



The impact of climate change on agriculture

From the Editor



just 0.7° centigrade since around 1900 (Stern review 2006). Due to this warming, glaciers and the polar ice caps are beginning to melt, causing sea levels to rise. Increased temperatures also result in significant changes to weather patterns with more extremes of rainfall and strong winds. These changes can result in increased frequency of droughts, floods and storms in different parts of the world.

Scientists are able to predict the effects of future climate change. The outlook is not encouraging. By 2100, the earth could be between 1.4°C and 5.8°C warmer than in 1990. This will depend on whether countries take urgent action to reduce the emissions of greenhouse gases, particularly in the richer countries, which at present contribute most to global warming.

The impact of climate change

Problems like drought and floods are not new. Neither are they always

Scientists around the world now agree that the climate changes that we are all experiencing globally are real and are the result of human activity. Climate change is a threat to people all around the world. This issue looks at the impact it is already having on agriculture and suggests some practical responses.

The greenhouse effect

Different gases in the air around us trap heat from the sun. They act like a blanket around the earth. They keep the temperature of the earth warm enough to make human life possible. These gases in our atmosphere are known as 'greenhouse gases'. However, in the past 150 years, humans have been burning fuel for factories, vehicles and homes at a rapidly increasing rate.

This has released more and more of the greenhouse gases, carbon dioxide in particular. This has resulted in steadily increasing temperatures in the earth's atmosphere – causing 'global warming' and climate change.

Global warming

The present signs of global climate change have resulted from an average increase in world temperature of

Photo David Crooks Tearfund

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Footsteps is a quarterly paper, linking health and development workers worldwide. Tearfund, publisher of *Footsteps*, hopes that it will provide the stimulus of new ideas and enthusiasm. It is a way of encouraging Christians of all nations as they work together towards creating wholeness in our communities.

Footsteps is free of charge to individuals working to promote health and development. It is available in English, French, Portuguese and Spanish. Donations are welcomed.

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

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Tearfund is an evangelical Christian relief and development agency working through local partners to bring help and hope to communities in need around the world.

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a result of climate change. They are also a result of local variations in the climate and of the way in which people care for their land. However, there is no doubt that global climate change is responsible for the increasing frequency of such hazards. Certain parts of the world are likely to suffer more serious effects than others – particularly semi-arid or low-lying areas. Poor people in developing countries will be particularly vulnerable. Climate change is already putting lives at risk and threatens millions more in the future.

Humankind has probably never had to face up to such a huge challenge. The future of our beautiful planet really is in our hands. All of us can

play a part, looking at our own way of life and doing all we can to protect our environment. We cannot undo the damage that has already been done, but we can try to lessen the impact. This issue focuses on the experiences of farmers around the world and shares practical information about what they are doing to adapt and to protect their environment.



Isabel

Living with climate change in Brazil

Three farmers' views

Conserving water

Francisco Geraldo Neto lives with his family in Caiçara village, northeast Brazil. The family cultivates half a hectare of land and they earn about US \$1,500 each year from selling their products in the local markets. Diaconia (a Tearfund partner) helps them avoid the use of middlemen so they can get better prices. They grow an amazing range of about 50 different species of fruit trees, vegetables, cereal and fodder plants on their farm, together with traditional plants, which they conserve.

It has not been easy to achieve this as they started with poor soils which had been damaged by the practices of slash and burn and single cash cropping. Neto comments: 'I hear of climate change in the newspapers, but I can feel its effects on myself and on my crops. The sun is hotter, the temperature is higher, and the wind is drier. I hear about the greenhouse effect, desertification and "El Niño". I don't understand it, but the results are



Collecting water from the stream as water levels fall.

drought in the Amazon, floods in some parts of northeast Brazil and more whirlwinds.'

Neto remembers that in the 1980s there was a stream running through their farm that flowed nearly all year. In the 1990s the water level fell gradually. This meant that three months after the rainy season ended the stream was dry. To help solve this problem the family built a dam in 1999. 'Water from the dam is used for irrigation and livestock. We are now irrigating

Photo Jim Loring Tearfund



Photo Jim Loring Tearfund

Carrying water back home.

much more than we did five years ago, because it is hotter and drier for half the year. We used to irrigate once a day, now it's twice, but even so the plants wither. We are concerned we may run out of water in the future as the climate is now so variable.'

Sustainable agriculture

José Ivan Monteiro Lopes lives with his parents and family in the Pajeú region in Pernambuco state. In 1998 there was a drought in the area and Diaconia established an emergency help programme. Their first objective was to improve water storage capacity for families. They established a food-for-work scheme where families were given food in exchange for digging wells and building water tanks to collect rainwater from roofs.

The following year Ivan's family was chosen, together with five other families, to participate in a food production programme using small-scale irrigation. One condition was that instead of their traditional practices of slash-and-burn and their use of chemicals, the families should start to use practices that respect the environment and people's health. They now use sustainable agricultural systems that provide

them with enough food and with surplus products to sell at market.

Ivan believes that the climate is 'now so out of balance that even the experience of our oldest people to predict the rains no longer works. Before, in years with good rains, we produced maize and beans watered only by rainfall. There was enough for us to eat and sometimes even to sell. Today we need



Photo Jim Loring Tearfund

Water for irrigation.

to use irrigation to guarantee food for the family.'

'Reading' nature

José and Isaura Mendes live in Pernambuco state in a semi-desert region that suffers from drought. There are regular losses of livestock on their farm because of the lack of fodder.

The family hears about climate change on the radio. They are very concerned about the melting of ice in the Antarctic and hurricanes. They believe these changes are caused by people's lack of care for 'the things of nature'. They are very worried by the 'rise in temperature'.

José comments: 'Winters are shorter and the rainfall is more irregular. It used to start raining in October and continue until July every year. The local stream that runs through the village either had surface water, or people could easily collect water there by digging a little hollow. Today it's much more difficult to find water there. Clearing trees from the banks of the stream and elsewhere around the springs has made this situation worse.'

José uses irrigation but still finds their plants suffer from the heat. Their cashew tree flowers dry out from the sun's heat and many of the fruits wither. He now irrigates the plants several times a month to keep the trees alive.

