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Principles and definitions of environmental sustainability

The term 'environment' is used to describe our surroundings – both the natural physical surroundings such as the land, water, climate, plants and animals that we can see, and the places in which we live with their social, cultural, economic and spiritual dynamics (usually called the human environment). This book focuses on the natural physical environment – the way in which our practices and lifestyles affect it, and the ways in which it affects our lives.

People depend on the natural environment for survival. Our food, medicines, shelter, fuels and clothing are all sourced from it. For example, a farmer's crop relies on adequate water, sunshine, fertile soil, unpolluted air and soil, and balanced insect life and micro-organisms. Without any one of these, the crop is threatened and the farmer may not have enough food to feed the family or to sell in the market.

People in urban areas also depend on the environment but perhaps in a less direct way. Their food may come indirectly through markets and shops. They usually buy rather than collect fuel for cooking. Manufactured products rely on the environment for:

- the raw materials such as wood or plant fibres
- energy – usually from fossil fuels such as oil or diesel, to work the machinery
- water – factories often use a lot of water for manufacturing processes
- transport – over land by road and rail, across oceans or along rivers to customers.

Human interaction with the environment often has a negative impact. Sometimes poor management of one resource leads to other environmental problems. For example, over-exploitation of forest reserves increases deforestation which can lead to landslides, flooding and soil erosion. There could be a loss of biodiversity or soil fertility if the cleared land is not managed properly.

1.1 Poverty and the environment

Since the industrial revolution in Europe in the 19th century, human economic activity has consumed resources at a faster rate than the earth can replenish them, causing damage to ecosystems, decreased biodiversity, and climate change. The ongoing desire to become wealthier and consume more has meant that people have used the environment for their own benefit without considering the negative effects. For example:

- Land is being farmed too intensively, which can result in lower crop yields, loss of soil nutrients and increased desertification.

- High demand for water is drying up many rivers and lakes.
- Industry is causing pollution. This includes liquid waste (often disposed untreated into rivers and oceans, affecting marine life), solid waste (often dumped or buried in the ground, affecting human health through pollution and diseases spread by insect pests and vermin attracted by the waste), and air pollution (which can change climates locally and globally).

According to the United Nations Development Programme (UNDP), the richest two per cent of the world's adults own more than half of global household wealth, while the poorest 50 per cent of adults own only one per cent. The rich have benefited the most from global economic growth; poor people have generally benefited much less. Much of the environmental damage that has been caused by humans has been to serve the consumption of wealthy people. They usually have an indirect relationship with the environment, and so rarely see the damage they are causing. They are therefore likely to continue with their high consumption.

Many poor people in the South have a direct relationship with the environment. They often rely directly on natural resources to meet their basic needs through agricultural production, fishing and the gathering of resources such as water, firewood, and wild plants for consumption and medicine. Poor people's health suffers most when the environment is degraded, such as through water, air or land pollution. Many poor people are forced to live in areas that are environmentally fragile, such as on steep slopes or flood plains, making them more vulnerable to climatic hazards. Poor people are also particularly vulnerable to the losses that result from environmental damage (such as crop failure due to drought or flooding) and may not have the resources to adapt to a changing environment.

Poor people may be forced to exploit the environment, not usually through ignorance but in order for their families to survive. Although they may be aware of the damage they are doing, their immediate need for survival takes priority over long-term environmental sustainability. They usually lack access to information and technology to help them to reduce that damage. Climate change is an urgent and global issue, but environmental degradation also has an impact locally and globally, including changing rainfall patterns and reducing the ability of the soil to hold water. Understanding these pressures is key to helping people to conserve and, where possible, enhance environmental resources and restore environmental damage.

Coastal erosion in Honduras

The removal of vegetation along the shoreline of a thin strip of land in Honduras, for use as firewood and to clear spaces for houses and other purposes, has led to significant soil erosion. Homes, infrastructure and livelihoods are being lost as a result. Water supplies are affected, which is impacting people's health. Although this environmental degradation has long been recognised, it was not until community participatory tools were used that the nature and scale of the threat was clearly defined. Small groups of neighbours have since been replanting mangroves to protect the shore from further erosion.

