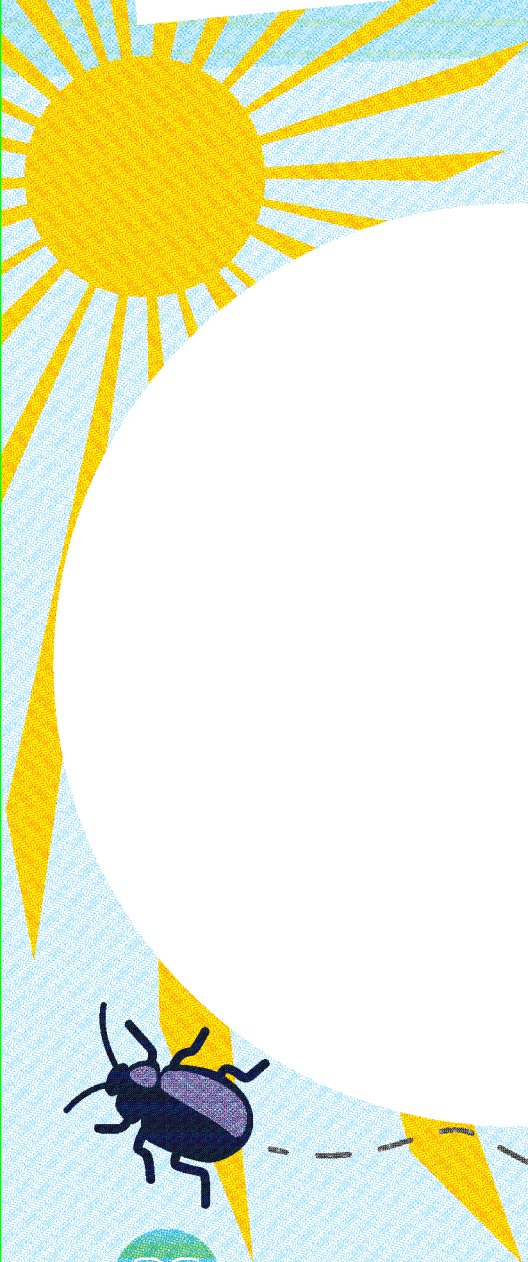
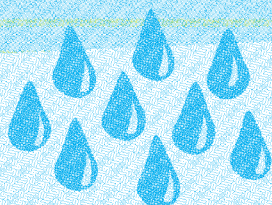
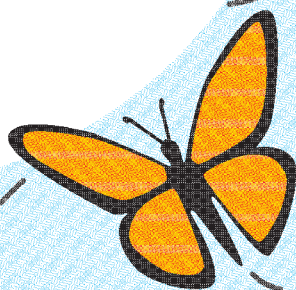
Draw a picture of your flower in the circle. Try to include as much detail as possible. If you know someone who cannot see very well, describe your flower to them so they can imagine what it looks like.

## GIVE THANKS

Thank God for the flower, the plant it is part of, the soil it is growing in, the rain that gives it water, the sun that helps it to grow and the insects that fly around it.

Everything is important in God's beautiful world. Here is an example.

- Insects drink a sugary liquid called nectar found in flowers.
- At the same time they pick up something called pollen on their legs and backs.
- The insects carry this pollen from one flower to another.
- The pollen helps new plants to grow.
- Without insects there would be fewer plants and less food for birds, humans and animals.



## BIBLE VERSE MEMORY CHALLENGE!

God wants us to look after and enjoy his beautiful world.

Can you learn this Bible verse?