He has some experience of natural signs that indicate 'good or bad rain years'. Usually when the flowers on traditional plants fall off unevenly during the flowering period, it indicates a period of poor rains. When they flower abundantly, and the flowers remain on the top of the tree for a long time, the rains will be regular. 'Older people used to know the times of the rainy seasons better, but then, they used to be easier to predict.'

These interviews were sent in by Marcelino Lima who works with Diaconia-PAAF in Brazil.

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Bird pests

Farmers concerned about birds damaging crops (*Footsteps* 68) should look for local materials that they can use to make scarecrows. Scarecrows look like people dressed in old clothes. Use wood, crop residues, bags and old clothes. Set them up in the field to scare birds away. Move them every couple of weeks.

The black reflective tapes from videos or cassette tapes could also be used. These should be tied to poles around the fields, so the wind can move the tape. When the sun shines, it reflects light and scares birds away, although they get used to it with time.

Old bells and other materials that produce sound could be hung up so that when the wind blows, they will make a loud noise. You could also look for an automatic siren that will make a loud noise at intervals.

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Stop destroying Lake Tanganyika

Lake Tanganyika, in southern Africa, is under threat. Much of the lakeside environment has already been destroyed. Illegal fishing and hunting destroy wildlife and fish stocks, harmful farming practices cause erosion, and waste products from industry and local households pollute the water. Such damage to the environment results in increased poverty in the region.

Lake Tanganyika plays an important environmental role in the region. Its waters help to provide rain throughout the entire Great Lakes region. The lake is full of many species of fish and the surrounding area is home to many animals and birds. Local people make an income from catching and selling fish. Trees in the surrounding forest help to absorb the carbon emissions

produced by industry. The lake acts as an important transport link and tourists bring economic opportunities to the region. However, all this is now under threat.

To solve the problem and reduce poverty across our region, people must be properly informed about protecting and promoting the environment. Everyone needs to be involved – government, industry and local people. Tree planting, waste reduction and recycling programmes need to be set up, and advocacy is needed in the fight against climate change. Let us join forces to save the lake. Destroying the environment that supports our livelihoods can be compared to someone sitting in a tree and chopping off the branch that is supporting them.



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Mouth filter

Does anyone know of a small mouth suction filter, or something similar that could be used to siphon fuel? This would prevent people getting ill when they are filling vehicle fuel tanks from barrels?

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Avocado soap



I would like to know how to make soap out of avocado, as avocados are easy to grow here, but farmers cannot earn a living from selling them. I would also like to know how to make paper out of local materials. This will generate income and also protect the environment. People could use paper bags to replace plastic bags.

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Cooking stoves

I research new ideas and technologies for renewable sources of energy.

Many useful ideas for cooking stoves and other inventions can be found on this website: www.repp.org/discussiongroups/resources/stoves/

They include a long-lasting, smoke-free cooking charcoal made from waste products such as sawdust, leaves, coffee husks, and maize husks. This benefits the environment by using up waste. It also improves health as many women suffer problems from breathing in smoke while cooking.

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Adapting to drought in Ethiopia

by Tadesse Dadi

Waaqayyo Muudaa used to herd cattle and camels in the vast grazing areas of Fantalle District in the rift valley of Ethiopia. Now he guards the grass and trees growing in the 15 hectares of enclosed land that the community established two years ago in his village of Xuxuxii. This is a huge change of lifestyle for a young man who used to walk freely with his animals, far from his village.



Photo: Scott Jones / Mind the Gap

Planting indigenous trees helps prevent soil erosion and enables more rainwater to soak into the soil.

Waaqayyo belongs to the Karayu clan who are part of the Oromo people. The Karayu live in a hot and semi-arid area of Ethiopia. For generations, they have lived a semi-nomadic lifestyle, migrating in search of pastures for their livestock – cattle, camels, goats and sheep. Their migration pattern used to be well organised, with each sub-clan moving within agreed areas and at agreed times, according to the availability of pasture.

Within one generation, however, this pattern of life has become threatened and is now changing. The traditional grazing land available to the Karayu has been much reduced by urban development and the spread of sugar cane plantations. Successive droughts have led to the death of large numbers of cattle, while increased population puts pressure on the land to support more households.

Climate change has resulted in a number of years of prolonged drought. This has meant that traditional pastures have failed to re-grow during the expected wet season. Between 2000 and 2002, the pastoralists lost nearly two-thirds of their livestock as a result of drought. In addition, the pasture was so damaged that there was not enough food for the remaining livestock. This made recovery very slow and

resulted in increased malnutrition of children and women. It was clear that the Karayu's pastoral way of life was under threat. It was vital for them to adapt to long-term climate change. They needed to restore their environment and make changes to their way of life.

For generations the pastoralists had led a relatively isolated existence with very little access to education or health services. Change was difficult for them. Gudina Tumsa Foundation (GTF), a local Christian NGO, had helped the Karayu to establish their first school and sunk bore-holes to provide drinking water. This NGO was available to help them. Their staff encouraged and supported the Karayu people to make changes. GTF introduced two simple but critical new ideas to help to sustain the Karayu's livelihood. They encouraged the planting of indigenous trees that could survive very dry conditions and suggested establishing feed reserves by enclosing sections of grazing land.

Choosing to adapt

Haji Rooba explained that establishing feed reserves was one of the options that his fellow villagers chose after much reluctance and debate. He explained that the enclosed area allows the grass to recover and this provides feed for the livestock during the dry season. The grass also protects the soil from being blown away by the strong winds in the area.

In Fantalle District, as over much of Ethiopia, there are few trees remaining. Trees are cut down for fuel and building work. Removing the tree cover exposes the soil to erosion and means that when rain does fall, less

> Fast-growing trees suitable for semi-arid areas

Always consider using indigenous trees first and ask for local advice.

- *Acacia albida*, *A seyal*, *A sieberiana*, *A tortilis*
- *Acacia holosericea*, *A trachycarpa*, *A tumida* (these species from Australia keep their leaves during the dry season)
- *Balanites aegyptiaca*

- *Bauhinia rufescens*
- *Cassia siamea*
- *Leuceana leucocephala*
- *Moringa oleifera*
- *Prosopis alba*, *P juliflora*, *P nigra*
- *Pterocarpus lucens*

water soaks into the soil. When trees are cut down they are rarely replaced with new tree seedlings. There is a traditional belief that danger and wild animals come out of the forest, so forests are seen as a threat and this makes people less likely to replant trees.