MOPAWI, Tearfund partner in Honduras

1.2 Sustainable development

Our dependence on a sustainable environment has been the focus of a number of international gatherings. In 1982 the World Commission on Environment and Development was established to look at the links between economic development and the environment. The report that was produced defined 'sustainable development' as, '*development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*¹

The 1992 Rio Earth Summit, as it became known, was the largest ever gathering of heads of government to discuss environmental issues. It resulted in historic agreements about a number of key principles related to sustainable development that have helped shape policies and practice over the last two decades:

- economic development and environmental protection should be integrated
- there should be more equity within countries and between rich and poor countries
- scientific and technical knowledge related to sustainable development should be improved
- governments should protect citizens from environmental problems
- the polluter should pay to restore damage caused to the environment
- environmental impact studies should be carried out before undertaking projects that are likely to have negative environmental consequences
- recognise the particular roles of:
 - women, who often play a vital role in environmental management and development
 - young people, so that the needs of future generations can be met
 - indigenous people, due to their knowledge and traditional practices related to environmental management.

Since the Rio Earth Summit, a number of agreements and plans related to sustainable development have been made at international level. For example:

- *Agenda 21* is a plan of action to take forward the commitment to the Rio principles.
- *Millennium Development Goal 7, Target 9* is to ensure that principles of sustainable development are integrated into country policies and programmes to reverse the loss of environmental resources.
- The United Nations *Framework Convention on Climate Change* aims to prevent dangerous climate change.

The above agreements indicate good progress in many areas on paper and in discussion, including a greater understanding of the importance of sustainable development. However, despite these international agreements, exploitation of the world's resources continues, mostly due to the demands of consumers in the North, increasingly at the expense of people in the South.

1 Bruntland, H (1987) *Our Common Future*, WCED, UN Reports 1987

1.3 Our environmental footprint

Stewardship of God's earth should be considered within all areas of our work and life. We all have an influence on our environment. Often this is a negative influence, using up resources or causing pollution, but we can also take actions to ensure that our way of life has a positive impact on the environment.

Most things we do in life involve interaction with the environment, whether directly or indirectly. For example, providing a meal requires energy to grow the food and cook it. Catching a bus or driving a vehicle results in air pollution.

When we walk through mud, we leave footprints behind. As we walk through life, we leave behind a mark on the environment, an environmental footprint. Some of us are like elephants, trampling down the vegetation and leaving a trail of damage behind in terms of our consumption, pollution and use of energy. Others are like antelopes, walking delicately and lightly, leaving behind a trail that can hardly be seen.



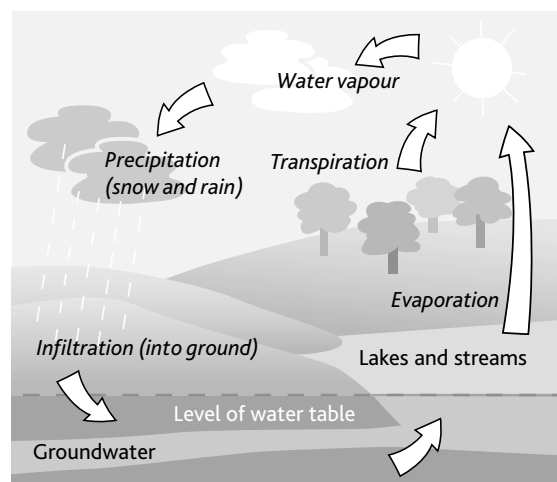
This footprint can cause environmental degradation. It has consequences for other people. Climate change is a key example. Our use of fossil fuels and deforestation is causing climate change which has negative consequences for people all around the world, but it is poor people who are suffering the most.

