

Food, farming and the environment – threats and building resilience

Environment – the foundation of livelihoods¹¹

Africa's social and economic development is now even more in danger because climate change threatens to undermine the integrity of the continent's rich but fragile ecosystems.¹² In Africa, these natural systems form the foundation of the economy of most countries, from which the majority of the population derive their livelihood.¹³ Africa contains about one-fifth of all known species of plants, mammals, and birds, as well as one-sixth of amphibians and reptiles. Biodiversity in Africa, which principally occurs outside formally conserved areas, is under threat from climate change and other stresses. Savannahs, tropical forests, coral reef marine and freshwater habitats, wetlands and East Africa montane ecosystems are all at risk.

Poor people, especially those living in marginal environments and in areas with low agricultural productivity in Africa, depend directly on genetic, species and ecosystem diversity to support their way of life. As a result of this dependency, any impact that climate change has on natural systems will threaten the livelihoods, food intake and health of the population.

With the extinction of plant species used in traditional medicines in Africa, it is expected that the change in climate will impact on people's ability to tackle illness. The World Health Organisation estimates that 80 per cent of the world's population in developing countries rely on these plants for primary health care. In Mali, traditional medicines have declined because many medicinal plants have been wiped out by constant drought.¹⁴

Livelihoods built for generations on particular patterns of farming may also become quickly unviable. If not addressed, climate change is estimated to place an additional 80–120 million people at risk of hunger; 70 to 80 per cent of these will be in Africa.¹⁵ With increasing temperatures and extreme weather events, climate change will further erode the quality of the natural resource base, thereby reinforcing conditions of poverty.

“Drought is becoming more and more frequent leading to drying-out of soil and the disappearance of vegetation. The life of an entire population is on hold, waiting for clouds, which promise less and less rain and which finally destroy the hope that cattle breeders and their herds will enjoy healthy pastures. They also destroy people's hope for a better tomorrow which would usher in an abundant harvest so passionately awaited by farmers and their creditors.”

Malian development group TNT

Mozambique: climate change, disruption and renewing rural livelihoods

Despite civil war and major floods and drought, Mozambique has emerged in the 21st century as a country of progress and possibilities, a flagship of renewal in Africa. The Adaptive research project set out to investigate how rural people have adapted to these disturbances so that rural communities can be better supported in the face of future changes, especially climate change.¹⁶

Research focused on the community of Nwadjahane in Gaza Province in southern Mozambique. The village was established in the 1980s following displacement from surrounding areas during the civil war. Over the years, villagers have had to live with political and economic instability, drought, and major flood and storm damage. Despite these difficult circumstances, villagers have developed creative and innovative ways of coping and adapting to this uncertainty and change.

Social networks are the links and connections that individuals and households have with family, neighbours and friends. Within Nwadjahane, these have evolved and changed over the last 20 years. A fundamental shift is from paying people with cash in exchange for help with tasks on the farm, to 'traditional' forms of non-cash bartering, such as exchanging labour. Villagers explain that this is due to the combined drivers of less cash within the local economy (linked to wider economic processes) and the perceived increase in the number of weather-related disturbances.

Increasingly frequent and severe droughts, floods, and storms have led to either less cash being available from crop sales, or simply the need for more labour to replant or repair damaged crops or farm infrastructure. One of the recognised positive outcomes from this shift is an increased sense of solidarity with neighbours.

Using the landscape to spread risk

Villagers in Nwadjahane farm both the fertile lowlands through irrigation and the higher sandy dryland fields. Increasingly severe floods and droughts over the last two decades have increased demand from households for plots of land in *both* areas. While the lowland can produce good crops of rice, vegetables and potatoes, these can be destroyed during floods. Highland areas can produce good crops of maize and cassava during flood years.

However, during drought years the highlands are less productive and families rely on lowland production. Households with land in just one area have started to develop informal farming associations to lobby those responsible for land

allocation. They've successfully managed to gain access to new areas to farm. This is especially important for very poor households as it enables them to share some of the production costs and risks, thus increasing their overall resilience to both droughts and floods. A lesson for development agencies is that external support to these farming systems needs to be careful not to favour one type of farming over another as it is the *combination* that provides resilience to climatic disruptions.