Plant appropriate trees

In the village of Banti Mogassa, Xadacha was pleased to see trees growing in what used to be a totally bare patch of land. Tree seedlings planted two years ago with community participation are now a metre and half high, and he is looking forward to sitting under the shade of the trees. GTF took care to consult with knowledgeable community leaders and elders before selecting indigenous tree species that have many different uses. Some of the trees were selected for their drought tolerance. Others had qualities such as being termite resistant which is good for house construction. Some trees had medicinal value. One of the tree species introduced is *Moringa oleifera*. It has vitamin and mineral rich leaves that can be eaten as a vegetable. In 2006 over 80,000 tree seedlings were planted in communal enclosures and around homesteads.

The efforts the Karayu pastoralists have made to adapt to the impact of climate change are a valuable start and provide an example to others. These new ideas need to be supported and scaled up so that a wider impact can be achieved. Small communities and local NGOs deserve support and encouragement from international development agencies as they attempt to deal with the worst effects of climate change.

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Storing rainwater in Rajasthan

In the past 15 years, climate extremes such as flooding, drought, cyclones and mud slides have caused about 85% of deaths related to natural disasters and over 60% of the financial damage. Extreme weather events unfortunately are becoming more common due to climate change, so we need to be better prepared.

Communities can make plans to reduce the impact of future hazards such as cyclones, flooding or drought. If outside organisations help to lead community discussions, they can share useful ideas from other places and build people's confidence to make changes. In India, staff of the Discipleship Centre (DC), a Tearfund partner, have carried out participatory disaster risk assessments with many vulnerable communities. They help them to consider likely hazards (such as drought or cyclones), and assess who and what would be affected. Then they help them to plan how to reduce the risks, building largely on the skills, resources and abilities available within the communities.

Community advocacy work in Rajasthan

Rajasthan state in India increasingly suffers from droughts. Local communities struggle to cope with the impact of the droughts. This is because people generally have few reserves. They have small plots of land, use farming practices that depend on fertilisers and irrigation and live in isolated areas with few other work opportunities. Water shortages are becoming more common.

Staff from DC work with five villages near Jodhpur. They help local communities to assess the risks of future droughts and other problems and consider how they could develop their capacity to respond. Through this exercise, a Village Development

> Advocacy with landowners in India

In Bihar the Discipleship Centre advocated to local landlords on behalf of poor rural villagers living on low-lying land that is regularly flooded. Before the advocacy work, villagers had no safe evacuation route when the floodwaters rose, because the safest route meant going across land owned by others. They were not allowed to trespass on this land. The Discipleship Centre was able to gain permission from 47 landowners to build a raised evacuation path across this private land. Relationships between poor villagers and wealthy landowners have improved since this intervention.



Children practising a flood evacuation across a raised escape route.

Photo: Caroline Irby/Tearfund

Committee (VDC) was formed. This committee provides the first opportunity for men and women of different castes to meet together to make decisions.

Discipleship Centre staff help the committee members to gain confidence and share ideas from other parts of India. From these meetings, two ideas have proved very successful in lessening the impact of future droughts.

Rainwater cisterns

Shortages of drinking water are a major concern during times of drought. The Indian government is opposed to the building of more tube wells as ground water levels have fallen considerably. The VDC made the decision to build rainwater cisterns. These are about 3–4 metres wide and 4 metres deep. During the rainy season, rainwater is collected by channels which run into the cistern. Each cistern can store 40,000 litres and is shared by three families. When full, the cistern can provide drinking water for these families all year round. It could also be used to store water brought in by tankers in times of drought.

Discipleship Centre provided training and materials to help the community build one cistern using cement. However, one cistern was not enough to meet village needs. Motivated by their new awareness and understanding, the village committee decided to take their cause to their local government meeting, the *Gram Sabha*. DC staff helped the committee to make a formal application and provided advice on how to present their case



These pictures of neighbouring fields were taken at the same time. The field on the left has a rainwater bund built around it, the other does not.

in the meeting. Both male and female members of the committee attended and the women were highly motivated by their new ability to represent their own causes. As a result of this application, the government have promised to build another ten cisterns for the village over the coming months. Five have so far been completed.

Rainwater bunds

Another idea which DC staff shared with committee members was to restore traditional practices that had been abandoned or forgotten. One of these was to conserve water by making bunds. A bund is an earth wall, 1–2 metres in height, that is built around the field. A large ditch is then dug out in front of the bund. The bunds must follow the contour lines. (See page 8)

The bunds help to prevent soil erosion from wind and rain. They help to

hold water in the soil by preventing rainwater from flowing away.

Villagers were mobilised by the VDC to dig a bund around the field of one of the village widows. This widow could not survive on what she could grow and had been forced to find work in a nearby stone quarry. Her children had to go with her as she had no-one to care for them at home. This meant they dropped out of school and began working in the stone quarry as well.

Thirty men worked for 20 days for 60 rupees a day to create a bund and DC paid them on a cash-for-work basis. After the bund was completed, the widow's yield of millet doubled in the first year, and the field now provides a huge contrast with surrounding fields. Now others in the village also want bunds for their fields. However, although most households are able to build bunds for themselves, they cannot afford the time away from the stone quarry, which is the main source of local income. This is a problem that both the VDC and DC are aware of and they hope to discuss possible solutions over the coming months.

Helping communities to assess the risks they face from natural disasters, and to respond by reducing some of these risks, will save many lives.

This case study was sent in by Oenone Chadburn, Disaster Risk Reduction Project Manager with Tearfund, and Blesson Samuel of Discipleship Centre, New Delhi.



Cistern for storing rainwater.

Contour barriers

All kinds of barriers can help to slow down run-off water from rain. This will reduce soil erosion and help to store more water in the soil for the benefit of crops.

Barriers can be built of whatever materials are locally available. They can be made of stones, old crop stalks

and leaves, or earth mounds, or by leaving strips of grass or vegetation unploughed.