'God saw all that he had made, and it was very good.'  
(Genesis 1:31)



# SUSTAINABLE AGRICULTURAL MECHANISATION

*In many parts of the world, the overuse of agricultural machinery has caused serious damage to both soil and water resources. However, if farmers do not have any mechanical equipment, it limits the amount they can grow.*

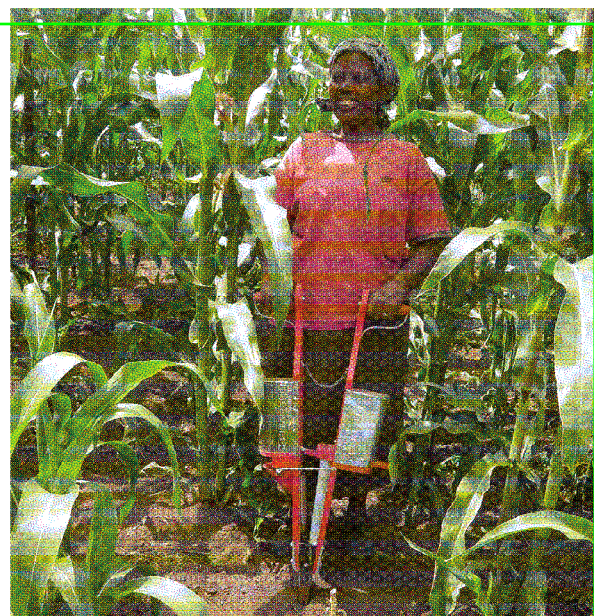
Sustainable agricultural mechanisation tries to make the work of farmers easier, while minimising the risk of environmental damage. Careful use of the right tools and equipment should:

- increase productivity by helping farmers sow seeds at the best time, depth and spacing
- make repetitive tasks easier and quicker
- avoid damaging the environment and protect ecosystems
- reduce poverty and increase food security.

Farmers need to choose the most appropriate tools for any activity. This depends on what they can afford, the work to be done and who is doing the work. For example, women play an important role in many farming communities. Sustainable mechanisation can reduce their workload by taking into account their specific needs and improving their access to appropriate machinery.

Within the context of conservation agriculture, planting in a carefully controlled way avoids damaging the soil and reduces the amount of seed and fertiliser that is needed. However, this takes a lot of time to do if the seeds have to be sown by hand. Light machinery – such as hand-held jab planters – is being developed to help make this task easier.

Guidance from the Food and Agriculture Organization emphasises that agricultural mechanisation must be



📷 Purity Mgobo in Kenya with the jab planter she used to sow her maize crop.  
Photo: Saidi Mkomwa/ACT

kind to the environment, affordable for small-scale farmers and able to meet the needs of both women and men. In addition, it is important that such mechanisation targets young people, making agriculture an attractive choice for employment and the development of new businesses.

.....  
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[www.act-africa.org](http://www.act-africa.org)*

# KEEPING THE SOIL COVERED

By Neil Rowe-Miller

*One of the main principles of conservation agriculture is permanent ground cover. This reduces the risk of soil erosion, keeps the soil moist and reduces the growth of weeds.*

To achieve this, a layer of vegetation can be added to the soil as a mulch, or the base of crops can be left in the fields after harvest. However, when food for animals is in short supply, they may be allowed to graze newly harvested fields or eat the vegetation that could be used as a mulch, leaving the fields bare.

Below are some ideas for overcoming this problem.

- Use any spare land to plant grasses or trees that can be used for animal feed, and/or mulch.
- Dry and store grass and other fodder for the dry season.
- Separate crop and grazing land. Where land is managed communally, establish and enforce grazing rules that everyone agrees with.
- Use fast-growing forage trees as living fence posts.
- Plant a cover crop such as pigeon-pea and use some of it as animal feed.
- To protect fields, keep animals in an enclosure and bring fodder to them.
- Engage the broader community. If only some people understand the value of keeping the soil covered, it will be difficult to agree how best to manage livestock in crop land. Raise awareness through farm visits, public meetings, radio broadcasts etc.