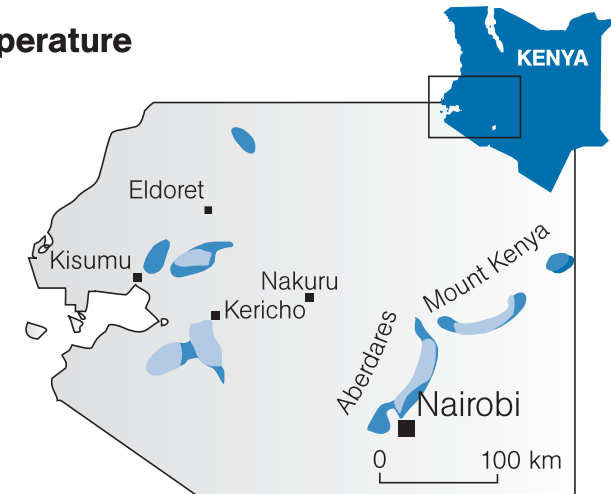
These farming associations have become the focus of innovative and experimental farming practices. By working in groups, villagers are able to spread the risk of new practices and technologies and learn for themselves through trial, error and experimentation. When successful, farmers have been able to take the lessons learnt back to their own individual farms. For example, 45 per cent of those interviewed had changed to more drought-resistant species of rice, maize, cassava and sweet potato at some point during the last six years as a direct result of the information exchange within and beyond the farming associations. The farming associations act as a buffer against initial risk with both poor and wealthy households able to experiment. The associations have also been particularly popular with groups of women, leading to a strengthening of their position within the farming community. With the support of extension officers these types of initiatives can strengthen livelihoods in the face of climate change and make livelihood activities more profitable and secure.

Within the Nwadjahane community, individuals, households, and formal and informal groupings of people are all looking for ways in which they can reduce their vulnerability to disturbances and increase the resiliency of their livelihoods. Some adaptations are driven specifically by experience of extreme climatic events, but many come from a combination of climatic, environmental, economic, political and cultural issues. The study shows that we need to take climate change seriously but that it *must* be viewed within the everyday context of people's lives.

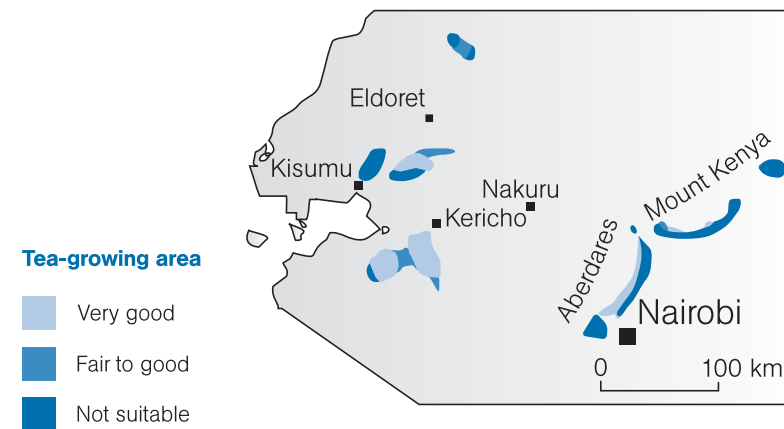
The Mozambique Government has recognised this. It sees the need to support local level attempts to build resilience; national planning strategies are deliberately addressing these issues. Some sectors of agriculture are being encouraged to commercialise at a large scale, while smallholders are being encouraged to participate in local level planning to build the human capacity for livelihood renewal. Thus climate change in Mozambique is not being viewed in isolation; it is being dealt with within the context of wider development issues.

Impact of temperature rise on tea in Kenya

Today's temperature



A temperature increase of 2°C



If temperatures rise by 2°C, large areas of Kenya currently suited to growing tea would become unsuitable. Were this to happen, the impact on Kenya's economy would be enormous. Kenya is the world's fourth-largest tea producer and second-biggest exporter. Tea provides nearly a quarter of the country's export earnings. Three million Kenyans, 10 per cent of the population, are directly or indirectly employed in the tea industry. But the impact on poor people could be even greater. Some 400,000 smallholders grow 60 per cent of the country's tea, with large estates growing the rest. The large tea estates may have the capital to afford the extra irrigation and other inputs that would be needed to cope with the effects of climate change, but smallholders may not be able to.

Source: UNEP/GRID Arenal/Otto Simonet

Agro-ecology: the way forward for climate-resilient food production¹⁷

Agriculture in Africa suffers from a persistent lack of investment. It's an issue both at the national level, with African governments cutting back on farming support services, and internationally, with funding from the EU, for example, going more to 'governance' and 'infrastructure'.