Over time the land between the mounds will become less sloping as earth collects against the mound. Specially tough grasses such as napier (elephant grass) or vetiver are ideal

for planting along contour mounds. Not only will they provide fodder for livestock, but their roots will provide a tough, lasting barrier against erosion.

Contour strips will improve crop yields by helping to conserve rainwater in the soil. This is particularly important if rains become less reliable.

Measuring contour lines with an A-frame

Contour lines are completely level lines across a slope. When building rainwater bunds or dykes or building contour mounds to control soil erosion, contour lines must be first identified. If people guess, this will result in bunds or mounds which may collapse during heavy rain and fail to prevent the rainwater flowing away.

The A-frame is an easy and well-tested method for measuring contour lines. It can be made at no cost from local materials.

Materials needed

- 2 poles about 2 metres long
- 1 pole about 1 metre long
- some string
- a stone

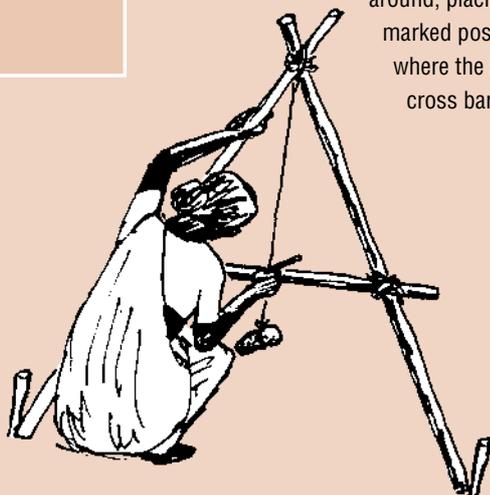
STEP 1



Tie the poles very tightly together to make the shape of a letter A. Hang the stone from the top of the A-frame, making sure the stone hangs below the cross bar.

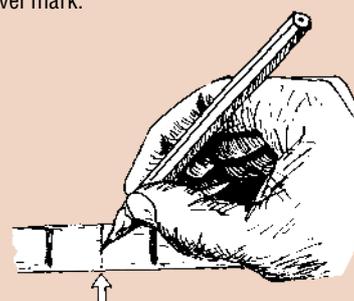
STEP 2

Hold the A-frame upright and mark exactly where the poles touch the ground. With a pencil, mark where the string crosses the cross bar. Turn the A-frame around, placing the poles in the marked positions. Again mark where the string crosses the cross bar.



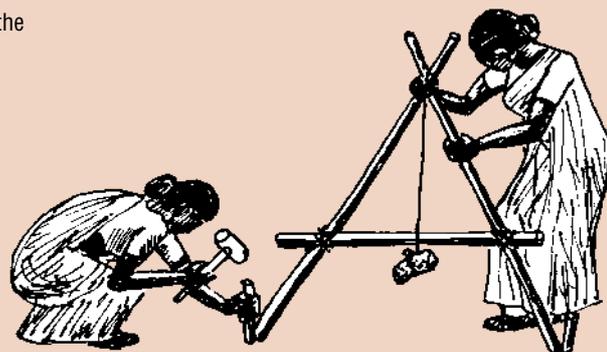
STEP 3

Mark the 'level mark' on the cross bar – exactly half way between the previous marks. If the first two marks happen to be in the same place, this is the level mark.



STEP 4

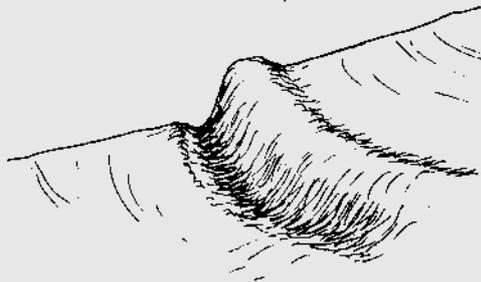
Before using the A-frame, collect a number of sticks. Begin at one side of the land where the first contour line is wanted. Hold one pole firmly on the ground. Move the other pole until the string touches the level mark. Place a stick into the soil by each pole. Move the A-frame along the field, alternately moving each pole (pivoting).



Alley cropping

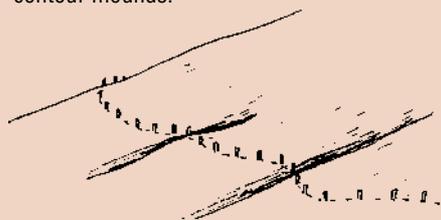
Compiled by Isabel Carter

Contour mounds built of earth should follow this shape.



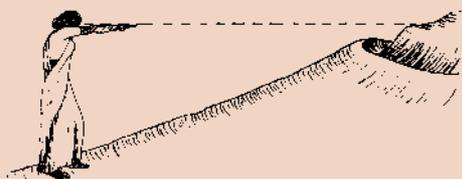
STEP 5

This will result in a line of small sticks. Smooth out any sharp bends in the line and use this line as the guide for building bunds and contour mounds.



STEP 6

To find the position of the next contour line, stand with one arm stretched out. Walk backwards down the slope until an identified contour line can be seen in line with your arm. Make the next contour line where you now are now standing.



WARNING: In areas that have very heavy storms, it may be dangerous to prevent all of the rainwater from flowing down a slope. Build waterways or drains with a very slight downhill angle of $\frac{1}{2}^{\circ}$ – 1° so that excess water is safely channelled away.

Alley cropping is a technique that is very useful for improving poor soils, providing fodder for livestock and protecting the soil from heavy rainfall.

Alley cropping is a simple way of combining tree-growing with crops. Rows of suitable trees are planted about 5 metres apart, usually by direct seeding into the soil at the beginning of the rainy season. In between the rows of trees, crops or vegetables are grown as usual. On sloping ground, the rows must be planted along the contour – across the slope. Alley cropping may also give some protection during irregular rainfall as the rows of trees help to trap rainfall in the soil.

The tree seeds are planted close together in the rows so the young trees form a hedge. If possible, try to mix several different species to form a hedge. Once the trees reach shoulder height (1–2 metres high) they are cut right back to just 20–30 cm in height. The leaves can be left on the ground as a mulch to rot down and add nutrients to the soil. Alternatively, they can be collected and used to provide animal fodder. The remaining stumps quickly grow back and the cutting can be repeated for many years.