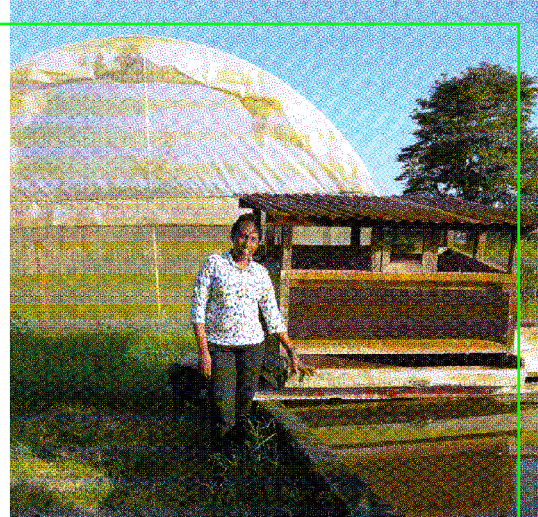
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*Neil Rowe-Miller is Agriculture and Livelihoods Technical Adviser (East Africa) for Tearfund and Canadian Foodgrains Bank.*

*Email: [neil.rowe-miller@tearfund.org](mailto:neil.rowe-miller@tearfund.org)*



# GROWING CROPS WITHOUT SOIL: HYDROPONICS

## AN INTERVIEW WITH ROSEMARY NYAMU



### What is hydroponics?

Hydroponics is the practice of growing plants without soil. The plants can be grown in a nutrient-rich solution, or in a disease-free substance such as sand, gravel or coconut fibre, watered with nutrient solution.

### What are the benefits?

First of all, fertile land is not needed to grow crops hydroponically. Crops can be grown anywhere – inside and out – in a much smaller space than traditional farming. The environment is more controlled so there are fewer weeds and a lower risk of pests and diseases.

With the proper set-up, plants will grow and mature more quickly than if they are grown in soil. This is because the plants do not have to work as hard to obtain the nutrients they need to grow. Their exact

needs are met so they can concentrate on leaf and stem growth instead of spending energy expanding their root systems. Fodder for livestock can also be grown quickly using hydroponics, reducing pressure on grazing land.

Water is recirculated so less is used and none is wasted. Where farmers have greenhouses, water can be collected and used from the roof.

### Are there any disadvantages?

The biggest challenge is the cost. Quite a lot of equipment is needed to create a large-scale hydroponics system: containers, pumps, lighting, nutrients etc. However, there are small-scale, cheaper options.

For larger systems, a high level of knowledge is needed to manage the system well and avoid costly mistakes. The plants need to be closely monitored and the pH and nutrient levels in the system adjusted regularly.

As the plants are grown close together in an enclosed system, pests and diseases can spread rapidly. It is important to have a good disease management plan including the use of disease-free water and growing materials.

### What advice would you give to someone new to hydroponics?

There are many different hydroponic systems to choose from, depending on the amount of money you want to spend and how complicated you want it to be. The wick hydroponic system is cheap and only requires a bucket, wicks, nutrient solution and something for the plants to grow in, such as sand.

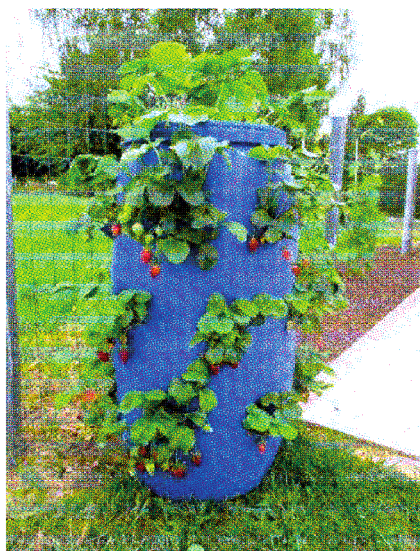
The wicks draw the nutrient solution up from the bucket and release it into the growing medium, making it available to the plant roots. Wicks can be made out of any absorbent material including string, wool or cut-up bits of old clothes.

Ready-made nutrient solutions can now be bought in many places. To make your own, ask your local agricultural department for advice or speak to other hydroponic growers.

Find out as much as you can about the technology before you start. See if there are any local courses and, if you can, look at the many 'how to' guides available online. Joining a group of hydroponic growers can be very helpful as everyone can learn from each other. Forming a cooperative can also be a great way to spread the cost and share labour and other resources.