Small-scale agriculture provides most of the food produced in Africa, and employs 70 per cent of the workforce. But a lack of investment in drought-resistant farming is in danger of creating serious problems for its ability to adapt in a warming world. Just as financial investors spread risk, it makes sense for farmers to do so as well in the face of global warming. A diversity of both approaches to cropping and to a range of crops is the way to achieve that.

This, in turn, means that farmers need access to seeds that are adapted to drought or reduced rainfall during critical stages in the growing season. A variety of forces have led to a reduced availability of local seeds, and increased dependence on hybrid seeds and crops like maize that are not well adapted to these conditions. Maize needs rain during the development of the cobs, and a gap in rainfall at a crucial time leads to crop failure. Exactly this is happening in Zambia in 2005, despite plentiful rain earlier in the rainy season.

Another pressure comes from the concentration of ownership in the seed industry into a handful of large corporations. Ten companies now control one-third of the global seed industry, further threatening agricultural biodiversity.

A key aspect of an agro-ecological approach is how different developments can produce synergies, leading to win-win situations such as increased production without additional external resources. Diverse cropping systems yield much more produce per unit of land than the mono-cropping favoured by 'modern' agricultural systems. They are also much more suited to the harsh conditions in which most farmers in Sub-Saharan Africa operate.

The example given from the semi-arid area in east Kenya illustrates the process. Sustainable agriculture is a method of farming based on human needs for food, income, shelter, and fuelwood. It also builds an understanding of the long-term effect of our activities on the environment. It integrates practices for plant and animal production, with a focus on pest predator relationships, moisture and plants, soil health and the chemical and physical relationship between plants and animals on the farm.

Most sustainable agricultural initiatives seek to reduce soil erosion and to make improvements to the soil's physical structure through its organic matter content,

Pooling resources in east Kenya¹⁸

A pioneer farmer and his neighbours in east Kenya pooled resources and decided to share information on farming technologies. They specifically wanted to carry out soil and water conservation, together with the construction of an earth pan to store floodwater. Using the water, he tried kitchen gardening using bucket-drip irrigation next to his homestead and was very successful. The project depended on the availability of water and, with help, the group installed a well and hand pump, sharing 50 per cent of the cost.

To reduce the damage from chafer grubs, which attack and damage the roots of maize seedlings, two methods were used which involved no chemicals:

- Applying manure increases the tolerance of the maize plant to damage from chafer grubs. The nutrients in the manure accelerate root growth and enable the seedlings to recover after attack.
- Early land preparation exposes the grubs' eggs to heat on the surface, which kills them, reducing the number of eggs that hatch.

Together, these two methods reduce damage from 50 per cent to a mere 5–10 per cent without a biotechnologist in sight. The farmer and his wife also attended a workshop on different uses of the neem tree and its products for pest control, animal and human health.

Since sustainable agricultural techniques were adopted, crop yields have increased four-fold. Livestock manure increases water retention and provides nutrients to achieve higher yields. Using these local resources and skills, the farmers have discarded the previous cut, burn, plant, and shift cropping system in favour of increasing yields from the same piece of land and leaving the rest for livestock pasture and environmental conservation. Currently all the farmer's cropping land is subject to rainwater conservation. He even harvests runoff water from the roadside. If the water supply is maintained he intends to grow more cash crops like watermelons and grafted yellow passion fruit. Both have a ready market. This will increase his income to see his son through university, increase the food supply to the local community and hotel industry, and also increase productivity from his land.

However, the key to the wider adoption of sustainable agricultural techniques depends on their promotion through official agricultural support, so called 'extension services'. In turn they need to be backed by a favourable policy climate and supportive research that addresses problems identified by farmers.



Gola forests chiefs at project meeting

and water-holding capacity. Water is a clear constraint in many rains-fed systems. When water is better harvested and conserved, it may be the key factor leading to improved agricultural productivity. Provided the soil's nutrient balance is maintained, better water management means better cropping.

Protecting the Gola Forests in Sierra Leone¹⁹

Deforestation accounts for between 20 and 30 per cent of all greenhouse gas emissions worldwide and has devastating effects on both biodiversity and local communities. The Upper Guinea Forest, which once stretched from Guinea to Ghana, now covers less than one-third of its original area and is highly fragmented into comparatively small areas. Sierra Leone has only one-seventh of its original Upper Guinea Forest remaining, half of which is made up of the 750-square-kilometre Gola Forests in the southeast of the country.

The RSPB and the Conservation Society of Sierra Leone (CSSL) developed one example of an innovative approach to natural resource management that balances peoples' livelihoods with sustainability. They formed a long-term partnership with the Sierra Leone Government and seven chiefdoms to protect the Gola Forests.