Alley cropping adds plant nutrients and improves soil structure. It protects soil from heavy rains. It is low-cost and easy to do, although it does require a



Photo: ICRAF

lot of labour to cut back trees. Without regular cutting, they will grow tall, develop thick trunks and compete with the crops.

Alley cropping should not be used in very dry areas. The trees will be more difficult to establish. Once established, the rows of trees will use what little water is available in the soil and make it more difficult for crops to grow.

Alley cropping requires a good supply of seed from the right kind of trees. It is important that only legume trees are planted, as their roots add plant nutrients to the soil. In many areas legume trees are already growing and they often produce plentiful supplies of seed. Legume trees produce seeds in pods and usually have small, divided leaves. They also tend to have deep roots that do not compete much with crops for water. If possible, get local advice on the best species to plant.

> Recommended species of tree

LATIN NAME	SOME COMMON NAMES
<i>Acacia albida</i>	acacia, kad, haraz, winter thorn
<i>Calliandra calothyrsus</i>	calliandra, cabello de angel, barba de gato, barbillo, barbejolote, clavellino
<i>Cassia siamea</i>	cassia, sélé, amarillo, kassod
<i>Gliricidia sepium</i>	gliricid, cacahuananche, madre de cacao, madiado
<i>Leuceana leucocephala</i>	leuceana, guage lamtoro, ipil ipil, subabul
<i>Moringa oleifera</i>	moringa, arzantiga, mbum
<i>Sesbania grandiflora</i>	sesbania, agati, bagphal, pan hatiya, tuwi, sesban, murunga, zapaton blanco

The impact of climate change on nomadic people

by Jeff Woodke



Photo Jim Loring Tearfund

Climate change has begun to affect the nomadic peoples of the Sahel region in Niger. Rainfall in this semi-arid area is becoming increasingly unpredictable, with changes in timing, frequency and the amount of rainfall. Temperatures are rising gradually. There have been several severe droughts since 1973, causing massive loss of livestock. Climate change is having a major impact on the natural grasslands, resulting in the spread of the desert and the loss of soil fertility.

The Tuareg are well adapted to surviving in the Sahel's dry, marginal land. If pastures fail in one area they move on, taking all their possessions with them. During the past 30 years they have developed ways to cope better with drought conditions. Even so, the effect on the nomads who live in this area is considerable. Many have lost their herds of cows and sheep and seen their traditional lands destroyed. Some groups are taking action to improve poor soils, stop the spread of the desert and respond to the effects of climate change.

Fixation sites

The Tuareg people decided that it was better to make some changes and

adjustments now and lose only some of their traditions, than do nothing and lose their whole way of life. At their request, Tearfund partner JEMED has been helping communities to establish 'fixation sites' since 1990 to enable them to survive the changes that the spread of the desert and increased population have brought. These fixation sites do not settle people permanently, but build upon a tradition that the Tuareg would spend part of each year camped in a particular place. They also enable communities to develop a social infrastructure and education, training, health and pasture management projects, while still keeping hold of many of their traditional pastoral ways. There are now 22 fixation sites and

each has a management committee elected from the local community.

Wells

Wells are very important to the fixation sites. JEMED has repaired or dug over 30 wells so far. Sometimes new wells have to be dug deep to find water (over 135 metres at Zeddagar for example). Once wells have water, a number of families are likely to take up residence at the site.

Literacy and education

So far, five of the sites have primary schools that provide dormitories and canteens so that students can remain there if their families move. All sites will eventually provide an adult education programme, targeting women's literacy and advocacy for land tenure and nomadic rights. Despite challenges, the educational programmes have made significant achievements. General literacy levels have risen to 20% from almost zero, enabling people to read medicine labels and Christian people to read their own Bibles. Numeracy skills have helped in the successful running of grain banks. Improved literacy and the resulting confidence it gives people, have permitted increased political involvement. JEMED uses a gender-sensitive approach which is much appreciated by women who greatly value their newfound liberty. They comment on 'being resurrected' and being 'placed on the back of the camel!'

Food security

Food security has been improved at 18 sites by establishing grain banks. These reduce the cost of grain and make it more easily available. At six of these, small shops have been established which sell basic household items (tea, sugar, matches).

Many nomads have lost their herds of cows and sheep and seen their traditional lands destroyed

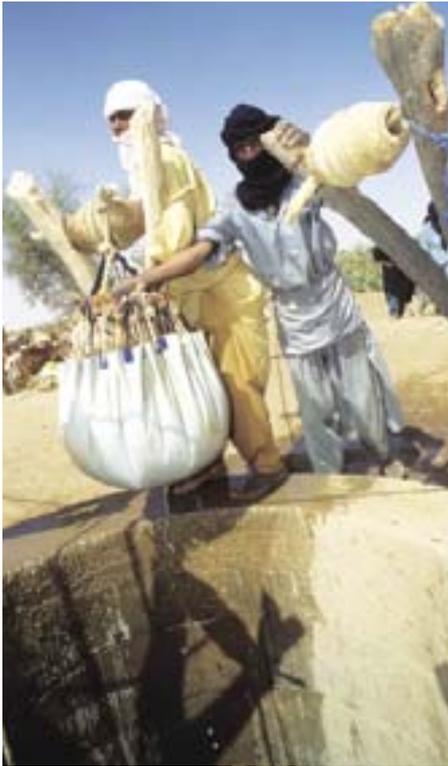


Photo: Jim Loring Tearfund

Wells are very important to fixation sites.

Rainwater dykes

In 14 sites, JEMED has helped communities to conserve rainwater by building a low bank, bund or dyke of stones across a valley, usually about 120 metres in length. When the rains come, the stones slow the flowing streams, causing water to sink deeper into the soil. Behind the dykes, the Tuareg have been able to grow wild wheat. In Intikikitan, an established dyke has increased moisture levels to the extent that plant species not seen for half a century have returned.

Fodder is of huge importance to nomadic people whose livestock is often their only source of income. Nine enclosures have been built behind dykes to protect and improve pasture for livestock. Pasture management associations have been created at all sites. Loans to buy animals are available to both men and women at some sites along with a livestock vaccination programme.

