

Final Report

**ASSESSMENT OF THE SOCIO-ECONOMIC IMPACT OF DESERT
LOCUSTS AND THEIR CONTROL**

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1 Introduction

Migrating locust swarms have been identified as an important threat to agricultural populations since biblical times. The desert locust (DL), one of the principal migratory species, breeds in semi-arid areas in a vast geographical band stretching from West Africa through the Middle East to South West Asia. Over 65 countries in this band can be affected by locust swarms and invasion.

Governments in the affected areas have perceived the risk of locust invasion as a serious threat to food security, both at the national level, and in particular for those sections of the farming population directly affected. Eyewitness accounts of locust invasions emphasise the suddenness of onslaught and the devastation locusts leave behind them. In the past governments have intervened with chemical pesticides to control swarms on an emergency basis. In the last thirty years, emphasis has shifted towards preventive control. Because of the transboundary nature of locust swarms, a number of regional structures have been set up to improve information flow and, in some cases, centralise expensive equipment for spraying. In 1988, FAO was mandated to take the lead in DL management, and has addressed this through developing a DL component of EMPRES, its Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases.

Desert Locust Control (DLC) costs have been estimated at an approximate average of \$US 38 million per annum, of which almost 40% is financed through international assistance.¹ Over the last decade there has been increasing questioning as to how justified this is, in terms of the actual benefits it produces, and whether there might be more economically efficient ways of addressing the threat of DL.

There have been a number of studies that have modelled the DLC problem conceptually, based on existing data (Joffe, 1997, Hardeweg, 2001). Other studies have been based on new survey work undertaken to provide quantitative evidence on economic losses at household level (Belhaj, 1999 and 2000²). The modelling work has been undertaken to examine the question, whether current methods of DLC make sense at national level. The survey-based studies are, for the most part, designed to produce nationally representative samples.

The present report has a different focus. It attempts to answer the questions, how do poor and marginal farmers see the problem of desert locust, how do DLC programmes affect them and are there alternative ways of helping them address the threat that DL may present to their livelihoods. The case studies are based on very limited field work, group and individual farmer and household interviews conducted primarily in

¹ These figures are calculated by Joffe (1997) for a 10 year period from 1987 to 1996, and the figures are given in 1990 US\$. However, national level figures are in many cases incomplete, and may also include double counting where one country gives financial assistance to a neighbouring country for DLC. Joffe thinks a more realistic figure could be over \$50 million per annum.

² A study is also being undertaken in the Sudan, by Bezabih Eman, but the report is still at a very preliminary stage.

the semi-arid areas where locusts breed, in Mauritania and Eritrea. The communities visited were poor, and most of the households interviewed would fall below national poverty lines. The results of the fieldwork are, where possible, placed within the context of national poverty assessments and strategies for agriculture development and poverty reduction

2 Current Debates on Desert Locust Control³

The current debates on DLC can be divided into two main areas: whether the focus of DLC should be on preventive action or control; and whether it makes economic sense to undertake DLC at all, rather than use insurance based approaches, or indeed take no action at all.

The debate on prevention versus control focuses on issues of costs and efficacy. Prevention can be categorised as outbreak prevention, upsurge prevention and upsurge elimination (Joffe, 1995). These all aim at preventing locust plagues from occurring, but vary as to the economically and environmentally desirable point at which to intervene. If successful, locust activity will be controlled before it threatens crop production. The alternative is to wait until swarms have developed and are numerous, at which point a greater impact can be had, because of the greater density of locusts. At this stage, however, aerial and ground spraying will have to be supplemented with crop protection activities on the part of farmers.

In practice, preventive control is rarely completely successful, partly because of the difficulty in monitoring the remote and sparsely populated areas where locusts often breed, and partly because, in the past, war has prevented effective prevention strategies being implemented. This report has little to say directly about this particular debate, though the two case studies show interesting differences in the structure of DLC employed in the respective countries.

The other major debate addresses the questions as to whether or not DLC, as it is currently practised, has positive economic returns, and, related, whether there may not be more cost effective ways of addressing the threat locusts present to farmers' livelihoods.

There are two main arguments given to justify DLC. One is that locust plagues threaten agricultural production and food security at the national level. DLC is an economically effective way to contain those losses. The other is that specific districts or individual households' livelihoods and food security are damaged by locust plagues. The first of these rationales is difficult to support from national data. In some countries, locust invasions have occurred in good rain years coming after a series of poor years. The rain has been an important factor in creating the conditions that allow locusts to gregarise. Therefore overall production figures may well be higher than average in years of locust invasion. National data show this to have been true in both Morocco and Sudan (Belhaj, 2000). Even where net damage is reported, this tends to be of the order of 2-5% of overall production. Where locusts alight on fields the

³ This section draws in particular on the works of Joffe (1995 and 1997) and Hardeweg (2001).

damage they do to those specific fields is high, but the effect will generally be felt in very specific and bounded areas of a country.

The effects of the costs of locust damage are distributed in a way that may not be immediately obvious. Where damage is sufficient to affect the overall supply of food, a rise in price will occur. Producers who still have surplus production to sell will actually benefit from the impact of other producers' losses, while some of the economic losses will be transferred to consumers, and producers who are net buyers of food. A model of this effect indicates that overall, urban consumers may bear a large part of the overall losses (Joffe, 1997). Where production is for export, there is unlikely to be an effect on the international price and producers bear a much larger proportion of the economic burden.

Joffe (1997) has simulated the relative costs and benefits of DLC over a five-year period, based on historical data, and under assumptions of efficient and less efficient control. He estimates that efficient control could be expected to generate net benefits in around 20% of cases, i.e. one year in five; for less efficient control this figure falls to 10%. Globally, preventive control as currently practised is uneconomic, but for individual countries with high values of commercial agricultural production a risk-averse decision-maker might be justified in intervening to control upsurges. At a global level, this would imply accepting net economic costs of between US\$10 million and US\$20 million a year.

Even if governments feel that this is an acceptable amount to pay to reduce the risks associated with DL, insurance may be a more economically efficient way to address the problem. Risk management analysis would indicate that the appropriate measures to protect against an event that has a low probability of occurring, but when it does incurs severe damage, is to adopt an insurance approach. This could either be self-insurance (e.g. in this context, income diversification or application of protective netting to fruit trees) or the purchase of market insurance (Hardeweg, 2001).

Insurance against natural events, such as weather-related crop damage, is still relatively rare in the developing world, though efforts are being made to develop a commercial insurance market (World Bank, 2002). In the absence of any examples which would give estimates of administrative costs of a DL insurance scheme, or farmers' willingness to pay, it is difficult to assess whether or not such a scheme, even if it were logistically feasible, would be economically more efficient than current DLC.

One of the major problems with analysis at the national level is that the driving factor is the value of the crop losses. Thus high value citrus crop losses in Morocco have a much greater weight in the calculations than relatively small losses of sorghum and millet sustained by large numbers of semi-subsistence farmers in Eritrea or Sudan. Yet, if commercial insurance markets develop, it is the larger commercial farmers who are likely to be in a position to access these markets. Small farmers who are poorly integrated into markets will have fewer options. It is difficult to weigh up the net benefits received by different groups of the population when one group may have little economic power but faces a high threat to their livelihoods.

For DLC, the analysis is further complicated by the nature of the service. DLC is a regional public good, i.e. if it is provided effectively it is non-rival and non-excludable. That means that effective control cannot be provided to some groups of the population in a country and not others. The argument also holds at an inter-country level. If one country decides to change from a DLC policy to an insurance-based policy this has strong implications for its neighbours.

This puts an increased importance on understanding the impact of DL on individual producers and their livelihoods, both in economic and social terms, as, in some countries, this may be the critical factor determining whether or not it makes sense to continue current DLC activities.

Research has begun to be undertaken to look at this issue, assessing the damage that households have faced in DL invasions, exploring the attitude of farmers to DLC and any other actions that they could take at an individual level to protect themselves against DL. Studies have been undertaken in Eritrea (Belhaj, 2000) and Sudan, though none of the reports have yet been finalised. These studies confirm that the incidence of damage from DL is unevenly spread, and indicate that experience of past damage is an important factor underlying farmers' willingness to pay for either control activities or an insurance scheme. This latter finding indicates the difficulty of assessing the benefits, as measured by farmers' willingness to pay for insurance, of a stand-alone insurance scheme, in the absence of any state DLC. It would be expected that DL invasions would increase if DLC were to be stopped, and that farmers would then become more prepared to pay for insurance, were it to be available.

To sum up, studies undertaken so far raise questions over the economic benefit of DLC at global and national level. Though criticisms can be made, for example none of the studies include possible livestock losses as a result of loss of grazing⁴, most of the assessments do indicate that DLC is marginal in terms of delivering net economic benefits at a macro level. To assess alternative approaches involves estimating what crop damage would be in the absence of DLC, again difficult at the macro level, though Joffe (1997) makes a valiant effort to come up with best estimates.

The case studies reported below look at DLC in the overall context of poverty reduction and livelihoods support. The objective was to look at marginal farmers, particularly those in the semi-arid areas which form the breeding grounds for DL, examine the importance of DL as a threat, assess farmers' attitudes towards the DLC programmes implemented by the state, and look at what options they had, in terms of self-insurance, informal safety nets and formal state assistance. As far as possible this was placed in the context of both the national DLC and the government's poverty reduction strategy.

