

Water
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Returning Thirsty:

Water, Livelihoods and Returnees in the
Gash-Barka Region, Eritrea

Gaim Kibreab and Alan Nicol
with Seife Berhe and Yemane Zekarias

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Cover photograph: watering point at private well in Goluj town (A. Nicol, January 2001).

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Acronyms and abbreviations

CERA	Commission for Eritrean Refugees
CPRs	Common Property Resources
DHA	Department of Humanitarian Affairs
EAE	Eritrean Agency for the Environment
ECDF	Eritrean Community Development Fund
EIA	Environmental Impact Assessment
EPLF	Eritrean Peoples Liberation Front
ERA	Eritrean Relief Association
ERREC	Eritrean Rehabilitation and Refugee Commission
EVDSA	Ethiopian Valleys Development Studies Authority
EU	European Union
GREDMCO	Global Resources Consulting Company
hh	Household
IDPs	Internally-Displaced Persons
MLWE	Ministry of Land, Water Resources and the Environment
MOA	Ministry of Agriculture
MOH	Ministry of Health
MOLG	Ministry of Local Government
NFIS	National Food Information System
NGO	Non-Governmental Organisation
PROFERI	Programme for Refugee Reintegration and Rehabilitation of Resettlement Areas in Eritrea
SEIA	Social and Environmental Impact Assessment
SL	Sustainable Livelihoods
SWL	Static Water Level
UNDP	United Nations Development Programme
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
WHO	World Health Organisation
WRD	Water Resources Department

Executive Summary

Conflict in the Horn of Africa has caused massive displacement and loss of livelihoods for hundreds of thousands of people. Displacement and loss remain to this day unfortunate features of the social and political landscape. Eritrea has suffered greatly in this respect, particularly during the 30 years of war against Ethiopian occupation. The resulting Diaspora population exceeded at its height half a million, many of whom ended up in neighbouring Sudan. Recently many thousands more were internally displaced during the border war with Ethiopia.

Nevertheless, with the de facto independence of Eritrea in 1991 (formalised after the referendum in 1993), thousands began to return from Sudan and other countries, both under their own effort and as part of formalised programmes. Many thousands of those returnees from Sudan began to resettle in the Gash-Barka region of Eritrea, an area characterised by low population density, relative availability of agricultural land, and access to other renewable natural resources, including building materials and wood fuel. It remains, however, an area with exceptionally few perennial water sources and little understanding of the groundwater potential. As people began to self-settle and join governmental-sponsored reintegration sites, the government established a rapid borehole-drilling programme to provide water to the newly resettled population. This programme both encouraged further population resettlement and the establishment of larger livestock populations in the area.

This study grew from the realisation that increasingly intensive resource exploitation, coupled with relatively sparse data on the nature and extent of the renewable natural resource base, could spell problems for the future sustainability of livelihoods in the region, both for returnees and for the stayee population. The central argument of the study is that in order to ensure effective resettlement, exploitation of water supplies – as well as the surrounding natural environment – has to be sustainable. Integrating returnee populations into relatively under-utilised resource areas, therefore requires a more holistic approach to managing resources and resettlement based on a thorough understanding of local livelihoods activities, and the interactions of these activities with the resource base and local and national institutions.

In order to analyse the relationship between water supply and the return process, the study examined nine communities in Gash-Barka, using rapid field appraisal techniques and analysis of existing secondary sources. Methods used to assess the pre-return and post-return situation included key informant and group interviews combined with a structured survey of 156 households across a range of communities, including returnee resettlement, stayee only, and communities where there was a mix of the two.

The key conclusions of the study are that:

- so far there are few problems of returnee reintegration with host communities based on difficulty in gaining access to renewable natural resources;
- the rapid development of boreholes in Gash-Barka has nonetheless had a significant impact on the types of water supplies being used by all communities, encouraging a significant shift away from traditional sources;
- many of the high-yielding boreholes have contributed to rapidly increasing livestock numbers in the region, which has caused significant change in the surrounding natural environment;
- without an effective policy and strategy to organise community management of boreholes, including a proper assessment of their ability to cope with future breakdowns, it is apparent that communities may resort to traditional sources in the event of significant borehole failures;
- a shift back to traditional sources will have immediate impact, given the pattern of livelihoods activities now established in communities that rely on motorised boreholes;
- future resource availability may also be uncertain given anecdotal evidence that aquifer levels in parts of Gash-Barka are falling;
- population increase and related demand for domestic fuel sources has led to rapidly deteriorating wood fuel reserves around some communities, causing scarcity and price increases with significant impact on some households;
- the development of markets for resources such as thatch, wood fuel and building materials has enabled households with animal transport to benefit (both as collectors and sellers); however those without transport and the capacity to purchase, have had to resort to coping mechanisms including significant reduction in use of some key resources;
- for the poor (returnees and stayees) both the rising costs associated with access to resources (in time and money) and emerging issues over future resource availability could prove detrimental to their livelihood security.