At one fixation site called Abrik, there is a valley that divides the 'dead' land to the north from the 'living' land to the south. The northern land is desert – partly from climate change but also because of human activity. The valley

itself was dying as well. JEMED was able to reverse this process and help the people to adapt to the changing rainfall patterns, for example through building dykes.

Results

The success of the fixation sites was put to the test during the recent severe drought from 2003 to 2005. The nomads had to survive not just one year of drought but two. During the first year, grazers came into the area from outside with their livestock, and pastures were quickly used up. JEMED staff noted the warning signs and advised people to sell their livestock, keeping only the best breeding stock. This was unheard of for nomadic people – they have never done this in the past. However, many people did sell their animals in time. The men took the remaining livestock to other areas and managed to keep their animals alive. As a result, people in the fixation sites lost a third less livestock during the drought than others in neighbouring areas.

JEMED helped with food relief, providing grain and fodder. The first year of drought was followed by terrible sand storms that buried grazing areas, and a very unusual flash flood that drowned many small livestock and camels, which were based in the dry valley areas.

During the drought period, the improvements made allowed some grass to grow in the enclosures. At most fixation sites JEMED has seen a change in the last three years. Women and children are increasingly staying at the sites while a portion of the men move with the animals during the rainy season.

Once the crisis was over, JEMED helped people to restock, providing 11,000 sheep and 700 cows to the worst-affected families. Each selected family receives two cows and 24 sheep, six of which are always given to the women to allow them to build up their own flocks.

Many other communities in the area are now seeking to adopt the fixation site strategy. JEMED hopes that governments and NGOs will see the value of this approach and help it to be replicated.

Jeff Woodke is Project Director of JEMED (Jeunesse En Mission Entraide et Développement)

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Photo: Jim Loring Tearfund

Preparing to plant wild wheat inside the dyke.

Adapting farming practices in Burkina Faso

Burkina Faso is an inland country in West Africa. The north of the country experiences a hot dry climate while the south receives more rain. Rainfall is irregular and for 30 years Burkina Faso has had very poor rains with three particularly severe droughts (1973–1974, 1983–1984 and 2000–2001).

The soils are generally of poor quality, partly due to erosion. Yields are low and have resulted in a shortage of grain with famine in areas of the north and central plains.

Increasing population growth puts more pressure on farming and the environment. In addition, for 20 years there have been high levels of internal migration. Many farmers from the north and central plains move to the lowlands in search of land to rent. Usually one member of the family goes first and then calls others to follow. In some areas there are now as many migrants as indigenous people. This is threatening the local customs and language. Sometimes migrants use dry riverbeds to plant crops. If rain does fall, these crops are often ruined because the riverbeds fill with water. CREDO, a Tearfund partner, is working

to mobilise grass-roots agricultural projects with very positive results.

Farmers in Burkina Faso have suffered from the impact of the changing climate for many years. Over time they have been adapting their farming practices to protect themselves from the endless cycles of drought and poor rainfall.

Following are some of the most well used techniques and ideas.

Sowing in dry ground

In order to avoid wasting a single drop of the very first rains, seeds are sown in dry ground just before the rains begin. This means that even the lightest rainfall is used for crops to begin growing.

Fast-growing varieties

Many farmers in the south of the country have begun using fast-growing varieties of millet, maize, sorghum and

rice (normally only used in the dry north), even though they know these give lower yields.

Improved seed

Government research centres have produced improved seed varieties that have become popular with NGOs and farmers. These seeds are now widely accepted and appreciated by farmers.

Animal traction

Farmers are very aware of the benefits of using animal power in farming to make sure land is ploughed and seeds sown as soon as the rains begin. The only problem is access to the animals and ploughs, which is beyond the reach of many farmers. CREDO helps by distributing ploughs.

Land-clearing

In order to be certain of harvesting something each season, farmers in wooded areas do not hesitate to chop down a little of the remaining forest every year in order to use the most fertile ground possible. People cut wood and sell it in the city. Farmers don't always realise the importance of trees. CREDO encourages communities to have forest management committees, recognised by the government, to train people to manage the forest so that there is a balance between cutting and planting.

Zai technique

This is a traditional agricultural practice that is particularly useful in poor infertile soils. Small pits measuring 20–30cm across and 10–20cm deep are dug. Two handfuls of crop waste or animal manure are placed in the pit and covered with a little soil. When the rains begin sorghum or millet seeds are sown in the pits. These pits are useful because precious rainwater collects in them and they make the most effective use of small quantities of organic waste and manure.

Animal manure gives better results than crop wastes as it is a more concentrated fertiliser. Composting crop wastes before use improves fertility, but takes more time. It can be hard work to dig the *zai* pits but it can be done during the dry season when there is less other work. This simple technique is providing farmers with increased crop yields in Burkina Faso.



Photo Caroline Irby Tearfund

Radio programmes are broadcast in local languages on the importance of tree planting and school pupils are encouraged to plant and care for 200 trees in each school.

Training in sustainable agriculture

Long-term training (for eight months) is given to young farmers on animal traction, breeding and farm

management. They are taught about sustainable agriculture, agroforestry, tree nurseries and market gardening. Following training, these farmers can have a big impact in their villages. Their crop yields often double, some have even tripled their yields. This helps other farmers in the villages to be more willing to learn from the knowledge these trained farmers can share.

Yanogo André is the development programme co-ordinator for CREDO.

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Rising sea levels

The global rise in temperature is melting ice which is frozen within glaciers and ice caps. Large amounts of fresh water are released. This is causing a gradual rise in sea levels. Low-level coastal regions are therefore at more risk of flooding and tidal surges.

The remote Mosquitia region of Honduras, with its mangrove swamps, rivers, grasslands and tropical rainforest, is a beautiful natural wilderness. It is the home of Miskito, Garifuna, Pesch and Tawakha indigenous people. However, the area and its people are under threat.

The weather is changing as a result of climate change. Rainfall has become unpredictable – sometimes there will be droughts and at other times there will be very heavy rainfall. In 2005 the area was affected by three hurricanes and very heavy rains over a short period of time. These caused rivers to break through sandbanks and part of a community was washed away. Large areas of trees are also being cut down, changing the micro-climate and increasing erosion.