The work was carried out over a short period of time and makes no claim to be representative of all farmers in the countries studied. In addition, it was quite some time, in both countries, since there had been a major locust plague. In Mauritania, the last upsurge had been in 1995, and in Eritrea, although there had been an invasion in 1997-98, it was geographically quite restricted. In Eritrea there was also the

⁴ These would be difficult to measure as, if they occur, it will be over a period of time, rather than immediately. They are also unlikely to be of high overall value at national level, but, as with crop losses, could be highly significant at household level

complication that in many villages, quite a number of farmers had been mobilised into the army in the course of the most recent conflict with Ethiopia, making it more difficult to find people who had direct experience of the 1997-98 invasion.

3 Mauritania Case Study⁵

3.1 Context

3.1.1 Poverty

The percentage of Mauritians living below the poverty line (US\$ 1 per day) has fallen from 56.6% in 1990 to 46.3% in 2000, although this figure is still unacceptably high. (ONS, 2000). Poverty is more widespread in rural areas, where 61% live under the poverty line and 44% live in extreme poverty (75 cents per day). 80% of Mauritania's poor live in the rural area, about 35% in the Senegal River Valley and 45% in the rest of the rural zone, which comprises arid and semi-arid areas. Although the incidence of poverty in rural arid areas has decreased since 1996, in the Senegal River Valley both poverty and extreme poverty incidence has increased over the same time period.

A series of droughts during the 1970s and 1980s brought serious environmental degradation, exacerbated rural poverty and resulted in a marked decrease in agricultural and pastoral production. During the most serious drought years (1983-85) food aid accounted for over 61% of available grain supply. Many livestock owners were forced to sell large numbers of their animals to those who could afford to feed them, thus decreasing their asset base and their ability to withstand further shocks.

As a result of these droughts, there has been a dramatic shift in population movements, with significant poverty-related implications. Nomads have become sedentary, thus increasing the number of villages, degradation of the environment and scarcity of resources. While pastoral nomads and sedentary farmers constituted more than 90% of the country's population in the 60s, by the mid-80s less than a quarter of the country's population were nomadic or semi-nomadic (World Bank, 1994), and by 2000 the percentage of nomads had fallen to only 4.8%. The percentage of the population that is urban rose from 4% in 1962 to over 55% in 1999, which the World Bank cited as one of the highest rates of urbanisation in Africa.

This rapid urbanisation has been accompanied by unequal development; urban migrants have settled in shantytowns ('kebes') on the outskirts of the country's principal towns (Nouakchott, Nouadhibou and Zouerate) where they live in cramped and insecure conditions with limited access to drinking water. They bring with them few marketable skills, inadequate qualifications for urban employment, and have no access to credit. Government has instituted relocation programmes designed to encourage urban migrants back to rural areas with incentives such as land, seeds and

⁵ The field work for this study was carried out with the assistance of Dr Ismael Sadegh, a local Mauritanian consultant, and with the help and cooperation of the CLAA and Mr Bob Aston, FAO CTA.

transport, but successive droughts have resulted in the failure of these programmes⁶. A recent study carried out by GTZ amongst migrants in Nouakchott concluded migrants regard drought as the overriding cause of their poverty (GTZ, 1998).

This rapid trend in urbanisation has also resulted in women having to take on many of the tasks traditionally carried out by men. Nearly 30% of Mauritanian households are headed by women, and the highest rate is amongst poor groups. Women's vulnerability is heightened by their lower education levels, lower participation in formal employment, and their reliance on income transfers.

The rigid and hierarchical social structure of Mauritanian society, founded on ethnicity, social position and caste identity, allows for a strong social safety net system whereby the richer support the poorer in the same social group, and the poor repay with labour, gifts and political support. However, during the bad drought years, the wealthier were often no longer able to support the poor, nor was there so much need for labour, the most common method of repayment. Migration and urbanisation have also created a distance between kinship groups that has helped to break down these social safety net ties, although they are being replaced by new mechanisms such as neighbourhood-based women's groups, NGOs and food aid.

3.1.2 Agriculture and food security

In the rural areas, although 78% of employment is derived from agriculture, only 15% of GDP comes from agriculture of which 5% comes from crop production and 10% from livestock. Despite being the chief source of employment in the rural areas, farming is characterised by a high degree of vulnerability. Landholdings are small, 60% being smaller than 1 ha, and land tenure is not secure. Land use rights are disputed between customary owners and modern "investors", and between sedentary farmers and pastoralists⁷.

Even in good years, Mauritania is a food deficit country. In 2000/2001, domestic cereal production was 132.7 thousand tonnes, and imports were 270.4 thousand tonnes, of which only 22.6 came through food aid. The forecast for 2001/2002 was of a similar magnitude. In a good year domestic production will not cover more than about 40% of domestic requirements. Mauritania's domestic food deficit has gradually got worse over the last three decades. Food aid donations have also fallen significantly and are now around 9% of commercial imports.

Agriculture in Mauritania falls into two basic patterns. Irrigated agriculture is centred on the Senegal River Valley. The main constraint here to improving agricultural production is the deterioration of the irrigation infrastructure. PDIAM, Mauritania's integrated development project for the irrigated areas, is rehabilitating the irrigation systems and encouraging farmers to diversify away from a rice monoculture. In the

⁶ The Government's present poverty reduction strategy focuses on rural areas predominantly inhabited by the poor. A set of programmes and policies have been mapped out which will concentrate on: revitalisation of production in key agricultural subsectors; development of rural infrastructure; institutional measures; and natural resource conservation.

⁷ However, ongoing land tenure reform and improvements in the mechanisms whereby land changes hands based on the development of the land may improve the situation for poor farmers.

rest of Mauritania most agriculture is rainfed, where the rainfall is sufficient. There are also oases and cultivation around small dams, but these are still dependent on overall rainfall levels. Here the principal constraint is climatic, but the PRSP identifies outdated technology, poor market organisation, environmental degradation and pests as other important factors.

Table 1 shows production for the main food crops in Mauritania over the last decade. The rainfed crops, sorghum and millet, show considerable year on year variation, whereas irrigated rice shows a steadier increase in production. The amount of food aid entering the country has been slowly reducing throughout the decade, and is now at very low levels.

Table 1 **Agricultural Production and Food Aid**
(tonnes)

Product	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Sorghum/ millet	51267	43971	82586	118986	138840	41518	49830	72400	85990	86964
Wheat	600	600	600	600	600	600	700	817	5600	0
Rice (paddy)	25007	21823	37045	31920	31691	40049	48565	61151	51878	45720
Cereal Food Aid	49692	44771	63362	22339	27567	23925	26978	23699	23788	5071

Source: Office National de Statistique

3.1.3 Policy context

Mauritania has undergone considerable reform over the last decade, starting with the introduction of decentralisation, through the establishment of a pluralist democracy in 1991 and a process of economic reform and liberalisation that has put an increased emphasis on the role of the private sector. This has delivered well at the level of overall economic growth, but, although the incidence of poverty has fallen, as indicated above, the rate remains high. In late 2000, Mauritania developed a PRSP in which five priority areas are identified for the 2001-2004 action plan. These are rural development, urban development, education, health and water supply. Within the traditional food crop area, the strategy will focus on increasing yields, strengthening supply channels and water control. Of particular interest from the perspective of this study is that one activity planned to increase yields is more aggressive pest control.

3.2 Locust Control

3.2.1 Approach employed

Locust control in Mauritania is the responsibility of the Centre De Lutte Antiacridienne De Mauritanie (CLAA), which was established by government in 1995/96 in response to the collapse of the previous regionally based control system OCLALAV. The Mauritanian government places a high importance on DLC. The CLAA is under the Ministry of Rural Development (MDRE) and has a permanent budget from government to carry out its surveillance activities. This is augmented by funds from the emergency budget when necessary. CLAA receives bilateral assistance for specific projects; for example USAID gave \$50,000 to assist the establishment of the RAMSES monitoring database.

FAO funds EMPRES, which has recently been extended to the Western region that includes Mauritania. This programme provides support to national DLC units, and overall regional coordination. FAO has also been funding, with Norwegian trust funds, a research programme on various aspects of DLC including the impact of pesticides on livestock.

Mauritania is a frontline country in locust prevention, providing one of the important regional breeding grounds. In recognition of the importance of effective DLC in Mauritania, neighbouring states, including Morocco, provide support to the Mauritanian DLC effort.

DLC in Mauritania places importance on early detection of locust and control during the breeding season and before gregarisation. To this end survey teams go out on a regular basis during the breeding season to identify locust movements. Mauritania fields 4-6 survey teams, depending on resources available, during the six month breeding season.

The RAMSES database has been used to analyse information on past locust invasions. This work has then been used to provide better management of survey teams and reduce costs of the survey operation. The database is updated on a continuing basis, with information from the survey teams, and information that comes in from nomads. The head of CLAA estimates that 50% of information on locusts comes from nomads, and the relationship between nomads and the CLAA is given great importance.

3.2.2 Recent experience⁸

Mauritania suffered an invasion of locust from Mali/ Niger in 1987-1988. This was followed by a period of remission and another invasion, from the central region, in 1993-94. There was resurgence of DL in 1995 and 1996, which required action.