We now look at two key environmental resources – water and forests. We then look at the issue of climate change – its causes, impacts and our responses. This will build a foundation for the following sections.

1.4 Understanding water resources

Plants and animals need water to survive. It is so precious that it is predicted that future wars will be related to control over, and access to, water.

More than 70 per cent of the earth's surface is covered by water, though most of it is in the oceans and too salty to drink. Some of the earth's water is held in glaciers and polar ice caps. Less than one per cent of the earth's water is fresh liquid water, held in lakes and rivers or below the ground. The total amount of water on earth



EEK – Environmental Education for Kids (www.dnr.wi.gov/eeek)
Wisconsin Department of Natural Resources

remains about the same from one year to the next. It circulates between the oceans, land and atmosphere in a cycle of evaporation and precipitation as the diagram shows. This water cycle is fundamental to the functioning of the earth as it recycles water and has a key role in regulating the earth's climate.

The sun heats the water in oceans, lakes, rivers and soil. Some of this water evaporates into the atmosphere as water vapour. Cooler temperatures in the atmosphere cause the vapour to turn into clouds. The water particles in the clouds collide, grow and then fall out of the sky as rain, hail and snow, back into the oceans or onto land. Rain that falls on land may run into rivers that flow into freshwater lakes or into the sea, or it may soak into the ground. This groundwater may be stored in rocks for long periods of time and it may emerge in freshwater springs or be used by plants. The water cycle then starts again.

A huge amount of water cannot be used productively due to pollution from industry, untreated sewage, mining, oil extraction, the use of pesticides and fertilisers in agriculture, and the dumping of rubbish.

According to the International Water Management Institute in Sri Lanka, about a quarter of the world's population now live in areas of water shortage where water is being used for industrial, agricultural and domestic purposes, faster than the water cycle allows. In addition, about one billion people face water shortages because their governments lack the resources or the capacity to develop safe drinking water supplies.

Water shortages affect poor people the most. For example, in Orissa, India, where groundwater levels have dropped, some poor farmers cannot afford to sink deep boreholes to extract water. Poor people often lack access to safe water to drink, causing damage to their health or lost productive time in walking long distances to find safe water.

Climate change is damaging the water cycle on which we are dependent:

- Increased temperatures are causing the polar ice caps to melt and sea water to heat up and expand, resulting in rising sea levels which threaten low-lying countries such as Bangladesh.
- Melting glaciers will cause short term flooding and longer term water shortages, often in areas of high population along the flood plains of rivers such as the Indus and Brahmaputra in Asia.
- Some areas of the world are experiencing more rain (sometimes falling in intensive storms and causing flooding), and other areas are experiencing less rain (sometimes leading to drought).

Deforestation is another issue that affects the water cycle (see Section 1.5).

REFLECTION

■ What are the water problems at local and national level in our country?

■ What do we consider to be the reasons for these problems?

1.5 Understanding forest resources

Trees have important natural and human benefits. They help to regulate the water cycle because they act as a sponge, soaking up rain and releasing water at regular intervals. Forests help to prevent flooding, erosion and landslides after heavy rain. Trees also provide and protect natural habitats for animals and plants. Many people depend on trees for food, fuel, shelter and medicines.

Forests cover around 30 per cent of the world's total land area. Yet, according to the World Resources Institute in the USA, in the last 300 years the global forest area has decreased by nearly half. This is due to the clearing of land for agriculture, roads and settlements, and due to high demand for timber.

Deforestation affects the local climate because forests influence the regional distribution of rain. As part of their life process, trees release moisture into the atmosphere, contributing to the formation of clouds. The clouds produce rain that falls back on to the forest. When forests are cut down, this process is reduced and the area can become arid within a few years.