### Which crops grow well in hydroponic systems?

Most vegetables and many other crops will thrive. Good examples include potatoes, tomatoes, strawberries, grapes, herbs, lettuce, cabbage and green beans. For a wick system, choose smaller, non-fruiting plants such as lettuce or herbs.



Hydroponic plants can be grown simply using locally available materials such as water barrels and plastic pipes. Photo: Vintage Greens Ltd, Latia Resource Centre

*Rosemary Nyamu is Deputy Director of the Kenya School of Agriculture.*

*Email: ronyamu@gmail.com*

*The Food and Agriculture Organization has produced several articles and manuals on hydroponics which can be accessed online: [www.fao.org](http://www.fao.org) (search 'hydroponics').*



# RESOURCES

BOOKS • WEBSITES • TRAINING MATERIAL



## PREVIOUS FOOTSTEPS

- FOOTSTEPS 99: Climate change
- FOOTSTEPS 89: Livestock
- FOOTSTEPS 85: Trees
- FOOTSTEPS 82: Natural resources
- FOOTSTEPS 77: Food security
- FOOTSTEPS 70: Agriculture and climate change
- FOOTSTEPS 47: Biodiversity

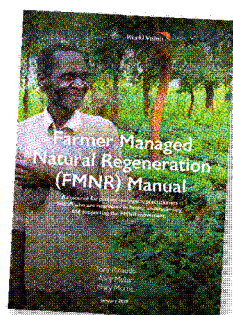
Visit [www.tearfund.org/footsteps](http://www.tearfund.org/footsteps) to download free copies, or contact us to order paper copies in English, French, Portuguese or Spanish.



## FARMER-MANAGED NATURAL REGENERATION MANUAL

By Tony Rinaudo, Alice Muller and Mary Morris

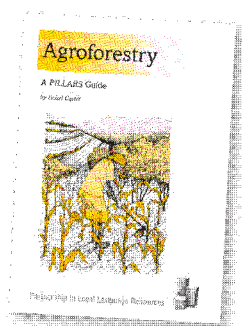
This manual contains all you need to know to practise farmer-managed natural regeneration. Download free of charge from [www.fmnrhub.com.au](http://www.fmnrhub.com.au). Alternatively, send an email to [feedback@worldvision.co.au](mailto:feedback@worldvision.co.au) or write to World Vision, GPO Box 9944, Melbourne, VIC 3001, Australia.



## PILLARS GUIDE: AGROFORESTRY

By Isabel Carter

The purpose of this guide is to encourage awareness of agroforestry for improving nutrition, soil fertility, fuel wood production and family income. Download from [www.tearfund.org/pillars](http://www.tearfund.org/pillars) or contact us to order paper copies in English or French.



## CONSERVATION AGRICULTURE NEWSLETTER

Canadian Foodgrains Bank publishes four excellent newsletters on conservation agriculture each year. They are available in English, French, Kiswahili and Portuguese. Download free of charge from [www.foodgrainsbank.ca](http://www.foodgrainsbank.ca), email [crgb@foodgrainsbank.ca](mailto:crgb@foodgrainsbank.ca) or write to Canadian Foodgrains Bank, PO Box 767, Winnipeg, MB, R3C 2L4, Canada.



## USEFUL WEBSITES

### [arochoa.org](http://arochoa.org)

A Rocha International is a Christian organisation working with communities to enhance biodiversity through sustainable agriculture and nature conservation. Website available in English, French, Spanish and Portuguese

### [caguide.act-africa.org](http://caguide.act-africa.org)

Canadian Foodgrains Bank and African Conservation Tillage Network have developed comprehensive training modules for people interested in conservation agriculture. Download free of charge in multiple languages.

### [cta.int](http://cta.int)

The Technical Centre for Agricultural and Rural Cooperation promotes food security through innovations in sustainable agriculture. Sign up to receive their informative *Spore* magazine through the 'publications' tab. Available in English and French.