Total costs of the 1993/94 campaign came to UM 1,090,512,688 (~ US\$ 9,565,900) and 834,400 ha. were treated, by ground and aerial spraying. There are no data on

⁸ Much of the material here is based on Abdallahi (1997).

how the area treated compares with the area infested by locusts. There was delay in attacking the locusts because of scarce resources and because this was the first locust plague to be treated by national DLC, but once assistance had come from outside there was intensive spraying. Most of the crop and livestock areas were protected. As Table 1 indicates, national production of traditional rainfed crops, sorghum and millet, actually increased because of better rainfall. Locally there are estimates of crop losses of 21% for the Wilayas of Brakna and Trarza, with more significant losses for vegetable crops. It was reported that loss of tomatoes resulted in a twentyfold increase in price on the Nouakchott market.

The 1996 campaign cost UM 95,704,923 (~US\$ 674,000) and 12,885 ha were treated mostly by ground spraying. Much of the cost was incurred by contract spraying by FAO helicopter. There was a very high rate of treatment of infested area, and, by concentrating teams in appropriate areas, irrigated agriculture in the Senegal River Valley was protected. Table 1 indicates again that at a national level there was little effect on production in 1995 and that rice production actually increased in 1996. Although traditional cereal production fell in 1996, rainfall was poor compared to 1995, and was very irregularly distributed both over time and spatially, which makes it difficult to interpret the fall-off of production in 1996. It was most likely linked to climate rather than locust. In 1996, CLAA teams carried out all ground spraying. There was no reported spraying by farmers themselves.

Annual costs of DLC are estimated at between UM 19,000,000 and 1,200,000,000 depending on how much direct treatment is required. (This translates roughly as US\$ 134,000 – US\$ 8,451,000). A significant amount of this reflects the cost of maintaining up to six survey teams in the field for six months of the year. (The cost of a survey team was estimated by FAO at \$2,160 per month in 1998.) This compares to a crop value (including cereals, horticulture and dates) of US\$166,725,250 in 1995/96.

3.3 Socio-economic Impact of Desert Locust at Household Level

Field work was undertaken in Tagant, to the East and North of Moudjeria, an arid region on the edge of the desert locust breeding area. Over 70% of the wilaya receives less than 100mm per annum and the remainder receives under 200 mm per annum. The 2000 census gives the population of Tagant wilaya as 62,000 of an overall population of Mauritania of 2.55 million. Roughly 6,350 of the Tagant population are classified as nomads. In November 2001, four of the seven communes within Tagant were deemed to be of extreme vulnerability⁹ or high vulnerability (CSA, 2001).

This was followed up by interviews with urban migrants in the bidonvilles of Nouakchott.

⁹ Extreme vulnerability indicates absolute difficulty in achieving food needs, whereas high vulnerability means that the population is food deficit, and in a vulnerable environment but may have alternative means of accessing food, e.g livestock sales or alternative income possibilities.

3.3.1 Rural livelihoods

The farmers consulted in Tagant live on marginal lands where they grow traditional food crops, mainly millet, as well as maize and sorghum. They also grow a small amount of vegetables, primarily beans, and some grow melons. Landholdings are very small, the maximum being 6 ha, and all farming is carried out by hand. With the exception of female-headed households, women are generally responsible for vegetables, which are grown close to their home, and men are responsible for crops grown further away. During harvest time, both men and women work together. The agriculture is predominantly subsistence, and most farmers with whom the team held discussions have to buy food for household consumption for three months prior to the harvest. Some families manage to sell a few vegetables and dates, although the income from these do not contribute significantly to household needs.

All the farmers who participated in the survey also own some livestock; sheep, goats, cows, a few poultry, donkeys (which they use for transport) and in one instance, camels. In general, women take care of the small animals (poultry, sheep and goats) kept near the settlement, while men take care of those that graze further away (cows and camels). They sell their livestock to liquidate cash for food and health care for themselves and their animals, as well as for travel when necessary.

All those with whom discussions were held have some sources of income as a supplement to their mainly subsistence farming practices, and as an insurance against food insecurity. Some receive remittances from family members who have migrated to a town, or abroad. Others carry out small income generating activities, such as the making and selling of charcoal (one man admitted that 85% of his family's income is derived from charcoal). Some of the women are members of cooperatives set up by the Ministry for Rural Development, through which they work collectively to produce and sell vegetables, or crafts such as tents and matting, although several women said that these activities do not represent a major source of income.

3.3.2 Attitudes towards locusts and other threats

Drought

Without exception, all those consulted confirmed that the overriding constraint to farming was lack of water, affecting both crop production and livestock husbandry. They cannot guarantee there will be sufficient rain to harvest their crops, and where they have access to small dams, these are insufficient. For four months during the dry season (starting from March/April) they have to buy food for their animals, especially sheep and cows, since camels and goats can survive more readily from the land.

Everyone referred to the last major drought, the effects of which lasted from 1973 to 1984. With no access to credit or insurance schemes, many family members moved to the towns in search of alternative sources of income, from where they send remittances home, and sometimes return to help with the harvest, if there is one. Generally the men migrate while the women stay on the land and take over the men's traditional farming responsibilities as well as coping with their own traditional tasks. The older generation prefer to stay on the land and maintain their independence, while

the younger leave in search of urban employment. One old man said that he'd rather die with his animals than move to town.

Lack of secure land tenure (in the form of property titles) means that land cannot be used as a useful collateral for loans. However, current land reform measures may improve this situation for poor farmers.

Discussions with urban migrants in Nouakchott confirmed that the drought of the 1970s and 80s was the chief reason for their shift from the rural areas to the town, and although they would rather live in their rural homes, they are forced to stay in the towns to earn money. Some return to their rural homes to help during harvest time, or just to see their parents and give them some money. For those rural families who were left with no alternative livelihood options when agriculture failed as a result of the drought, the whole family moved to the town for good. Some even lost their land, which was taken over by others when they left. They said that if they returned they would have nothing to do, and even if they had land, this would give them no source of livelihood because there is too much insecurity involved in farming, and they cannot guarantee rain.

Pests

Farmers whom the survey team consulted in the rural region of Tagant ranked the threat of pests as second to the threat of lack of water and drought. Pests most commonly mentioned as harmful for crops were birds, and it is often the woman's responsibility to shoo them away from the fields. Almost everyone indicated that caterpillars are a significant hazard as they eat the crops, and one family reported that when their animals eat the leaves on which caterpillars have settled this induces miscarriages. Other pests listed as significant threats were locusts (see below), termites, rats, plant louse, squirrels, snakes, scorpions, jackals and monkeys. For camels, ticks were regarded as a major problem.

Locusts

During discussions on pests, farmers initially seemed more preoccupied with those that bring a small amount of crop damage or animal ill health with annual or seasonal regularity. However, when the subject of locusts was raised, it became clear that these are regarded as an altogether different type of hazard, a periodic shock causing total destruction to an extent that is incomparable with the regular damage of other pests. A locust plague will eat an entire harvest and will leave no pasture for animals to graze. Most respondents, referring to the locust plague of 1993, used vocabulary such as "catastrophe", "crisis", "disaster", reflecting the severity of the destruction and placing it on the same level as the last major drought. There is a saying that if a locust lands on a stone it will eat the stone. One farmer told the survey team that according to Islam the locust is the last living creature on earth that will survive.

In contrast to that, the survey team were also told that certain types of locust bring good luck, because they do not do a great deal of damage, and they signal a better quality of pasture (presumably linked to rainfall).

Sedentary farmers are less able to avoid the effects of a locust plague than nomads as they cannot move their fields out of the way, although one family interviewed with camels said there was no point moving their camels in a locust plague as they do not

know where the locusts will swarm next. As with drought, the threat of locusts is more serious for sheep and cows than goats and camels as the latter can survive on less vegetation.¹⁰ Although desk studies of locust damage focus on damage to crops, a number of farmers mentioned the damage to their animals arising from a locust plague. As well as problems arising from lack of grazing, farmers believe that if animals eat locust faeces, this acts as an abortifacient.

Like the drought of the 1970s and 80s, most farmers said there was nothing they can do to prepare for or avoid the damage of a locust plague. Some (especially women) did not know where locusts come from, where they go, only that they arrive at night and leave at dawn. Others knew that locusts can originate from across borders, and could differentiate between the "small red ones" which are harmless and the "others" which destroy everything.

Farmers have traditional methods for dealing with a locust plague, which involve: burning trees (which they acknowledged has the negative effect of depriving animals of vegetation); burning tyres (in the hopes that the smell will push the locusts away); making a noise with sticks or stones placed in a box; shaking trees; tying stones into a sling and flinging them in the fields; building trenches to collect water into which the locusts fall. One respondent referred to a witchdoctor who had tried to get rid of the locusts by citing passages from the Quran. However, in general respondents were disparaging of the effects of these control methods, admitting they were next to useless in the face of a locust swarm.

Attitudes towards government locust control activities were varied, although there was a general agreement that these were more effective than traditional methods. Some farmers understood the preventative nature of the government's regular monitoring and control methods, that involves spraying pesticides, and although most said they had no contact with the control teams, with some not even knowing of the existence of these teams, a few said they talk to the teams if they meet them and pass on relevant information. Some farmers said if they became worried about another serious risk from locusts they would inform a local government representative because even though they did not know what the spray was, or how it worked, they had more faith in its effectiveness than traditional methods of locust control. During the last locust plague, farmers remembered that the government sent planes which sprayed (this was described by one farmer as "little bombs") or people came to spray in vehicles, and during this time everyone was told to leave their fields. However, in this instance the government treatment was too late as the locusts had already eaten everything.