Many people live very close to the sea because the climate is much nicer there. There is a breeze and it is cooler. There are fewer insects. However, these



Higher tides and coastal erosion threaten many communities.

Photo Steve Collins

people are very vulnerable to rising sea levels. If the area continues to be affected by more frequent and stronger hurricanes and the sea levels rise, then hundreds of people on the coastal strip will have to migrate. If they have to move into the forest areas, diseases such as malaria will become a big problem. They would then lose access to safe water supplies, schools and other community services.

Rising sea levels will also have a huge effect on the natural environment. Seawater surging into the coastal lagoons may kill the existing fish

and plant life and lead to permanent changes in vegetation and fish stocks.

Tearfund partner MOPAWI is working with the communities helping them to plan for disasters and to replant trees around the lagoons. They make sure that hurricane alerts are given on the radio during the hurricane season. People are also taught evacuation procedures so that they can respond at short notice to the warnings.

Jude and Steve Collins worked as environmental advisors with MOPAWI, Honduras.

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Bible study

The two books

Many early scientists were Christians and through their science investigated and learned about God's creation. They talked about God's revelation in the form of two books, the book of God's works (his creation) and the book of God's Word (as found in the Bible). We can see the same idea in the structure of Psalm 19, written by King David about 1,000 years before Christ. The first six verses speak of God's works in creation while the following three verses (6-9) speak about God's Word in the Bible.

Read Psalm 19:1-6

As a shepherd boy, David must have spent many hours looking up at the sky and becoming familiar with the stars, moon and planets.

- *How would we try to describe creation?*
- *Reflect on the different ways in which David tries to describe the wonder of God's creation. How do they make us feel?*



Photo David Crooks Tearfund

Read Psalm 19:7-11

Here David draws a clear parallel between God's physical laws controlling creation and God's moral laws regulating human behaviour and relationships.

- *Are these words and descriptions you would use to describe God's moral laws?*
- *How do they help you to reflect on the value of God's moral laws?*

David had only a small fragment of God's Word in the books of Moses. Today we have the whole Bible and, in particular, Jesus – the perfect image of God. But we live in a world where God is generally ignored, the Bible is largely unknown, God's rules are often not followed and many people do what they like.

Putting both God's books together (his creation and his Word) has big implications for the way we care for creation. From science we learn that human activities are causing rapid and damaging climate change. The poorer nations will bear the greater proportion of this damage and the much higher frequency and intensity of extremes such as floods and droughts.

As Christians, we should care for the whole of God's creation. Urgent action is needed so that some of the worst damage of climate change can be avoided.

- *Jesus is the one 'through whom all things were made' (Colossians 1:15-20). How does that make us feel as we consider the scope of God's creation?*
- *Discuss three ways in which we can take action to care for the environment.*
- *Discuss three ways in which we could help raise awareness of climate change.*

Read Psalm 19:12-14

These final three verses encourage us to apply God's word to our personal actions, words and thoughts. David prays very beautifully for God's help with obedience, so he can live out God's revelation as presented in both his books. It is a prayer that we can regularly make our own.

Sir John Houghton is a Director of the John Ray Initiative (www.jri.org.uk) that connects environment, science and Christianity. His previous positions include Chief Executive, Meteorological Office, and Co-Chair, Scientific Assessment Working Group of the Intergovernmental Panel on Climate Change.

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Seeking justice for all

This new PILLARS Guide presents a number of common situations of injustice based on the UN Universal Declaration of Human Rights. It seeks to help people to learn about their human rights and to discuss ways of promoting them in different local situations. Each topic includes Bible references that help us to understand God's compassion and passion for justice. This Guide helps us understand how to challenge unjust laws, to become familiar with our human rights and to promote and defend the rights of others.



Improving food security

This PILLARS Guide provides practical information on pest control, grain banks and new techniques for food preservation and storage. It increases awareness of the benefits of maintaining genetic variability and traditional crop varieties.

Agroforestry

This PILLARS Guide encourages awareness of agroforestry for improving soil conservation, nutrition, soil fertility, fuel wood production and family income. It includes details of nursery techniques.

PILLARS Guides can be downloaded free at: www.tearfund.org/tilz

Printed copies are available from:

Tearfund Resources Development
PO Box 200, Bridgnorth, Shropshire
WV16 4WQ
UK

Email: roots@tearfund.org

Footsteps CD Rom

The latest Footsteps CD Rom contains the content of issues 1-65 in English, French, Spanish and Portuguese. It uses



html format which means that it is easy to search for any topic. Individual articles can be printed for use in training or translating. The CD Rom costs £15 (US \$27, €22) and can be ordered from the above address.

Tools together now!

This toolkit is produced by the International HIV/AIDS Alliance and provides a selection of 100 Participatory Learning and Action (PLA) tools for community mobilisation around HIV. PLA tools are interactive activities that enable communities and organisations to work together to respond to HIV in their community. The tools cover learning, developing a plan, acting on it and evaluating and reflecting on how it went. All the tools and approaches described in this toolkit were developed or adapted in the field by Alliance partner NGOs with communities.



The toolkit is available to download as a pdf, or order from the website: www.aidsalliance.org

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Teaching-aids At Low Cost (TALC) is a UK-based charity providing free and low-cost books and educational materials to healthcare workers and organisations throughout the world.



You can now order free and low-cost healthcare aids from the website: www.talcuk.org

Where There Is No Doctor – online!

An updated 2006 edition of the classic community healthcare manual, *Where There Is No Doctor*, is now available online. This manual is designed for health workers, clinicians, and others involved in primary healthcare delivery and health promotion programmes around the world. It provides practical, easily understood information on

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www.tearfund.org/Campaigning/Climate+change+and+disasters/

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www.unfccc.int/

Reports from the United Nations conferences

www.tiempocyberclimate.org/portal/bulletin.htm

Global information including a regular free magazine *Tiempo* and practical information

www.climatenetwork.org/

A global network of NGOs

www.linkingclimateadaptation.org

A network sharing information about adaptation to climate change.

www.panda.org/about_wwf/what_we_do/climate_change/index.cfm

WWF's website introduces the issues behind climate change, with ideas for action

www.ids.ac.uk/climatechange

www.iied.org/CC/index.html

www.eldis.org/climate/index.htm

UK-based centres of academic research

www.greenpeace.org/international/campaigns/climate-change

Practical ideas for campaigning

International action

by Isabel Carter

Climate change affects the whole earth, but it is the world's poorest people – who contribute least to global warming – who will suffer the most. Since the early 1980s, scientists have been predicting the serious consequences of climate change and raising the need to take action. Climate change will put 100 million more people at risk of hunger by 2080 – with 80% of them in Africa.