### [fao.org](http://fao.org)

The Food and Agriculture Organization website contains a lot of useful agricultural advice. Click on 'themes' to find a long list of topics. Available in multiple languages.

### [sri.ciifad.cornell.edu](http://sri.ciifad.cornell.edu)

Browse this site to find extensive information about the System of Rice Intensification in many different languages.

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John reading his copy of *Footsteps* 20 with a Moringa tree in the background. Photo: John Medcraft

## CELEBRATING 30 YEARS OF FOOTSTEPS!

*John Medcraft from Brazil has been reading Footsteps since the first edition was published in 1989. When I asked him to tell me about the impact the magazine has had in his work over the years, he told me this story.*

'I have in front of me the precious original copy of *Footsteps* 20 from September 1994. The theme of the edition was the environment, which is a passion of mine, so I remember reading it with a lot of interest. But when I got to pages 14 and 15 and read about the tree *Moringa oleifera*, I wondered if this was just another "miracle solution" for dry regions.

'Despite my doubts, I decided to contact the organisation offering a few seeds free of charge. I soon received them and I planted 24 seeds. I was amazed! The seedlings grew so quickly, and with very little water. I still have my scribbled notes on the 2,188 seed pods that were produced by 20 trees, resulting in about 20,000 seeds! This was the beginning of ACEV's seed bank.

'ACEV has since supplied seeds to every region of Brazil, and has even fulfilled requests for seeds from Africa and

Europe! As the *Moringa* tree has become increasingly well known, the people of north-east Brazil have discovered its many benefits for themselves, and they are planting it, consuming it and spreading the word like nobody else can.

'Two pages of *Footsteps* have blessed countless thousands of lives with nutritious food and clean water. We praise God for the ministry of *Footsteps*!'

► **Editor's note:** The fast-growing *Moringa* has many valuable properties. The leaves and seed pods are rich in vitamins, minerals and proteins. They can be dried and used as a food supplement, cooked as a green vegetable or used for animal fodder. The tree improves soil fertility and the seeds can be crushed to produce oil for cooking. Crushed seed kernels can also be used to purify water. Find out more by searching for 'Moringa' at [learn.tearfund.org](http://learn.tearfund.org).

Email: [john.medcraft@gmail.com](mailto:john.medcraft@gmail.com)

ACEV is a Christian development organisation working in the dry north-east of Brazil: [www.acevbrasil.org.br](http://www.acevbrasil.org.br)

### **Footsteps in Swahili!**

In response to reader feedback, and with the support of Tearfund Ireland, we are delighted to announce the publication of our first edition of *Footsteps* in Swahili. It is on the topic of orphans. If you would like a copy, please get in touch using the contact details below.



## FOOTSTEPS

ISSN 0962 28619

*Footsteps* is a magazine linking health and development workers worldwide. It is a way of encouraging Christians of all nations as they work together towards creating wholeness in their communities.

*Footsteps* is free of charge to grassroots development workers and church leaders. Those who are able to pay can buy a subscription by contacting the Editor. This enables us to continue providing free copies to those most in need.

Readers are invited to contribute views, articles, letters and photos.

*Footsteps* is available in French as *Pas à Pas*, in Portuguese as *Passo a Passo* and in Spanish as *Paso a Paso*. It is also available in Hindi.