No one who participated in the survey referred to any negative effects of government spraying on humans or animals.¹¹

¹⁰ Although camels and locusts thrive on the same type of vegetation.

¹¹ An FAO-led operation on testing the effects of locust control spray on camels, using blood samples, concluded that there was no negative effect, although those involved found that nomads were reluctant to allow anyone to handle their camels without very good reason, and the very act of testing led some nomads to suspect there was a problem, thus endangering relations between the government locust control programme and the nomads. However, an FAO report on current practices during operations to locate and control desert locusts found that, although some nomads were initially unhappy about

3.3.3 Coping strategies and safety nets

The farmers consulted in the study are fully integrated into market structures and had multiple sources of income. These were generally not heavily affected by either drought or locust, except where they were affected by a general reduction in rural income. A family that depends on selling charcoal reported that locusts could improve this activity, as they killed the trees and increased supply in the short run.¹² Households can also borrow. While no one consulted said they have access to formal credit lines, everyone said that during times of stress (for example between harvests of crops and dates) local shops would sell them food on credit.

Discussants confirmed that, during times of stress, traditional social safety nets still come into play. Families will receive help from others for payment of transport to hospital, or for food when necessary. Female-headed households, where the mother has to take on what is traditionally male farming responsibilities in addition to her own agricultural and domestic tasks, benefit especially from this traditional social safety net system.

There was little evidence in the area where the interviews took place of effective formal state safety nets. One elderly man said that food aid had been distributed in the area in the past few years, but that it had not been distributed well, or reached the most needy people. (Food aid donations to Mauritania have been falling in quantity over the last decade, and currently are less than 2% of overall food needs in the country. Most food aid is distributed in FFW projects or mother and child feeding programmes). In general, there appeared to be very limited interaction between local government agencies and the farming population in this area.

In the event of a locust plague causing total destruction of crops and pasture, as in 1993, farmers do not have a wide range of coping mechanisms to protect their livelihood. In the absence of access to insurance schemes, or credit, most survive by selling some animals¹³, or other income generating activities such as the sale of charcoal, or relying on remittances from members of a family working elsewhere, or simply by the social safety net system that is entrenched in the traditional ties of kinship. Although no one admitted that the last locust plague alone pushed people out of the rural areas into the towns in search of alternative employment, many of the migrants interviewed in Nouakchott confirmed that the threat of another locust plague reinforced their fear, primarily caused by drought, that they will fail to survive if they try to eek out a livelihood that relies on farming alone.

spraying being carried out, "good relations with nomads were observed and are essential both as sources of supplies and information and to facilitate operational activities".

¹² Cutting down trees to make charcoal is illegal, though in Tagant there are no resources to allow the responsible government official to monitor this.

¹³ An official of the CDHLPI said that the best safety net that a household can have is small animals. If you have 25-30 animals, you will have no problems. A project has been started in 50 villages to distribute 10 sheep or goats, according to the area, to households that have no animals. They are allowed to sell the males but not the females.

3.4 Implications

Locust control in Mauritania should be examined at three levels: the household, the national and the regional.

At the household level, locust invasions undoubtedly cause hardship, but not necessarily much more than drought. Many of the families the survey team talked to had experienced the droughts of the 1970s and 1980s and had adapted, often by extending part of their families into the urban areas, or abroad. Crop production was only a part of their livelihoods. They were already self-insuring, in economic terms. They were undoubtedly poor, but had chosen to stay in the rural areas while others had migrated into the urban areas.

However, over the past six or seven years, they had been protected to a great extent by the DLC in place. People had to think back to 1993-94 to give examples of severe locust damage, and therefore it was impossible to get any quantitative estimates of the losses due to locust invasion at household level. It is difficult to assess the impact on households if DLC were to be stopped, and whether the coping strategies, which appear to function fairly effectively at present, would be adequate for a severe invasion.

There appears to be little in the way of formal government safety nets in place to assist the kinds of farmers included in the fieldwork. FFW programmes appear to target the chronically food insecure, rather than those suffering from transitory food insecurity. There is no access to formal credit in the arid areas – agricultural credit is focussed on the Senegal Valley. There is no insurance in the rural sector and no state emergency fund. Animals are an important part of the savings/ security system, and there has been very little work done on the impact of DL on animals.

This study did not look at households in the Senegal River Valley. However, some of the poorest families in Mauritania can be found there. In recent years, this area has been protected from locust, as upsurges have been stopped before they reach the river valley. However, as many of the poorest here are agricultural labourers, it is likely that an uncontrolled invasion would affect the demand for such labour, and hence the livelihoods of the poor.

At the national level, there is little evidence of significant aggregate net loss of production as a result of desert locust invasion. DL invasion years have, if anything, shown increases in production because of the good rainfall. It could be argued that the DLC programme has contained potential losses at a cost of, on average, US\$ 4million per annum.¹⁴ It is difficult to compare this cost to the likely value of agricultural losses, as the value of agricultural production varies considerably year on year in Mauritania. However the average DLC cost figure represents almost 4% of production value in a good year (1995/96) and would be a considerably higher percentage averaged over a ten-year period. The cost of DLC is likely to be greater than the value of the crop production which would be lost in the absence of DLC.

This, however, does not take into account the effect of DLC in the region as a whole. DLC in Mauritania has prevented locust invasions from reaching both Senegal and

¹⁴ Averaged out over a ten year period which contained 3 serious outbreaks (Joffe, 1997).

Morocco. Possible locust damage could be significant in both of these countries, particularly for citrus production in Morocco. There are important externalities to DLC in Mauritania, and it is extremely difficult to put quantitative estimates on them.

One point worth making about the DLC system in Mauritania, which may be a factor in explaining how difficult it is to get household level information, is that it is very top down. Very little evidence was found of consultation between the government locust control activities and primary beneficiaries, farmers and nomads. Also CLAA is managed as a stand alone programme, and, although it is a strong and committed unit, it has little communication with other departments of the Ministry of Rural Development. A district level MDRE inspector indicated that survey teams in his area sometimes informed him of their activities, but this was not a matter of course. If the justification for external donors to continue funding DLC activities is based on its disaggregated livelihoods impact, then DLC, even when it is as efficient as the CLAA appears to be, would benefit from taking a more inclusive approach, informing and involving farmers more.

4 Eritrea Case Study¹⁵

4.1 Context

4.1.1 Poverty

Two overriding factors contribute to widespread poverty in Eritrea: war and drought. A 30-year war with Ethiopia (1961 – 1991), following which Eritrea gained her independence in 1993, was repeated by a subsequent border conflict which erupted in 1998 and escalated into another war, from which the two countries have only recently signed a tentative peace agreement (still to be ratified). By 2001 more than a third of the population were internally displaced and many have been deported from Ethiopia. The war has caused significant loss to agricultural production (the two regions most affected by the recent conflict, Gash-Barka and Dehub, normally account for 70-75% of the country's agricultural output); infrastructure; port revenues; private sector activity and exports. Prices of basic commodities, including food, have increased dramatically. Severe drought between 1998 and 2000, has exacerbated the damage caused by war.

Levels of health, nutrition and education are amongst the lowest in the world. Although these improved after independence, the recent war has disrupted further progress.

Average life expectancy at birth is just over 50 years (1998). Maternal mortality is one percent, the rate of mortality among children under five is five percent (2001), and 40% of all Eritrean children are chronically malnourished (1996). Poor health status is compounded by limited access to both curative and preventative health services, acute shortage of health staff, and very poor access among the rural population to clean drinking water (approximately only 10%) and to sanitation

¹⁵ The field work for this study was carried out with the assistance of Mr Woldu Teklegiorgis and various field officers of the Plant Protection Unit of the Ministry of Agriculture.

facilities (almost none). The HIV virus also poses a major barrier to improved health; approximately 3% of the total population is presently infected, a rate that is in danger of increasing dramatically in the light of recent large scale population movements as a result of war and planned demobilisation of the army (State of Eritrea, 2001)

The situation regarding education is no better. The overall adult illiteracy rate in 1998 was 75%, and for women, 80%, representing some of the lowest rates in the world. Only 30% of children attend primary school, and even less secondary. Female enrolment is lower than male enrolment, especially in Muslim areas where early female marriage is the norm. Access to schools is limited further by long distances (sometimes as much as a four hour walk) and the transience of agro-pastoralist families in search of grazing land.

The greatest number of the poorest live in the highlands, which accounts for only 5-10% of the country's total land mass, but where 60% of the total population are estimated to live. The worst incidences of poverty, however, are found in the arid areas, such as the coastal plains and the northwest lowlands where the majority of rural dwellers are semi-nomadic pastoralists who rely on selling their livestock for grain and vegetables during drought years. These receive only limited access to social services, such as health and education, and suffer higher rates of maternal, infant and child mortality and a lower life expectancy than settled groups. The poorest amongst them possess no land or livestock and survive by working for others.

At the community level, a strong social safety system exists whereby the better off help those with no assets or means of survival. It is regarded as a duty to offer a portion of what you have to those who have nothing with which to survive.