Deforestation is also contributing to global climate change. The Intergovernmental Panel on Climate Change estimates that deforestation contributes 15–20 per cent of global greenhouse gas emissions. Trees store carbon because in order to grow, they withdraw carbon dioxide from the atmosphere. They are sometimes called 'carbon sinks'. If wood is burnt or left to rot, carbon is released back into the atmosphere. Although wood used for building or furniture continues to store the carbon, the carbon will eventually be released when the wood is no longer needed. The use of wood is not bad in itself if the trees cut down are replaced (this is called sustainable forest management). However, in many countries, laws governing forests are rare or poorly enforced, which leads to a decrease in tree cover globally.

CASE STUDY

RENEWING TREE RESOURCES

When the Maradi Integrated Development Project (MIDP) first started work in the Maradi region, Niger, there were very few trees because farmers traditionally cleared all their land in order to grow crops, and there had been much demand for wood for building. This meant that soils were exposed to the effect of wind, hot sun and fierce storms, and people were no longer able to harvest wood locally for cooking and building.

MIDP promoted the practice of allowing tree stumps to re-grow and become productive. Farmers are encouraged to leave five shoots per tree, cutting one each year and letting another grow in its place. On removing a shoot the cut leaves are left on the ground which reduces soil erosion and improves soil fertility. Enough wood grows in the first year to provide firewood. In the second year, the branches are thick enough to provide wood to sell. The trees also provide fodder, edible seed pods and timber for construction. The presence of the trees reduces wind speeds and provides shade for the crops. The farmers now consider the trees to be an essential part of sustainable agriculture rather than a nuisance.

Climate change itself is affecting the wellbeing of forests. As global temperatures rise and rainfall patterns change, some areas of forest are becoming so dry that they are at risk of fire. Forest fires release huge amounts of carbon dioxide into the atmosphere, adding to global warming.

Since trees store carbon, they have the potential to help reduce climate change. The planting of new forests (afforestation) enables trees to remove carbon dioxide from the atmosphere. Political will and appropriate laws and enforcement systems are essential to ensure that forests are managed sustainably.

REFLECTION

■ What is the situation regarding tree cover and forest in your local area? Are more trees being planted than cut down? Are supplies of building timber and fuel wood sustainable?

■ What are the issues that lie behind the situation?

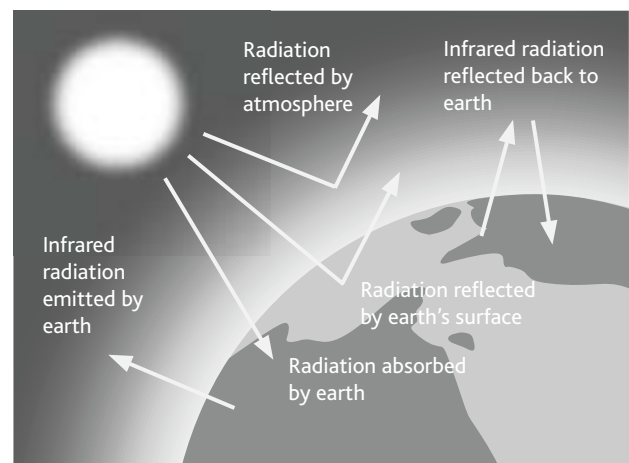
1.6 Understanding and responding to climate change

The impact of climate change on the environment is considerable and is increasing rapidly. We need to understand the causes and impact of climate change in order to respond effectively.

Understanding climate change

The greenhouse effect

Energy from the sun warms the earth's surface. Some of this energy is then sent back into space. Some remains within the earth's atmosphere, which is a narrow layer of gases surrounding the earth. This ability of the atmosphere to retain warmth from the sun (known as the greenhouse effect) helps to keep the earth at a comfortable temperature for life on earth (a global average of 15°C).