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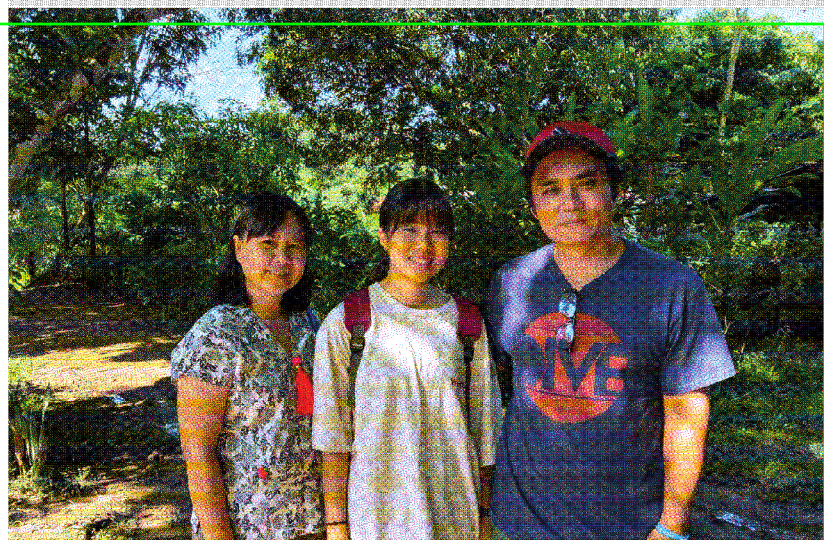
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# INTERVIEW

## 'CRAZY LITTLE FAMILY'



Together Da, Leklek and Tui grow and rear most of their own food in a sustainable way.  
Photo: Farming as Mission

*In 2006, Tui, Da and their daughter Leklek decided to move from the city to a farm. In contrast to the industrialised farming around them, the family wanted to grow food and rear livestock in an integrated way that would provide for all their needs. Here Tui explains why they have chosen to do things differently.*

'I am from an ethnic group called the Karen and my wife is from the Lahu tribe. Our daughter is now 17 years old. We are based in Mae Ai district in northern Thailand.

'Our desire as a family is to glorify God by caring for his creation in a way that allows us to eat healthily, make a living and bless other people.

### CHALLENGES

'The area where we live is dominated by large citrus orchards. These rely heavily on agricultural chemicals which cause soil, water and air pollution. Forests have been chopped down so there is less water. Many young people have moved away to work in the city.

'Those who remain have stopped growing their own food. Every morning a truck arrives full of vegetables, meat and other products. People run to the truck to buy chili, chicken, eggs, soy milk: all of which could be produced locally.

'When our "crazy little family", as we were called, built a house and prepared to farm,

we were asked if we were planning to establish a citrus orchard. When we said we wanted to practise integrated farming in a similar way to our ancestors, people turned their backs and walked away.

### SIMPLE GOAL

'We set ourselves a simple goal: to grow all our own food and eat healthily.

'We began with activities such as land preparation, construction of the chicken house, planting trees and digging fishponds. We read many articles and books and visited other people's farms to learn from them. We looked for market opportunities and started to harvest eggs, vegetables, fish, chicken and rice.

## 'WE SET OURSELVES A SIMPLE GOAL: TO GROW ALL OUR OWN FOOD AND EAT HEALTHILY'

'Our farm of three hectares is now carefully planned for integrated farming. One third is for rice and the rest is for fish ponds, chickens, ducks, fruit trees, bamboo for construction, corn, beans, herbs, medicinal plants and vegetables. We raise bees in the fruit orchard for organic honey, pest control and pollination.

'We use farming practices that work with nature, not against it. We use compost and animal manure to fertilise the land. Pests and diseases are kept under control by insects and birds that are attracted to our farm by the trees, ponds and permanent vegetation.

### FRIENDSHIP

'Our vision is to see local churches and Christian organisations promoting sustainable farming practices. We teach that natural resources are created by God and we are all responsible for taking care of them.

'Our farm has become a place where people come to relax, learn and eat healthy, home-cooked food. Each year, people from many different countries visit us and we build friendship through sharing and learning from one another. It is a blessing we never expected when we started.

'Local farmers have started to become more aware of environmental concerns, and young people are moving back. Like us, many people are beginning to include new technologies like solar power into their traditional farming systems, with great results.

'We pray and thank our creator God for everything. 1 Thessalonians 5:16-18 says, "Rejoice always, pray continually, give thanks in all circumstances."

*If you would like to find out more, please send Tui an email: kersertoo@gmail.com*

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