Women's position in Eritrean society is ambivalent. They participated in the country's struggle for independence alongside men, thus increasing their independence and involvement in community and public affairs. Often women find themselves responsible for sustaining a livelihood for their family as well as carrying out traditional female duties such as raising children and caring for the elderly. As a result of the war, 45% of households are headed by women, although many reports on Eritrea suggest that these are amongst the poorest households in the country¹⁶. In recognition of women's important social and economic role in society, there is a strong commitment at the highest levels of the Government to gender equality, and at independence the Government enacted legislation guaranteeing a woman's rights to inherit property, retain rights to property in her husband's village upon his death, and the right to divorce. However, in reality, deep cultural traditions marginalise women in the social, political and economic spheres, making these commitments to gender equality difficult to implement on the ground. School enrolment rates are lower for girls, and female illiteracy rates are higher than male. Women are still concentrated in low skill and low wage employment, and their access to productive assets such as credit is limited.

At present there are few data on which to base a quantitative estimate of the number of poor in Eritrea. The World Bank carried out a Rapid Appraisal Survey in 1993-94,

¹⁶ However, this is contradicted by other reports which state that, contrary to the general trend in Africa, female-headed households in Eritrea are not poorer than male-headed households as they have access to land and other productive assets.

and this still forms the basis of most statements on poverty in the country. On the basis of this, 69% of the population were assessed to be below a national poverty line in the absence of food aid. With food aid taken into account this fell to 53% (World Bank, 1996). A poverty assessment is being planned for 2002-2003 as input into the development of a PRSP.

4.1.2 Agriculture and food security

Approximately 60% of the population relies on agriculture, animal herding and fishing, although agriculture accounts for only 16% of GDP. The majority of the rural population are sedentary and practise rain-fed subsistence agriculture on small land holdings, along with animal husbandry. Small marketable surpluses are sold on local markets. Agricultural practices are based mainly on traditional techniques using animal-drawn implements and characterised by low productivity.

The agriculture sector is hampered by: irregular and inadequate rainfall with recurrent and long drought periods; poor technology; high crop and livestock losses from pests; continuous degradation of soil, forest and water bodies; inadequate storage and marketing; and limited extension services. In terms of food production, Eritrea has never been self-sufficient. Domestic production presently only covers 30% of the country's food needs. Before the war, the food deficit ranged between 40% and 80% depending on rainfall.

Agricultural production varies according to the climate and topography, which differs significantly across the country. 70% of the country's overall agricultural production comes from the central highlands and southwest lowlands, the most densely populated areas, although these are areas that have witnessed the most intense fighting and have consequently suffered from losses in crop and livestock production, as well as inaccessibility of land, and labour.

The lowland areas of Anseba, the North and South Red Sea regions, and parts of Gash Barka are transitory food insecure areas, even in good years. Average rainfall is under 200mm per annum. Here two years of little or no rainfall has dramatically increased the population's vulnerability. Migration of families in search of food has become common. People have lost their cross-border trading, employment and grazing opportunities with Ethiopia (and to some extent with the Sudan). Grain prices have increased and households have been selling their animals, leaving them even more vulnerable.

Animal husbandry is practised throughout the country, especially in the lowlands where rain is scarce and irregular and where livestock raising is therefore a natural response. However, recurrent drought and war has reduced livestock resources by as much as 70%. Although the sale of livestock is considered the last coping mechanism employed when all other resources have been depleted, the past year has seen many pastoralists sell or eat their dying livestock as they were unable to find adequate water and pastures for their herds.

Access to credit for small-scale farmers is very limited because the banks demand collateral of fixed assets, such as a building in major towns. Consequently, most farmers have long since given up seeking credit.

Insecurity of land tenure poses a core problem that constrains modernisation of agriculture by reducing the incentives to intensify land use. There is no private ownership, and although land user rights can be inherited, since there is no land market, these user rights cannot be used to raise credit. During the Italian colonial period a communal land system was introduced by which land is re-distributed every seven years, a pattern that still exists, minimising any incentive for investment. Land reform measures which were started by the Government have been stalled by the war, and their delay acts as a significant disincentive for better land use.

Within the agricultural sector there is a marked gender division of labour. While men are responsible for ploughing and feeding the oxen, women are responsible for less strenuous tasks such as: weeding; clearing of stones and dry grass in the wake of the plough; sowing; harvesting (with men and children); and preparation of food and coffee to take to the men in the fields. A participatory safety net system, or variation on share-cropping, exists at the community level whereby female-headed households borrow male labour from neighbours or relatives to plough their fields in return for a percentage of their yield.

The Government's poverty reduction strategy contains a focus on increasing agricultural output by expanding land under cultivation, increasing yields, and encouraging the production of higher-value crops for export or domestic consumption. The Ministry of Agriculture is presently implementing programmes such as: food for work initiatives; crop breeding for major varieties; on-farm soil and moisture conservation (which is less successful because of land ownership problems); support to small livestock; and integrated pest management. The Ministry of Agriculture's Home Economics Unit has parallel programmes for women with the objective of improving the living conditions of agricultural households. These involve initiatives in: food and nutrition; clothing and textiles; mother and childcare; home improvement and management; health and environmental sanitation; and income generating activities, such as poultry farming, bee keeping, horticulture, animal husbandry, and handicrafts.¹⁷

At present a total of 1.8 million people are now in need of food assistance (United Nations, 2002). With a permanent food deficit, Eritrea is one of the most food insecure countries in the world. Government estimates suggest that 50% of the population require food aid in a good year, and as much as 80% in a bad year (State of Eritrea, 2001). Table 2 shows cereal production and food aid receipts over the last decade.

The government is very concerned about increasing dependence on food aid, and by 1997 had ceased to operate emergency relief programmes. It felt that its importation capacity was sufficient to import food commercially and had planned to cease food aid imports totally in 1998. However, the conflict with Ethiopia changed the situation totally and triggered a new humanitarian effort. This was further complicated by the start of drought in 1999, which is continuing at the present time.

¹⁷These programmes very much reflect the marked gender division of labour in agriculture.

Table 2 Cereal Production and Food Aid

		('000 tonnes)							
Year	1993	1994	1995	1996	1997	1998	1999	2000 ^e	2001 ^e
Cereal Production ('000 MT)	86.8	253.4	122.5	85.4	99.1	457.8	427.1	71	150
Cereal Food Aid	245.5	152.6	64.8	9.0	63.3	102.7	90.8	220.9	n.a.

Source: Ministry of Agriculture, FAO
e – estimates

4.1.3 Policy context

The Government's short-term policies to alleviate poverty involve the provision of emergency needs for those who are drought-affected or displaced, including deportees (from Ethiopia) and demobilised soldiers. Its short-term focus is on: the rehabilitation of infrastructure; assistance in re-establishing farms and businesses; improvement of social services; and restoration of investor confidence

With the realisation that that food insecurity issues will not be solved through agriculture alone, the Government's medium term objectives to alleviate poverty focus on sustained economic growth through rapid private sector-led and outward looking economic expansion with equitable distribution of economic gains, equitable access to basic services and the empowerment of women. It plans to raise the skills and wellbeing of people by investing in education, nutrition, health care, water and sanitation, as well as aiming to reduce rural poverty by investing in rural infrastructure, agriculture, management of livestock and pastures and development of fisheries. There is a strong emphasis on development of the rural sector and increasing agricultural productivity.

The government's Transitional Economic Development and Poverty Reduction Strategy also identifies three areas of special emphasis or cross-sectoral priorities (State of Eritrea, 2001). These are:

- Demobilising and reintegrating soldiers
- Enhancing the status and increasing the participation of women in development
- Restoring, enhancing and preserving Eritrea's ecological integrity

So long as the war with Ethiopia is not prolonged, these measures may help to reduce poverty in Eritrea and pull the country out of its dependence on external aid.

Eritrea will start the process of developing a PRSP by the end of 2002. The first step will be to conduct a participatory poverty assessment.

4.2 Locust Control

Areas of potential locust invasion cover the entire country, and locusts may come from other countries, such as Sudan, Ethiopia, or Yemen. The far north of the Red Sea coast area of Eritrea, near the border with Sudan, is a main locust breeding area, although this is not a farming area.

4.2.1 Approach employed

There is a strong government commitment to the promotion of desert locust control, and the government plans to establish a unit within the Ministry of Agriculture just for locusts and other migratory pests¹⁸. Following the first control campaign since Independence, in 1993, when there was no early warning system, the government set up a task force to devise short and long-term strategies for monitoring and controlling the desert locust. Eritrea belongs to the regional Desert Locust Control Organisation for East Africa, to which it regularly pays its dues and in return can employ their planes (based in Nairobi) for spraying. There is also a strong collaboration between the Food Security and Early Warning System and the Plant Protection Department within the Ministry of Agriculture, the latter supplying the former with monthly reports on pests.

In the area of locust control, strong links exist between the Ministry of Agriculture at the national level, its regional offices, and farmers. When locusts are sighted by farmers or nomads they report to regional Ministry offices, who in turn initiate surveys, using farmers, to analyse the extent of a locust presence. Extension workers from the Ministry are trained in locust surveying and control, and they in turn regularly train farmers, (always male), selected for their active role in the community, who are then called farmer scouts. The training consists of: conducting surveys, (especially in favourable conditions when rain is heavy and locusts are more likely to breed); outbreak control (i.e. spraying); and organisation of farmers into collective action. These farmer scouts, who represent the link between farmers and the Ministry of Agriculture, are employed for six months (depending on the climatic zone) in a range of duties, the aim of which is to prevent, rather than control, damage to agriculture from locusts, thus expending less time and labour than would be necessary in a control operation. Locust upsurges that have occurred since these trainings have been well controlled as farmers on the ground have identified the problem early on. However, population displacement as a result of the war means that more training programmes are needed.