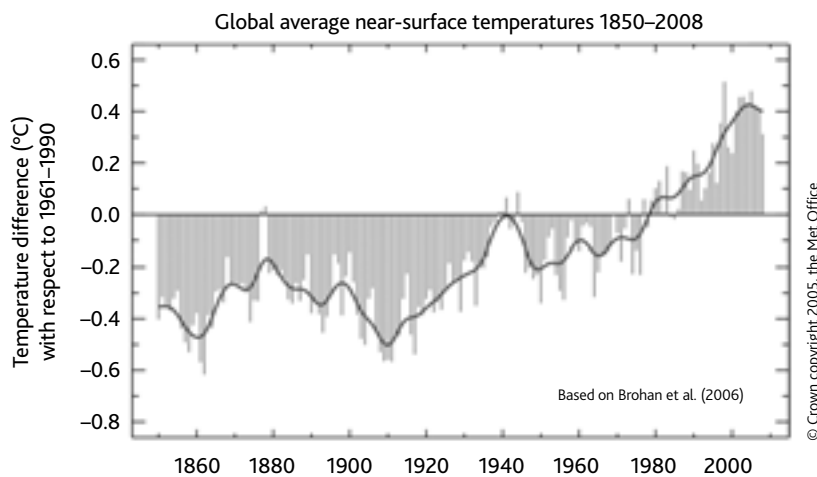


Climate change

Since the industrial revolution that began in Europe in the 1850s, the burning of fossil fuels for energy and manufacturing has increased the amount of certain natural gases in the atmosphere (known as greenhouse gases). The burning of coal, oil and gas produces large quantities of one

of these gases – carbon dioxide. At the same time, deforestation has increased, which releases carbon dioxide into the atmosphere. The amount of carbon dioxide and other greenhouse gases, such as methane and nitrous oxide, has been increasing steadily and in the past decade has increased dramatically. This means that more heat is being retained in the atmosphere. While changes to the climate occur naturally over time, the world’s leading scientists now agree that climate change is becoming more rapid and is caused by human activity. Scientists have measured an average increase of about 0.76°C in global temperatures during the 20th century and up to 4°C in the Arctic. Although this does not sound very much, it is already having dramatic effects around the world, and by 2100, average global temperatures are projected to increase by between 1.8°C and 4°C, and perhaps by as much as 6.4°C depending on how effectively and rapidly we respond to the problem now. Although global temperatures naturally increase and decrease over time, this rate of change is demonstrated to be the fastest ever recorded. If average global temperatures rise by more than 2°C, the impacts of climate change could become unmanageable.

Rise in average global temperatures during the past 150 years



The impacts of climate change

Since the 1970s there has been growing concern about rapid and unusual changes in the world’s weather. This concern started among scientists, but has more recently become an issue of global importance that is discussed among many different people, from local farmers to national governments at international level.

Due to climate change, weather patterns are becoming more erratic. A rise in global temperature is resulting in less predictable rainfall patterns, more frequent droughts, stronger heat waves and more intense weather hazards, such as flooding and cyclones (typhoons/ hurricanes). These changes are already having a devastating impact on people’s lives in many parts of the world, particularly in poorer countries.

According to the Intergovernmental Panel on Climate Change (IPCC)² and other leading researchers:

■ **SEA LEVELS ARE RISING**

As global average temperatures get warmer, the glaciers and polar ice caps are melting

2 IPCC Fourth Assessment Working Group II Report (2007) Climate Change 2007: Impacts, Adaptation and Vulnerability

and the sea is getting warmer and expanding. In the next 100 years, sea levels may rise by several metres. This is leading to increased flooding and tidal surges, deaths due to drowning, displacement of populations, salinisation of soil and fresh water, and loss of infrastructure and livelihoods. Many natural ecosystems, such as wetlands and coral reefs, are being badly affected.

■ **SEVERE WEATHER EVENTS ARE INCREASING IN BOTH FREQUENCY AND INTENSITY**

Warmer temperatures cause changes to weather patterns, such as strong winds and more extremes of rainfall because the water cycle speeds up. This results in increased frequency of droughts and floods. As well as the risk to human life, such events cause displacement of people, disease, soil erosion, reduced crop yields, wildfire, loss of livestock and wildlife, and widespread damage to homes, infrastructure, livelihoods, food and water supplies.