The Intergovernmental Panel on Climate Change (IPCC) was established in 1988, bringing together 2,500 of the world's top scientists, and has produced three detailed scientific reports. Each year the United Nations hosts a major conference on climate change – the Conference of the Parties (COP). At a conference in Rio de Janeiro in 1992, 188 governments agreed to reduce their emissions of greenhouse gases. However, these agreements were not legally binding so this was followed by the Kyoto protocol, agreed at COP3 in 1997 and signed by 141 countries in 2005 after years of difficult negotiations. There is particular concern that the United States, (which emits the highest level of greenhouse gases per person), has refused to sign up to the Kyoto protocol, and that many of the signatories are failing to meet their targets.

Countries can meet their targets by directly reducing emissions of

greenhouse gases or by creating carbon 'sinks' that absorb carbon dioxide from the atmosphere (for example by planting forests). They are also encouraged to promote investment in renewable energy, to help poorer countries develop without fossil fuels and to 'trade' in carbon emissions by paying countries with low emissions for their 'quota' of carbon. In addition, developed countries have made agreements to invest in special 'adaptation funds' to help developing countries adapt to the impact of climate change.

These decisions are moving in the right direction, but painfully slowly. Time is not on our side. The more delays in taking decisive action, the more global temperatures will rise – and the more serious the impacts will be. Carbon dioxide has a long life. Once in the atmosphere, it remains there for 200

Please do all you can to raise awareness of this issue by talking to others about it and writing to your leaders asking that they take action.

Please contact the Advocacy Group at Tearfund for more information about taking action.

Email: ppadmin@tearfund.org

years. We are already much too late to undo the damage of climate change – all we can do is to lessen the impact.

Managing scarce water resources is increasingly important, yet few countries have an integrated plan.

At the recent climate change conference in Nairobi (COP 12), few significant decisions were made. Before the conference Kofi Annan, UN Secretary-General, said: 'Until we acknowledge the all-encompassing nature of the threat, our response will fall short.' After the conference, Bishop Paul Mususu from the Evangelical Fellowship of Zambia commented: 'I did not expect such weak action on African soil after all the promises about emissions cuts from rich countries. Millions of people on this continent are vulnerable to the droughts, floods and erratic rains that come with a changing climate. We need urgent action!'

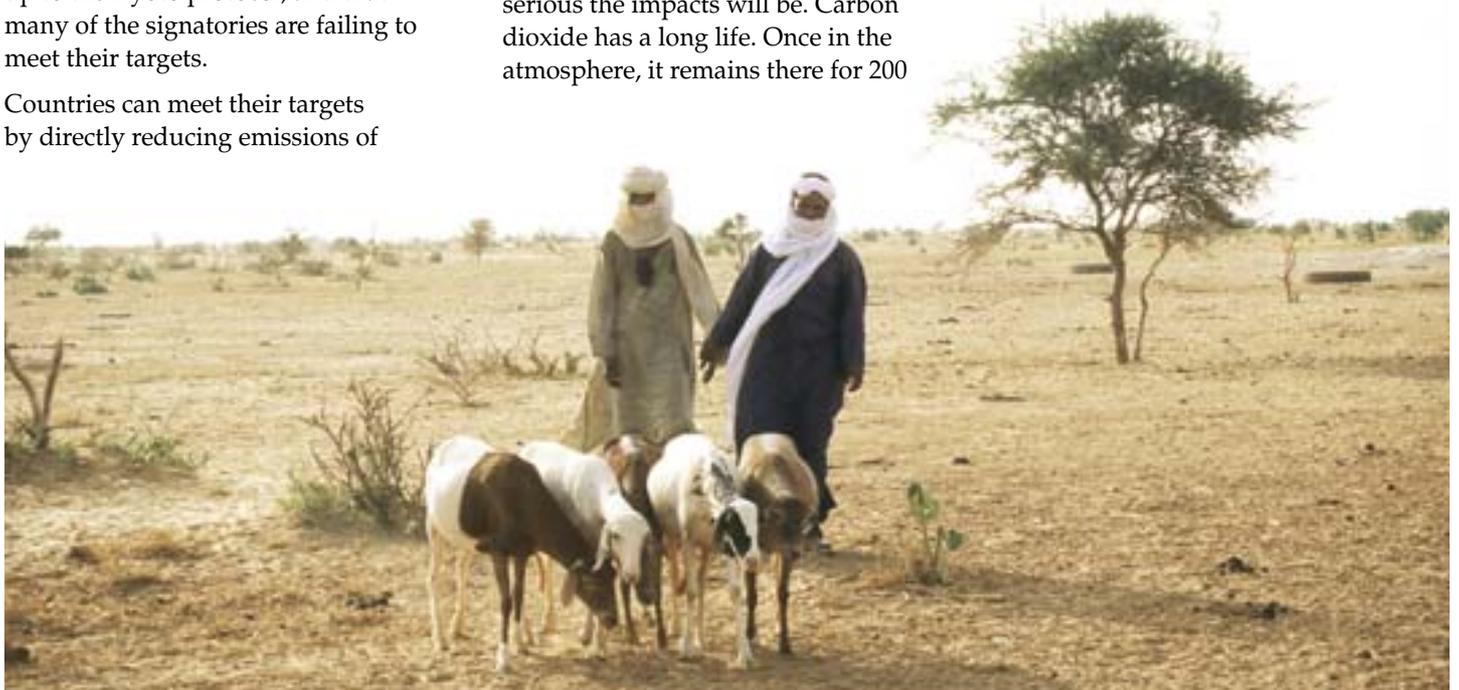


Photo: Jim Loring, Tearfund