Whereas farmers have to buy fungicides, herbicides and insecticides for other pest-related needs, in the case of a desert locust outbreak, the government takes on the responsibility of control, while farmers are employed to help with spraying¹⁹. In a severe outbreak, spraying is done with planes as well as by hand. All farmers in the area are mobilised, as is the Ministry of Health in case of an accident. Committees are

¹⁸RAMSES, was introduced in 1995/96, but is not now operating because of staff shortages. It last appears to have been used in 1997/98.

¹⁹ It has been reported by the Ministry of Agriculture that some nomads are reluctant to participate in spraying, believing that the pesticide harms their animals.

formed at the district level and at national level a task force and a steering committee are set up.

As a result of strong links between the Ministry of Agriculture and farmers (see above), there seemed to be a high level of awareness amongst farmers consulted of the importance of surveying locust movements, and farmers are prompt to report to the regional Ministry of Agriculture offices when they detect locust activity. Farmers also appear knowledgeable on the origins and breeding habits of the desert locust, and can frequently state from which area of Eritrea, or which other country, a certain outbreak began.

4.2.2 Recent experience

Since Independence, there have been significant Desert Locust outbreaks in Eritrea, where pesticides were used against swarms, in 1993, 1995 and 1997.

In 1992-93, after good rains, nomads reported hopper bands. 11,301 has. were ground sprayed and 18,300 has. were controlled aerially using planes from DLCO-EA. The country was not well prepared for a desert locust outbreak; there was no overall strategy and a pesticide shortage developed (Teklegiorgis, 1997)

In 1995, reports were received from farmers of desert locust swarms entering Eritrea from Sudan in July. 26, 317 has. were treated using ground equipment and 25,580 has. were treated aerially. Again, there was little in terms of a pre-developed strategy, but more pesticide and vehicles were available in country.

In late 1997, almost the entire Eastern Coastal region was infested by DL, swarms having entered from Sudan. 18, 165 has. were treated.

The 1995 campaign was costed at \$283,000. If Joffe's estimates of \$19 per ha for average total control costs are applied²⁰, this gives an alternative estimate of around \$1 million. An estimate of the cost of spraying in 1997/98 was \$185,650. (Belhaj). However, these are the variable costs of a specific campaign, and do not include the costs of maintaining infrastructure and pesticide stocks, and any ongoing staff costs for surveys. Joffe's more comprehensive unit cost estimate would increase this figure to \$345,135.

There is no indication at the macro level that DL had a significant impact on cereal production (see Table 2). In fact production in 1998 was one of the highest on record, to a large extent due to the good rains that in turn created good conditions for locust gregarisation. Attempts to model the impact of DL on production levels in Eritrea (Belhaj, 2001) show overall a small positive relationship between DL invasions and production, reflecting the impact of good rainfall. For the lowlands area, where the actual invasions took place, the relationship is negative but insignificant.

To place potential damage from desert locust in Eritrea in context, most estimates of damage from a locust invasion in a country place it at around an average of 3-5% per

²⁰ Estimate based on data from a number of country case studies.

annum²¹. The head of the planning division in the Ministry of Agriculture estimates losses due to pest damage in general average over 30%. Against this, there is a strong institutional memory of a pre-Independence DL invasion where losses were estimated at more 46,000 MT of sorghum, completely wiping out the crop.

4.3 Socio-economic Impact of Desert Locust at Household Level

Field work was carried out in two zobas in Eritrea, North Red Sea zoba, which is a semi-arid area containing 9 sub-zobas, and an estimated population in 1999 of 558,500, about 14% of the total population of the country, and in Debub, one of the major food producing areas, where 26% of the population live. (Estimates from World Bank, 2001). Average cultivated land per rural person is 0.07 ha. in N. Red Sea and 0.13 ha in Debub.

The majority of respondents came from small scale farming families with an average household landholding of 1.5ha and a small number of livestock. The exception was a few larger-scale citrus farmers in Debub Zoba, where locust outbreaks have been prevalent in the past. Farmers were either settled, or semi-nomadic, moving between small plots of land in the highlands and the lowlands.

Farming in the North Red Sea zone is carried out either under rainfed conditions, or under spate irrigation. Spate irrigation is the leading form of irrigation in Eritrea, involving the diversion of seasonal floods from the highlands, but it is very risky, as crops may fail because of drought, or because of flooding, if the water is not adequately controlled. However, in good years, yields are much better than from rainfed agriculture and costs are low (World Bank, 2001).

4.3.1 Rural livelihoods

Along the Northern Red Sea coastal plains, and the central lowlands and mid highlands, the main crops grown are maize (during the rainy season) and sorghum (outside the rainy season), and a little millet and cotton is also grown. Some farmers also cultivate vegetables and water melons. In the highlands of Debub Zoba, to the south of Asmara, one of the only two regions in the country that produce a food surplus, farmers grow maize and finger millet (the two highest value food crops in Eritrea), as well as teff, barley, sorghum, vegetables and citrus fruit. Cultivation is either rainfed in the highlands, or from spate irrigation in the lowlands, whereby farmers catch rainwater coming from the hills using earth diversions, or a combination of both²². All farmers owned a small number of animals. Most practised subsistence farming, only selling a small amount of their produce in a good year. The semi-nomadic farmers interviewed spend on average eight months in the lowlands and four months in the highlands, with either the entire family moving, or just one or two members. A few farmers interviewed in highland areas said that they also owned

²¹ This is not an indication that in any year of high invasion, crop loss would be restricted to that, but that averaged over a period of time, taking invasion and non-invasion years into account, losses would be of this order.

²² "Spate" harvests do not happen every year, but when they do occur they produce the best yields in the country.

fields in the lowlands, which they rely on in times of drought when they lose their highland crop.

Most farmers had access to local markets, but transport costs were high, in terms of time and money. Commercial activities appeared to take place within a very localised area. Women living in small rural towns had some opportunities to sell eggs, or make clothes for sale. Other income earning opportunities appeared to be limited to participation in cash for work schemes, or employment on regular public works, such as road building.

In the highlands of Debub Zoba, to the south of Asmara, farmers had better access to interventions from the Ministry of Agriculture (probably because of the regions' closer proximity to Asmara), such as training and seed demonstration plots. They also had better access to markets and a better knowledge of agricultural inputs. In other areas farmers did not have sufficient knowledge to ask for these.

4.3.2 Attitudes towards locusts and other threats

Threats

The most commonly mentioned threat to farming was lack of rainfall, or, in extreme cases, drought. In rain fed areas the rain is often inadequate and in areas where spate irrigation is practised a common complaint was that the flood from the highlands does not reach the crops, or the dams constructed have silted up and are unusable and supplementary rainfall is not sufficient. Several respondents said that they have been forced to sell or eat their animals in years of insufficient rainfall because there was not enough vegetation to sustain them. In one area farmers said that they had not been able to rear animals for five years because of lack of vegetation.

Pests were also frequently mentioned as posing a significant threat to crop cultivation, and lack of insecticide was a common complaint. Chief pests mentioned were: army worms, sting bugs, stock worms, grasshoppers, green stingbacks, termites and ants. White flies and locusts were regarded as a larger threat, but ones that were not regular, were taken care of by the government and therefore did not represent such an ongoing hazard.

A study done in 1999 asked farmers to rank the factors limiting cereal production.(Belhaj, 2001). Drought came first, lack of oxen was second and locust invasion came sixth.

Many respondents also considered the lack of income generating opportunities, either through employment or off-farm business, as posing a significant barrier to improving their livelihoods. Some viewed poor access to health services and the lack of medical professionals as being important, while many complained about the effects of malaria.

Impact of Desert Locust

Farmers spoke of the threat of a locust outbreak as far more damaging to their crops and vegetation than the threat from other pests. Although they are often seen as being synonymous with heavy rain, ("with locusts come the rain, which brings vegetation and a good harvest"), they are also regarded as being capable of eating an entire crop.

Unlike other pests, (with the exception of the white fly), farmers consulted also considered the responsibility of locust control to lie with the government, probably a result of the government's swift response in the past to locust outbreaks with spraying. One farmer said he preferred heavy rain and locusts to drought "because the government takes action with locusts."

When remembering past locust outbreaks, most farmers reported in the same fashion; that because of government spraying damage to crops and vegetation was minimised. However, most admitted that despite all government efforts, a few farmers still lost all or almost all of their crops. One farmer remembered how in 1997 the locusts ate all his grain and even the trees. Another remembered how locusts came from the Sudan in 1995 and resulted in his losing 40% of his yield. In the same year, another remembered the locusts eating everything and all he salvaged was seed for next year's planting. Although the major impact from locusts was seen as damaging crops, some farmers also said their livestock suffered. When asked how they survived when they lost almost all or all of their crops from locusts, most farmers responded that they relied on food aid. Some also said that they sought alternative employment either working on the roads, on buildings, or on others' land. Many sold their animals; some remembered selling their goats to nearby soldiers, and several relied on charity from those who had not lost everything.

Despite almost total reliance on government control, in serious locust outbreaks farmers also attempt to save their crops with their own traditional methods. These may involve: digging ditches to entrap hoppers (only effective at a certain stage); swiping with thorned branches; laying a mixture of bran and insecticide on the fields in the hopes the locusts will eat it and die; shooing away with sheets; and even praying. However, they regarded these as desperate last resort measures, and had far more faith in government control. No one admitted to concern about environmental hazards of spraying, although they knew that it was important to stay away from fields after spraying and not to touch the crops for five days²³. Although the pesticide used is said to harm bees, none of the farmers consulted regarded this as a serious threat, saying instead that all beekeepers know to make sure the pesticide is not sprayed near their hives.