■ **HUMAN HEALTH**

Climate change affects the spread of well-known diseases that are sensitive to changing temperatures and rainfall. For example, malaria and dengue fever are spreading beyond the tropics, and flooding is promoting the spread of water-borne diseases such as dysentery. Droughts are encouraging white flies, locusts and rodents. The WHO say that 150,000 deaths a year may result from the health impacts of climate change.

■ **EFFECTS ON AGRICULTURE, FORESTS AND SEALIFE**

While agricultural yields in some colder places may increase in the short-term, areas of warmer countries are becoming too hot and dry to grow crops. Crop yields may fall due to higher temperatures, decreased water availability, flooding or increases in insect pests. Forests are affected by an increased number of forest pests that enjoy warmer temperatures, and are at risk of wildfire during drought. Increased ocean temperatures and acidity are affecting sea life, which is beginning to impact on people who rely on fishing for their livelihoods or for their nutrition.

■ **WATER SHORTAGES**

Up to four billion people could suffer water shortages if temperatures rise over 2°C. This is due to increased drought, unpredictable rainfall patterns, flood contamination of wells and boreholes and the loss of regular melt water from glaciers.

Past and current emissions of carbon dioxide and other greenhouse gases by rich, industrialised countries have made the largest contribution to climate change. Now emissions from some other countries are growing rapidly as well. Poor people and poor countries are the least responsible and yet they are most at risk from the impact of climate change. Changes are happening at such a rate that poor communities often lack the knowledge and resources to cope. As future weather patterns become less certain, traditional knowledge of the climate and local environment is becoming less useful to poor people.

Science can never be 100 per cent certain about any issue – there is always an element of uncertainty. However, climate change is one of the most well researched scientific subjects ever, and eminent scientists all around the world have reached a consensus that the recent and rapid changes in global warming are the result of humanly induced climate change.

Local impacts of climate change

'Rainfall is becoming more erratic and there is less each year. The streams and rivers are drying up – which are the source of drinking water ... The water table is now lower than before.'

River of Life, Malawi

'After 1984, the really bad years started: we had severe drought, many animals died.'

Ibrahim, Niger

'The longest drought period used to be up to four months but now it can be for six to seven months.'

MOUCECORE, Rwanda

'One of the health impacts as a result of changing weather patterns is that malaria mosquitoes are spreading into highland areas that were historically free from malaria.'

Tadesse Dadi, Ethiopia

'The frequency of cloud-bursts is increasing, when there can be 60mm of rain in five minutes. There have been two of these in the last three years and these were not happening 30 years ago [in the northern mountainous areas].'

EFICOR, India

'Higher tides in coastal areas are causing waterlogging and loss of crop land.'

HEED, Bangladesh

'Previously, the rains fell during six months of the year [June – December]. Nowadays the rains come together at one time, causing floods and droughts. There are places in Honduras where floods occur every year. The time lapse between floods has been shortened from five years to one year.'

OCDIH, Honduras

Source: Tearfund (2005) *Dried up, drowned out: Voices from the developing world on a changing climate*

REFLECTION

■ Is there evidence of climate change having any local or national impact in our country?

■ What are the consequences on people's lives?



Jim Loring Tearfund

During severe drought many streams and rivers dry up.

Responding to climate change

There are two main responses available to us in responding to climate change:

- Reduce greenhouse gas emissions to limit further climate change. This is sometimes called **mitigation** and involves cutting the emissions of wealthy countries and rapidly developing countries such as China, India and Brazil, and enabling poor countries to develop in a sustainable way without high greenhouse gas emissions. Section 6 looks at how advocacy can support these changes.
- Help communities to cope with the impacts of climate change. This is sometimes called **adaptation**.