Following the recent conflict in Sierra Leone, there was a concern that commercial logging would resume in the Gola Forests, bringing in much needed but short-term money. Instead, the CSSL and the RSPB have concluded a 'conservation concession' agreement with the Sierra Leone Government under which the forest management rights will be used for conservation rather than logging.

Senegal: the dangers of large-scale mono-cropping²⁰

In comparison to the positive examples shown in Mozambique and Kenya, Senegal's experience of peanut farming leaves them more, not less, vulnerable to climate change. Climatic phenomena, such as the drought cycles of the last two decades, have worsened desertification. Vegetation cover has been increasingly degraded and there has been overgrazing.

Beginning as long ago as the early 1880s, the French Administration, with the help of armed troops, demanded that farmers grow peanuts for the French vegetable oil industry. Peanut monoculture expanded rapidly after World Wars I and II and boomed again during the 1950s. Peasants needed cash to pay taxes imposed by the French and peanuts were the only source of francs. However, the cash crop also brought unexpected catastrophe. Today, around 40 per cent of Senegal's arable land is used for growing peanuts. Economic dependence on the export crop has led to excessive mono-cropping, soil degradation and forest clear-cutting.

The environmental impact of the peanut farming has been comprehensive. Small-scale farmers did not own animals, so manure was unavailable. A fallow period would have allowed nutrients to re-accumulate in the soil, but the people could not afford the time. Instead they grew peanuts till the soil was exhausted, then moved to new lands. They chopped down trees, which held topsoil in place and helped absorb infrequent rains. Before the peanut take-over, the roots and stalks of the millet crop used to be left in place, holding down the topsoil. But the peanut, on the other hand, is wrenched from the ground, the soil loosened and clouds of earth swirled away with the dry-season winds.

Under a logging concession, the Government and local communities would expect incomes from the concession holder through fees and royalties. This potential loss of income has to be compensated for by the new conservation agreement. Income for the Government is fed directly into its Forestry Division to manage and develop the Gola Forests for conservation. Local communities will receive royalties to put into conservation-friendly community development projects. The agreement will also guarantee employment and engagement of communities in the management of the forests. A trust fund will meet these costs in perpetuity.

Will climate change break the herder's back?

Niger and the story of Hamidou Oussemane²¹

Hamidou is a farmer from the village of Guidan Ali in the district of Birnin Konni. His extended family comprises 40 people.

Climate uncertainty is a way of life for Hamidou. As a young child he remembers the good times when the rains were abundant and more reliable than they are today. But since the drought years of the 1970s and 1980s, the rains have never been consistent from one year to the next. Adapting to unpredictable and erratic conditions has not been easy, but over time Hamidou has developed a farming system on which he has raised a family while managing to help others.

The family's livelihood is based on a mixture of farming, livestock keeping, and the selling of fuelwood. The family farms 10 fields covering about 26 hectares located on different soil types (sandy dunes, and low-lying clay areas) and producing a variety of food crops including millet, sorghum and rice, in order of importance. The women cultivate smaller plots on which they grow sorrel and okra. In a good year, the family produces a surplus, which is stocked in the family's granaries, although a small amount of rice may be sold from time to time. The family also looks after 61 cattle of which 41 belong to them. The other animals belong to neighbours and friends. Until 1982, the herd was taken in different seasons either north towards Tahoua, or south to northern Nigeria. But for a variety of reasons, including conflict and the rising costs of accessing pastures in the dry seasons, Hamidou's sons now look after the herd themselves in the vicinity of the village and it is used to manure the family's fields and those of other village members.

Livestock, manure, plentiful household labour, and access to the relatively well-watered clay soils at the base of the sandy hills have been the main ingredients behind Hamidou's success as a farmer. Although he has a large family to look after, he has a big farm by Sahelian standards with a broad mix of land types and soils. In an average year he is able to harvest sufficient food to feed the whole family and put aside for future years. Since he doesn't need to sell animals or milk to buy grain, the herd is able to grow relatively fast. Hamidou's system is an example of the benefits of an integrated crop-livestock farming approach widely promoted by policy-makers in the Sahel.

However, it is a system that is highly vulnerable in the context of increasing climatic uncertainty and greater rainfall fluctuations. Global warming introduces extra tension into an already stressed way of life that could make a critical and negative difference. Over the last 20–30 years, Hamidou has become more and more 'sedentary'. He no longer takes his animals to more distant pastures and he has lost the contacts he used to have with families in other areas of Niger and Nigeria.