Because of the strict agricultural gender division of labour, the threat of locusts and locust control appears to be a male concern. When asked about locusts, most women looked nonplussed. One replied: "Truly I don't have a chance to get out of the house so I haven't seen a locust". She hadn't even heard men mentioning the problem. Most female respondents were less aware of the potential damage that locusts can cause, and none were involved in spraying.

²³ This is in contrast to the Director of the Environment Division in MRDE who expressed strong concerns over the impact of spraying on Eritrea's water and marine resources.

Very few remember the effects of locust outbreaks in days before government control. There is no oral tradition telling tales of locust plagues that ruined the land. Most of the younger farmers have not even heard of pre-control outbreaks. In contrast, one old man in the central lowlands remembered, as a little boy, a large locust outbreak when there was no spraying at all. He spoke of how the locusts damaged everything, first as hoppers, when they ate the grass, and then when they flew. Men collected them in sacks to eat. That was the year they called "The Great Damage", when even the animals were eating the locusts. In Debub Zoba, to the south of Asmara, a 90-year old citrus farmer remembered an untreated locust outbreak in 1960 when they ate everything, including all the trees. Animals died, people died of hunger, and they simply prayed for the locusts to go away. They stayed for a month, and then disappeared into the sea at Massawa. He has never seen anything like it since, and regards it as an act of God.

It was not possible in the time available to get quantitative estimates of value of cereal production loss at household level. A study done in 1999, which looked at the impact of the 1997/98 DL invasion found that, based on a sample of 401, 20% of lowland farmers lost all their cereal production in 1997/98, with an estimated average value of \$268 per farmer. Of these, 1.5% had no yield in 1999, which they attributed to the knock-on effect of DL. (Belhaj, 2001).

4.3.3 Coping strategies

When rainfall is inadequate, and crop yields are lower than normal, or non-existent, these small farmers are forced to find alternative means of survival. Some seek casual employment in nearby towns, such as loading and unloading in the port of Massawa, or construction work on roads and buildings, or they participate in the government's Food for Work programmes. Others hire themselves out to work on neighbours' fields, for which they share a portion of the yield as payment. Many receive food aid from the government. As a last resort they may have to sell their animals, thus depleting their asset stocks further. Although informal credit is available from local shops, to be paid back after the harvest, with the exception of farmers in the highlands of Debub Zoba to the south of Asmara, no one had access to any formal credit schemes. One factor in this is the confusion currently surrounding land tenure in Eritrea. However, most farmers also said that they would not think of asking for credit, as they could never pay back the loan.

A strong community-level solidarity existed in all the survey areas; those who had nothing receive handouts from those who are better off. Government food aid is distributed by the community itself, with decisions made by a local committee, based on their perceptions of the most vulnerable. As one farmer put it: "We know each other so we know who is most in need".

There are a number of female-headed households, where the husband is at the front. Their land is cultivated by male relatives or neighbours, who in return receive a portion of the yield. This is also the situation for divorced or widowed women.

4.4 Implications

The data available in Eritrea on DCL and its impact make it difficult to assess the programme at national or regional level. At national level, at present, it is probably unlikely that DLC should be a priority from an economic perspective. There are losses due to pests taking place on an annual basis that are of similar magnitude to those which could be anticipated from DL in an invasion year. However DLC is currently an integral function of the Plant Protection Department, and the additional costs associated with the farmer scout system of monitoring are unlikely to be high. Plans to set up a specialised migratory pest unit may be misjudged.

At the regional level, the situation becomes more complex. Eritrea is an important breeding area, and therefore DLC there has repercussions for the surrounding countries. The team were told by USAID officials who had worked in the AELGA programme undertaking training in Eritrea, that the Eritrean government had a responsibility to control as far as other countries were concerned, and that they had no choice but to control.

There is a little more information on which to assess the importance of DLC for the household.

In Eritrea, poor rural households in the N. Red Sea zoba have very limited options in terms of alternative livelihood possibilities. If their crop is damaged by DL or indeed by drought, they will almost certainly look to government assistance with food aid to see them through. In the villages where the survey team held meetings, there was a good relationship between local Ministry of Agriculture staff and farmers, reinforced by the high level of organisation within villages. This had positive aspects. Farmers tended to be aware of actions that the Ministry took to combat DL, they had more knowledge about the DL itself, and would go to get pesticide from government. However, they also have an element of dependence. This allows them to stay in the countryside, rather than move to the cities, but frequently on plots of land that currently will not give them an adequate livelihood in most years.

Are there alternative viable approaches? Although Belhaj finds that there is willingness to pay for insurance in Eritrea, averaging between US\$5 and US\$20 a year, it is unclear whether that is a realistic approach to take in the present circumstances. In any case, the willingness to pay for insurance was estimated based on the existence of an efficient preventive control in remote breeding areas, which is also currently unrealistic. The figures reflect the value farmers put additional protection from DL, where there is efficient but not totally effective DLC. It does not indicate how much farmers would be prepared to pay for protection in the absence of DLC. It is unlikely that many of the farmers the survey team spoke to would be able to afford the premiums of a commercially run insurance scheme.

Another alternative approach would be to rely on food aid assistance to compensate farmers for DL damage. WFP estimate current costs of providing food aid to a drought victim family at Nk3,060 per annum, and for participants in a FFW programme at Nk4,032 (WFP, 2002). This compares to a minimum wage of Nk5,400, and to an estimated crop loss from locust damage of Nk 2,776 (as reported in Belhaj's survey). It is difficult to compare the costs of such a programme to the costs of DLC, because of the problem of quantifying the number of families who would be affected by an uncontrolled locust invasion. In any case, there are concerns about an

increase in dependency in Eritrea that would make such an approach politically unacceptable.

5 Conclusions

Poor farming households in the arid and semi-arid areas of both Mauritania and Eritrea face considerable problems in making a living from farming. In many cases, crop production is a secondary activity to animal husbandry. The greatest threat they face is from drought. In Mauritania this has led to major population movements from rural to urban areas over the last few decades. In Eritrea it has led to massive dependence on food aid over the last few years.

Most of the farmers the team met also suffer high pest losses on a regular basis. Desert locust is seen as a different kind of threat. In Mauritania, it is seen as unpredictable and out of any individual's control. There is little interaction with the DLC programme. In Eritrea, there is a much greater feeling of mutual responsibilities – farmers for monitoring and information and government for control. Recent years of DLC have reduced the number of farmers with direct experience of DL invasions, but those who have lived through an invasion remember it as a catastrophe. Nonetheless, farmers are unanimous in preferring a year with good rain and locusts to a drought year.

The farmers interviewed in Mauritania had developed much more self-insurance in terms of income diversification and links with the urban sector, largely as a result of their experience with drought. It was not clear what the Eritrean farmers would do in the event of a locust invasion if there were no food aid. Probably they too would have to consider moving to the towns.

For these farmers in semi-arid and arid zones, in both countries but particularly in Eritrea, a major locust invasion, as a result of reduction of DLC activities, would be a severe shock to their livelihoods which they have very limited resources, if any, to withstand.

At the national level, in both countries, the economic returns to DLC are probably marginal if not negative. The value of crop production in these countries is not sufficiently high to justify significant expenditures on crop protection for economic reasons. It would probably be possible to develop a scenario whereby in the medium term, an economically more attractive approach for national governments would consist of commercial crop insurance protection for larger farmers and introduction of a state financed safety net, probably in the form of food aid or public works, for the types of farmers that are the focus of this study. In effect, this would privatise part of the cost of crop protection and reduce the charge on the public purse²⁴. It is not a scenario that is currently realistic, given the present state of development of the insurance market in most LDCs. Reliance on safety net programmes also carries the risk of failing to protect the more vulnerable farmers, given the difficulties of achieving effective targeting. Dependence on food aid programmes would be seen by many governments as politically unacceptable. The social impact of DLC must be

²⁴ Though not necessarily on government finances, as some proportion of DLC is funded by donors.

taken into account. However, it is currently difficult to assess for either country in this study how many poor households should be regarded as at risk from desert locust.

Looking at the social and economic benefits from DLC at the national level is, in any case, not the most appropriate question to pose. DLC has strong externalities. DLC in one country is made much more difficult if there is no DLC in neighbouring countries, particularly if they contain important breeding grounds. It makes sense to analyse the system at a global level, as Joffe did in economic terms (1997). This analysis could be modified to include information on social costs or risks to livelihoods. The problem here is that there is little information that allows this kind of social analysis to be undertaken. How many marginal farmers in the region are at risk from a DL invasion? What kinds of damage have they incurred in the past?

Up until now, both DLC systems and the recent analysis have been focussed on crop losses. To address these questions at a regional level, national monitoring and control systems would have to shift emphasis towards the people they are trying to protect, rather than the present systems which tend to focus almost entirely on locusts, and then, in a secondary manner, on agricultural crops. One possible way to improve information on households at risk would be to develop closer links between DL organisations and food security monitoring, especially in countries where a vulnerability mapping approach has been adopted.