The study recommends that :

- resettlement of returnees is accompanied by an increased understanding of current and future livelihood activities, the likely demands these activities will have on water supplies and the capacity of aquifers to support increased abstraction in the long term;
- the siting of water supplies should take careful consideration of the impact increases in motorised boreholes and human and livestock numbers will have on surrounding natural resources; planning future land-use around pre-existing settlements and resettlement areas is therefore essential;
- local knowledge to assist in the siting of water supplies, and choice of technology, should become integral to programme development, both to reduce the cost of expensive drilling failures and to enhance the sense of community ownership (without creating a sense of ownership through effective participation and awareness-raising, communities will remain unable or unwilling to undertake maintenance and management activities);
- a key aspect of participation requires involving women as

the main water users and collectors;

- a regional-level water forum to co-ordinate institutions involved in the sector and to encourage links between civil society, the private sector and the government would facilitate bottom-up governance of resource management, responding more effectively to community demand and enabling greater user-participation in decision-making.

Actions to be taken:

- undertake a full hydrogeological survey of Gash-Barka that should combine analysis of recharge activities, resource needs and development opportunities;
- assess water supply requirements of future returnees based on sustainable livelihoods analysis;
- adopt a strategic planning framework that systematically approaches the complexity of returnee resettlement and water-supply development in Gash-Barka and similar areas.

A planning Framework:

The strategic planning framework proposed (see page 10) outlines key elements of planning effective water supply interventions where there is major resettlement.

1-2 Assessing the livelihood activities of returnees and stayees

Agencies and government should develop in depth an understanding of existing and future livelihood activities and their demands for water. This should be within the context of a sustainable livelihoods approach, including issues like human and social capital availability. Such an understanding will help to reveal the complexities of poverty and vulnerability facing returnees and stayees, leading to actions that address – and support – a full range of household assets, capabilities and livelihoods strategies. This assessment stage should also cover the relative impact of policy and institutional environments on development activities, including the likely impact on particular livelihoods strategies by, say, increases in veterinary provision in a particular area and changes to ownership relations over resources.

3-4 Anticipated water demand by activity

The water requirements of different livelihood activities should be assessed based on water consumption by animals and people, capacity for water re-use, the demand on water supplies by other livelihood activities and access to different types of source. The seasonal water needs of each of these activities should be factored in to help build up a picture of anticipated demand for the resource by different household types throughout the year. Aggregate levels of demand for settlements, sub-regions and the region as a whole can then be estimated and used to help in planning future interventions.

5-7 Knowledge of resource base behaviour

The structure of demand for water (i.e. by activity, by season and according to year) should be accompanied by a clear analysis of the resource base. This will include estimates of safe aquifer yields, the known and anticipated behaviour of groundwater levels by season, long-term trends in aquifer levels based on local knowledge, and the behaviour of surface run-off. There should also be a thorough inventory of existing water points, and their actual and estimated yield by season.

8-11 Supply management problems

Assessment of supply structures should be complemented by a full understanding of the institutions governing their maintenance and management, problems to date that have been encountered by the institutions and actions taken to mitigate these problems. Of key importance will be the assessment of cost and the financing capacity of institutions that are responsible for management. For instance, if this is largely the community's responsibility then how far is there a sense of ownership and an ability and willingness to pay a monthly fee and/or a volumetric tariff? Clearly issues at this level will be closely related to participation by the community through inception and implementation, to monitoring and evaluation phases.

12-14 Demand management problems

An assessment of stress placed on particular water points should be undertaken to understand the origin of problems encountered – for instance, were they a result of overuse or misuse? If the latter what are the difficulties in enforcing rules governing access? How has the management of demand for water been undertaken and what kinds of sanctions against (mis)users have been applied? What are the key inter-sectoral demands and how have these been managed, if at all? This kind of analysis will be essential to feed back into planning and future management processes. It will also help inform wider policy making.

15-17 Development of decision support frameworks, early warning systems and resource-use scenarios

With the above analysis, decision support frameworks can be created for use at national, regional and sub-regional levels. These frameworks could undertake the following:

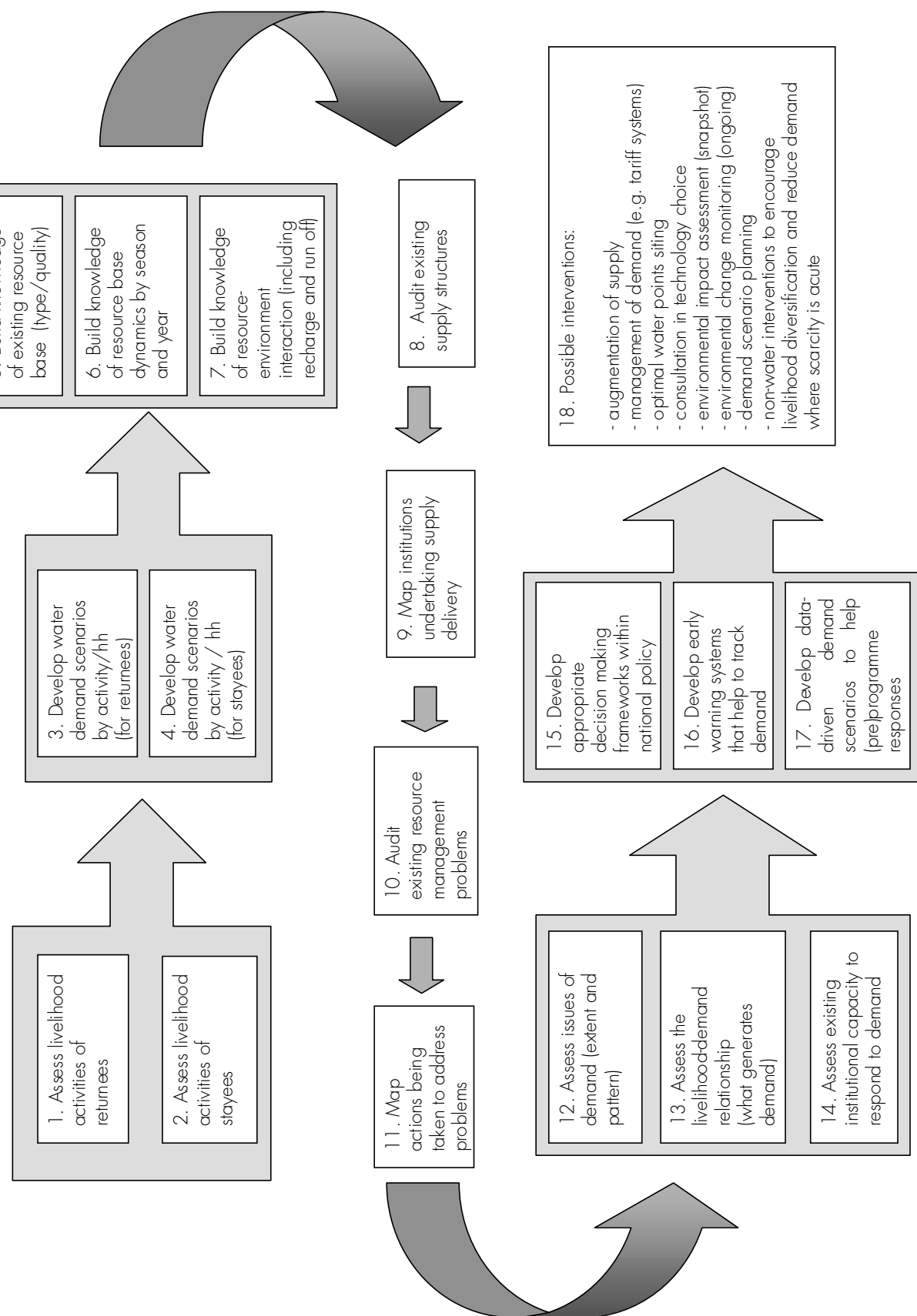
- establish the separation of responsibilities between agencies including financial, administrative and legal aspects in order to identify clear lines of responsibility and encourage accountability;
- analyse and define the current property rights regime(s) in the area, including defining the terms of entry by outsiders and the powers (customary and formal) to exclude users, if need be;
- based on knowledge of the resource base and property rights regimes, undertake land-use planning studies to enable policy makers to identify sites that are resilient or sensitive;
- develop legislative tools to help in defining local jurisdictions over resources, and to resolve conflicts arising out of resource use;
- establish population projections for particular sites, the water supply capacity at those sites and the likely availability of other environmental resources;
- create social and economic incentive structures to encourage resettlement away from highly water-stressed areas;
- build effective and transparent criteria for spacing of water points, based on planned future ground and surface water development according to anticipated settlement patterns, and areas of potential pressure on resources;
- conduct EIA in potential areas of critical resource degradation, establishing sensitivity indicators for use across the region;
- encourage planning through inter-institutional

- communication and information sharing;
- early warning based on reports from water user associations of groundwater behaviour and, specifically, inter-annual depth of the water table should complement supply-led approaches;
- data sets collated at a regional level can help to determine serious areas of depletion and allow the targeting of activities to ameliorate anticipated impacts. Early warning will need to be combined with future resource-use scenarios based on low, medium and high-level use, on which long-term planning of water supply development (or the need to find alternative settlement sites) can be based.