His farming system is heavily dependent on manure. In the event of a serious drought or a series of below-average years, Hamidou may find it difficult to save his animals as he has no obvious 'refuge area' and local pastures are increasingly rare due to the pressure of cultivation. The locust plague of 2004 added an extra burden on many farmers in Niger; aid agencies are warning that 2005 will be very difficult.

The loss of the herd would undermine Hamidou's farming system and livelihood. Livestock routes are blocked, the institutions managing access to resources are 'corrupted', and there is increasing competition over local resources.

His plans now are to diversify into other areas of economic activity, which are less dependent on the rains. Already two of his sons regularly go to Nigeria in the dry season to earn money as labourers. His nephews too earn money in this way and are planning to set up a small restaurant business in a nearby town. Hamidou is also thinking about buying land in a nearby irrigation scheme. He says he will wait to see what the future brings and whether God will answer his prayers for more rain.

Ethiopia and support for smallholder agriculture²²

Many of the approaches that constitute 'good development' also double as excellent techniques to adapt to the uncertainties of global warming. Smallholder farming in Ethiopia is a case in point. Ethiopia is crippled by unfavourable international trade rules, lack of rural roads and market access, unemployment, debt, and environmental degradation. Ten per cent of Ethiopia's annual income still goes on debt repayments – twice what it spends on healthcare each year and three million people have contracted the HIV virus. So, when the rains fail in Ethiopia there is nothing to fall back on.

The Ethiopian Orthodox Church, which works with the agency Christian Aid, is addressing these issues through its Rural Integrated Development Programme in Bugna, in the Amhara region of northern Ethiopia. Project co-ordinator Deacon Abate Desale says, "The land is so degraded in this region that erosion causes floods when the rains come and drought when it does not. Most Ethiopians are dependent on the land for their livelihoods so we must invest in it." Techniques, such as terracing land on hillsides to stop erosion and collect water for irrigation, replanting trees, and protecting areas of land for regeneration, are all effective long-term measures to prevent drought leading to famine in the future.

The programme shows Ethiopia's potential. In the middle of the dry, unproductive landscape lies an oasis of lush, green vegetation and bird song. This 'garden of Eden' is designed to teach neighbouring farmers how to successfully grow vegetables and trees with traditional organic methods, enabling them to earn an income and have a more balanced diet. Vegetables, such as carrots, lettuces, tomatoes and onions, rarely seen in rural Ethiopia, are intercropped with a variety

The Churches and climate change²³

“When I was a child, there was so much rain that we prayed for it to stop. Now we pray for rain.” The Catholic archbishop of Bulawayo in Zimbabwe, Pius Ncube, says that local people over 50 years of age have noticed much less rain in Matabeleland than there was 30 years ago. “There has been a big climate change within living memory”, he reports “and the rainy season, which used to run from October to April, now starts around mid-November and ends in February.” Yet, he adds, “We have so many immediate crises in our country – starvation, poverty, AIDS, human rights abuses – that environmental issues such as water shortages, the random chopping of trees for fuel and the diminishing wildlife are not really being addressed.” In neighbouring Zambia, the Catholic bishops issued a letter in 2004 deploring that, “We have not taken the best care for this environment on which we depend for our survival.” The letter identifies “massive deforestation” as a key problem and blames it on the ever-increasing need for fuel wood. The bishops say that lack of access to electricity in poor communities has encouraged charcoal burning. In South Africa, the Church has begun awareness-raising work on the issue of energy, particularly encouraging the development of renewable energy such as solar and hydro. More than 70 per cent of total energy consumption in South Africa comes from coal – a highly carbon-intensive fossil fuel. Local ecumenical groups in South Africa, such as the Diakonia Council of Churches in Durban, are incorporating climate change into their bible study materials, which link scripture with the realities facing modern society.

Two Protestant church leaders have warned of the dangers of climate change triggering disasters in Africa. In December 2004, Rev. Ishmael Noko, from Zimbabwe and head of the Lutheran World Federation, said the tsunami disaster that month was a warning of the vulnerability of low-lying coastal areas to rising sea levels caused by global warming. “It is a reminder that we would do well to heed, at a time when even the relatively inadequate efforts by the international community to address climate change continue to be subverted and undermined by some of those most responsible,” Noko said. His concerns were shared by Rev. Dr Sam Kobia, a Kenyan Methodist and the head of the World Council of Churches, who called on powerful nations that had not signed the Kyoto Protocol on greenhouse gas emissions, to do so. In October 2004, at the Coventry launch of Operation Noah, the British churches’ climate change campaign, a plea was read out from Africa asking for the help of faith-based groups in securing equity for Africa in the world’s response to climate change. In a letter to conference delegates, Grace Akumu, Co-ordinator of the Nairobi-based Climate Network Africa, reported that, “Frequent flooding and droughts leading to famines and deaths, destruction of infrastructure, economic and livelihood ruins, are now a