Even if greenhouse gas emissions were completely stopped today, the effects of the emissions released over previous decades will affect the climate for about two centuries to come. Climate change adaptation is therefore essential. Here we introduce the main ways in which vulnerable communities can adapt to the effects of climate change:

- Some **reduce the impact of natural hazards**, such as building dykes (walls) against sea level rise. Communities that are vulnerable to flooding can grow trees on slopes to reduce soil erosion by slowing down the run-off of water during heavy rains. Actions can be taken to reduce the need to cut down trees in the first place, such as by using efficient wood stoves or solar ovens.
- Some adaptation methods **reduce the vulnerability of communities** to climate change, such as changing agricultural practices to make the most of the rainfall or introducing alternative ways of earning a living. Farmers can change the type of crops they grow to take account of different weather patterns or lack of water. In some situations irrigation could be introduced to ensure that water is available when needed. Rainwater could be harvested using tanks.
- Other methods **reduce the damage caused by climate change**, such as constructing buildings that can withstand flooding or bridges that take account of sea level rise.

Where possible, adaptation strategies need to build on those already used by local people because they have knowledge about the local environment. They, or nearby communities, will know what strategies have been used before and what measures will not be appropriate. However, past experience can no longer provide a reliable guide to the future. Communities may not be aware of the likely future impacts of climate change as projected by scientists, or of new technologies or methods used elsewhere in the world that may be appropriate locally. Development organisations therefore have a role in developing local knowledge and capacity in these areas. To find out more about climate change adaptation strategies, see the **Resources and contacts** section of this book.

CASE STUDY

THE IMPACT OF CLIMATE CHANGE ON NOMADIC PEOPLE

Rainfall in the semi-arid Sahel region of Niger is becoming increasingly unpredictable, with changes in the timing, frequency and quantity of rainfall. Average temperatures are rising gradually. There have been several severe droughts since 1973, causing massive loss of livestock and food shortages. Climate change is having a major impact on natural vegetation, resulting in the spread of the desert and the loss of soil fertility.

The Tuareg people are well adapted to surviving in the Sahel's dry, marginal land. If pastures fail in one area they move on, taking their possessions with them. However, during the past 30 years many have lost their animals and have seen their traditional lands destroyed due to increased drought.



Jim Loring Tearfund

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. Tearfund partner JEMED has been helping them to establish 'fixation sites' since 1990. These fixation sites do not settle people permanently, but build upon a tradition that the Tuareg spend part of each year camped in a particular place. The sites 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, many with grain banks, wells, schools and small shops.

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 water flow, causing it to sink deeper into the soil. Behind the dykes, the Tuareg have been able to grow wild wheat and fodder for their livestock. In Intikikitan, an established dyke has increased moisture levels to the extent that plant species not seen for half a century have returned.

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.

By Jeff Woodke, JEMED, *Footsteps 70*

CASE STUDY

ALTERNATIVE CHOICES FOR PASTORALISTS IN ETHIOPIA

The Karayu clan in Ethiopia depend on herding cattle, camels, goats and sheep for their livelihood. They live in an area that is hot and semi-arid, with low rainfall. For generations, the Karayu have migrated to particular places at particular times of the year in order to provide pasture for their animals.



Scott Jones Mind the Gap

However, within one generation, this had changed. The development of sugar cane plantations and urban growth reduced the land area available to the Karayu. Increasing drought led to the death of large numbers of cattle, while population growth meant that the land had to support more households. It was clear that their way of life was under threat. Adapting to climate change was essential.

The Gudina Tumsa Foundation, a local Christian NGO, introduced two simple but important innovations that will, in the long-term, help the Karayu.

- They re-introduced indigenous trees that can withstand the harsh ecological conditions of the area. Community leaders were consulted to ensure that the tree species chosen were indigenous and had multiple uses. For example, some trees were selected because they are resistant to termites and therefore good for house construction, while others had medicinal or nutritional value.
- They established forage reserves by enclosing sections of the rangelands. These enclosed areas allow the grass to recover and provide forage for the livestock during the dry season.