One final observation on the fieldwork is that in semi-arid and arid zones, livestock is an important element in households' livelihoods strategies. There appears to have been very little work on the impact of desert locust on livestock systems. Farmers told the team that grazing could be badly affected and that this could have a very negative impact, particularly for sheep and cattle. A better understanding of this would assist in the assessment of vulnerability.

6 DFID Further Support for Locust Control Technology?

One of the purposes of this study was to provide the basis for advice to DFID on whether further support for the development and transfer of technologies for locust control is justified. In reality, the study has done more to clarify the questions underlying this decision than to answer them. The following points can, however, be made.

- It is much easier to justify support to DLC on a combination of social and economic factors than on economic factors alone. The fieldwork shows that there are significant sections of population in the two countries who are vulnerable to DL threat and have few resources to insure against this, either in financial terms, or on the basis of self insurance.
- DLC has strong elements of an international or regional public good. If it is being provided as a service/ security measure to vulnerable poor people it will be provided to all, including those who could afford to, and are willing to pay for it.

- To better assess whether DLC is a cost-effective way of assisting poor vulnerable populations, it is necessary to have much better information on the size of those populations, and how much they are at risk of losing. Currently the information on this is very limited.
- Support to international public goods can be provided at a number of levels. In particular, donor countries can provide support at international level, for example the development of coordination frameworks and technologies, and at national level to assist in actual delivery of DLC. There is clear need for support at both levels and effective DLC is dependent on both.
- Over the past few years DFID has provided support to DLC at the international level, financing UK representation in international DL fora and funding the development of the RAMSES system of electronic data recording and analysis. It seemed to the study team that RAMSES was too sophisticated for the capacity available in Eritrea, and that, in any case, it was a very technocratic approach that focussed on locusts, rather than the people affected by them. In other words, it responded to a perception of DLC as a scientific problem, not a social one.
- This is not to say that, in countries where there is capacity to utilise RAMSES, and implement a process of preventive action based in part on its findings, that the result may not be an effective way of assisting marginal farmers. However, in the absence of any information on the at risk population, there is no way of assessing this.
- The study team would recommend that DFID look at ways of linking existing locust-focussed databases, such as RAMSES, with ongoing socio-economic work on vulnerable groups, such as food security vulnerability assessments. Then it would be possible to assess the threat of DL in context, along with the other threats that marginal farmers face, and thus better evaluate the appropriate level of resources to devote to this problem.

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ANNEXE 1

FIELD TRIP ITINERARIES AND PERSONS MET

Mauritania, November 28th – December 7th, 2001

Field work in Tagant, November 29th – December 3rd, in Bidonville Kebba (slums in Nouakchott), December 5th and in Lehrath (maraichage a Nouakchott), small farmers, December 7th.

PERSONS MET

Mohamed Abdallahi Ould Babah, Chef, Centre De Lutte Antiacridienne De Mauritanie (CLAA)

Bob Aston, Chief Technical Advisor, Desert Locust Control Project, FAO.

Bouh ol Sid' Ahmed, Directeur General, Union Nationale des Cooperatives Agricoles de Credit et d'Epargne de Mauritanie.

Regional Officer, MDRE, Moudjeria.

Ely El Hadj, Directeur, (Commissariat aux Droits de l'Homme, à la Lutte contre la Pauvreté at à l'Insertion (CHDLCPI))

Directeur, Integrated Development Programme of Irrigated Agriculture in Mauritania (PDIAM)

Head of Agriculture Division, Ministère du Developpement Rural et de l'Environnement

Michel del la Taille, Resident Representative, UNDP, Mauritania

Mohameden Ould Zein, Directeur de l'Observatoire Securite Alimentaire

Directeur, Programme de Gestion des Ressources Naturelles en zones pluviales (PGRNP).

British Counsel Representative, Nouakchott.

Centre Culturel Francais: Directeur, Nouakchott.

Secretariat d'etat a la condition feminine: Directrice de la Promotion Feminine, Nouakchott.

Directeur, OXFAM

Economist, PNUD

Programme Officer, UNICEF

Eritrea, January 21st – January 30th, 2002

Thursday 24th– Sunday 27th Jan

Field Work in Northern Red Sea Coast Zoba

Tuesday 29th – Wednesday 30th Jan

Field Work in Debub Zoba

PERSONS MET

Bereke Ogbamichael, Head, Plant Protection & Quarantine Unit / MoA

Kidane Gebrekidan, Plant Protection and Quarantine Unit, MoA

Heuston Dagg, Resident Representative, FAO, Asmara.

Teleab Misgina, Director General, Department of Environment, Ministry of Land, Water and Environment,

Mr Roso, Assistant Commissioner, Eritrean Relief and Refugee Commission
Amare Beyene, Base Manager, Eritrea Office, Desert Locust Control Organisation,
Eastern Africa.
Asmeron Kidane, Assistant General Director, Department of Research, Plant
Protection Department, Ministry of Agriculture.
Firhouz Sobhani, Senior Deputy Resident Representative, UNDP
Jeffrey Allen, Catherine Bensperg, USAID.
Patrick Buckley, Representative and Country Director; Mamadou Mbaye, Deputy
Country Director; Jacob Kern, Emergency Coordinator, WFP.
Solomon Haile, Head, Planning Division, MoA
Yemene Tekleyohannis, Head, EWS, MoA
Tekle, Programme Officer, Norwegian Church Aid
Country Director and Programme Officer, Refugee Trust Eritrea
Warwick Thomson, Chief Technical Advisor, Agriculture Sector Support Programme,
Ministry of Agriculture
Gimga Amare, Home Economics Unit, Ministry of Agriculture.
Head of Northern Red Sea Zoba (Massawa)
Head of Dehub Zoba
Plant Protection officers in Foro, Shieb, Afabet, Dehub, Areza and Dekemal sub-
Zobas.

ANNEXE II **TERMS OF REFERENCE**

Assessment of the Socio-Economic Impact of Desert Locusts and their Control Background

It has long been believed that attacks by desert locusts have a serious negative impact upon agricultural production, and consequently upon the livelihoods of the rural population and the national economies of those countries affected. However, more recently questions have been raised concerning both the real extent of that damage and the significance of this pest as a hazard to the livelihoods of poor farmers, in comparison with other hazards. The effectiveness of the current preventative control strategy has also been questioned, especially in view of its cost both to the affected countries and to the international community.

DFID has provided funding for desert locust control for some years, most recently through ASSC support to the FAO's EMPRES programme. A recent review of selected ASSC-funded activities concluded that there is insufficient understanding of the social, economic and institutional issues in desert locust control. Moreover, lack of understanding of the livelihoods of poor farmers in affected areas makes it very difficult to assess the impact of locusts or other pests, or of control strategies, on the well-being and food security of the intended beneficiaries.

Purpose of the Study

To assess the socio-economic impact of desert locusts and their control on the livelihoods of poor farmers living in marginal areas; and
Based on this analysis, to advise DFID on the justification for further support for the development and transfer of technologies for locust control.

Activities

The consultants will:

1. review briefly what is known about the extent and economic cost of crop losses to desert locusts, and the cost of locust control;
2. review briefly recent and current work on this topic by Joffe, Krall, Belhaj, the University of Hannover, Bezabih, and others;
3. conduct fieldwork in areas where farmers live on marginal land in two countries (possibly Mauritania plus Eritrea or Sudan) to investigate farmers' own views of the threat posed by locusts and other hazards to their livelihoods.
4. attempt to quantify (as far as possible) the economic losses caused at the micro level (e.g. to households in these countries);
5. establish what (if any) mitigating, coping, control and/or preventative strategies are undertaken by government or by farmers themselves against locust attacks;
6. quantify costs of these strategies as far as possible, including at national level;
7. assess any other social, health or environmental aspects of locusts and how they impact on poor farmers.
8. review current knowledge of government interventions to compensate for locust attacks (e.g. insurance schemes).

Fieldwork

Fieldwork should be carried out among communities near to locust breeding areas (it is likely that poorer farmers will be working these marginal lands).

Mauritania or Sudan are suggested because they have had RAMSES technology installed and both also have effective locust control teams who would be able to advise on suitable locations. Moreover it is believed that relatively good data are available in these countries. However, if access and movement within Eritrea are possible, this may be chosen if it is felt that FAO-funded work in Sudan would be duplicated. The Red Sea coastal plain near Suakin (in Sudan) or north of Massawa (in Eritrea) would be appropriate as a winter breeding area, while in Mauritania the summer breeding area in the Aioun region is a possibility.

Timing: fieldwork in Mauritania should be conducted in September-November, and in Sudan (or Eritrea) in November-January to coincide with the main locust breeding periods in the selected field sites and the times when locust survey teams would be normally in the field.

Field analysis should be both qualitative and quantitative, providing explanation of social and economic phenomena as well as the statistical data to back up assertions. Participatory Rural Appraisal (PRA) or similar techniques should be used, as well as questionnaires and random sampling.

Team Composition

It is expected that both a social anthropologist/social development specialist and an agricultural economist may be needed to complete this task satisfactorily. The team should consult at an early stage with the DFID locust co-ordinator.

Duration

The two team members should work concurrently. A maximum of 30 working days each is allowed. Limited funding will also be available to pay for field assistants in the study locations.

Reporting

A draft report in English should be presented to the Head of DFID/RLD and the ASSC Manager by the end of February 2002. Comments will then be incorporated into a final version within one month. Following DFID/ASSC approval, the results of the study will also be presented as a contribution to FAO/ EMPRES and disseminated in appropriate journals/ technical publications.