common feature in Africa with some countries experiencing these impacts even twice a year.” She added: “At this faith-based groups’ meeting, we appeal to your conscience to support the concept of Contraction and Convergence as it is not only ethical and moral, but it provides the avenue through which all countries can participate in restoring the ecological and climate change imbalance in an equitable manner. Africa has suffered enough in human history, from slavery to colonialism and now our people are at the mercy of the unbridled economic development of the North.”

of seedlings, such as coffee and fruit trees. Farmers learn about organic pest control, irrigation and water conservation and are provided with seeds and tree seedlings to give them a head start.

Carbate Bazarba is one of 400 farmers currently benefiting from this project. Like most Ethiopian farmers, Carbate used to grow cereals only. “The greatest thing I have learnt from the demonstration site is how to plant new crops like fruits and vegetables and how important these things are for our diet. Now my wife and children have a better diet and I earn money from selling vegetables. My only problem now is that my children prefer guava and papaya and won’t eat their injera!” Injera is an Ethiopian staple meal – a large flat pancake made from teff, the Ethiopian grain.

Climate change and locust plague in the Sahel²⁴

During 2004, several West African countries fell victim to the largest locust invasion in 15 years.²⁵ Millions of hectares of crops and pasture were destroyed by giant swarms of insects.²⁶ Production, especially of food crops, decreased drastically to reach 8,978,142 tonnes against a minimum need of 10,234,193 tonnes in the Sahel.²⁷ The locust plague that began in summer 2004 undermines poor people's livelihoods as 80 per cent of the population depends on seasonal staple-food production to feed themselves. West Africa is not the only region vulnerable to locust invasion. There are three main areas where locusts reproduce: in the Sahel and Maghreb; around the Red Sea; and along the Indian and Pakistani border. The area covers about 16 million km² and includes some 30 countries.

Widespread and heavy locust infestations occur in periods of one or more years. A plague can occur when favorable breeding conditions are present (which will be affected by climate change) and when control operations fail to stop a series of local outbreaks from developing into an upsurge that cannot be contained, mostly due to poor preparedness. There have been 6 major plagues of Desert Locusts in the 1900s, one of which lasted almost 13 years. These can cover an area of about 29 million km², and can extend across 57 countries.

Plagues occur in relation to locust biology.²⁸ Vegetation, soil structure and habitat all affect their behaviour, all of which, in turn, are influenced by temperature and rainfall. Most climate change models predict an overall decline in rainfall, and within that, greater extremes of weather conditions, from droughts to inundations. Heavy rains create ideal conditions for locust reproduction. A combination of rain, vegetation and humidity leads to rapid breeding.²⁹

Over the past decades, Africa has experienced important changes in rainfall patterns due to sea surface temperature changes, inducing both desertification, and the higher temperatures that could influence locust plagues.³⁰

The Sahel has neither the means – in terms of equipment, products and logistics – nor the finances to avoid such disasters, much less stop the locust invasion from heading north towards the Maghreb. An invasion occurring during harvest will cause a major disaster that will lead to famine if the risk of residual eggs is not addressed. Economic impact can be reduced if farmers react quickly and save their crops before an invasion. But the ability to react quickly is not great so any damages will be huge.

The key to reducing impact lies in the response of governments of countries of neighbouring the Sahara. But that means securing financial support. Without money and the support of the International community it will be difficult to address the problem.³¹ When poorer nations are using up to half of their revenues to pay debts it does not leave much room for any poverty-reduction measures or for action to be taken to alleviate the catastrophic consequences of locust plague.

As for a technological solution to the plague problem, history has shown that it has never been possible to stop a plague of locusts using pesticides once the plague has developed. Natural forces always stop the plague, which means that dealing with a locust plague requires social, not technological, measures. Communities need to be trained equipped and prepared at all levels for them to adapt to this new situation.

Aid agencies are extremely concerned at a mounting food crisis in Mali and Niger this year, with reports coming in of severe malnutrition among children in pastoralist communities in both countries. The causes are partly to do with drought and partly with last year's locust invasions. Major relief assistance is likely to be needed.