18 *Actions to mitigate negative impacts and promote sustainable management and use*

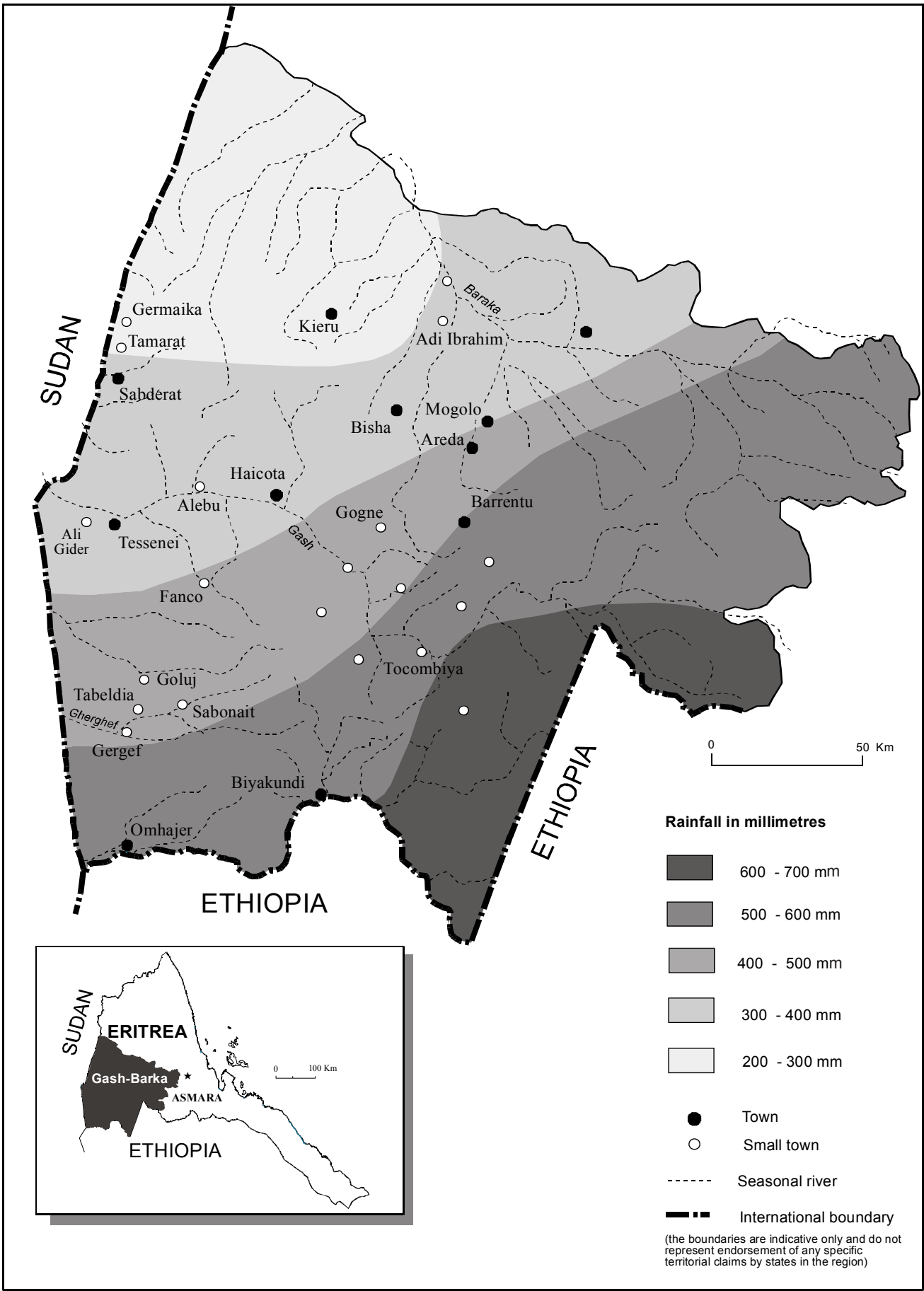
It is argued in this study that the impacts of unplanned water supply development in a fragile environment can lead to many associated socio-environmental problems. Actions to ensure that water supplies are available to resettled populations must take account of the capacity of a resource base to provide for the anticipated demand for water over a longer period. Where the resource base is fragile, demand management is essential. In addition, understanding the complexity of livelihoods strategies adopted by households will help in identifying the most appropriate sites for supply development, based on factors including availability of other environmental resources and access to markets. Monitoring impact on the environment as well as encouraging livelihoods diversification away from activities with a detrimental impact (for instance charcoal production) would then be necessary. Actions such as these are demanded by the circumstances of returnee resettlement, but will only be possible if undertaken on the basis of an understanding of social and economic demand for water and a more in-depth knowledge of the natural resource base.

Returnee resettlement: strategic resource planning framework

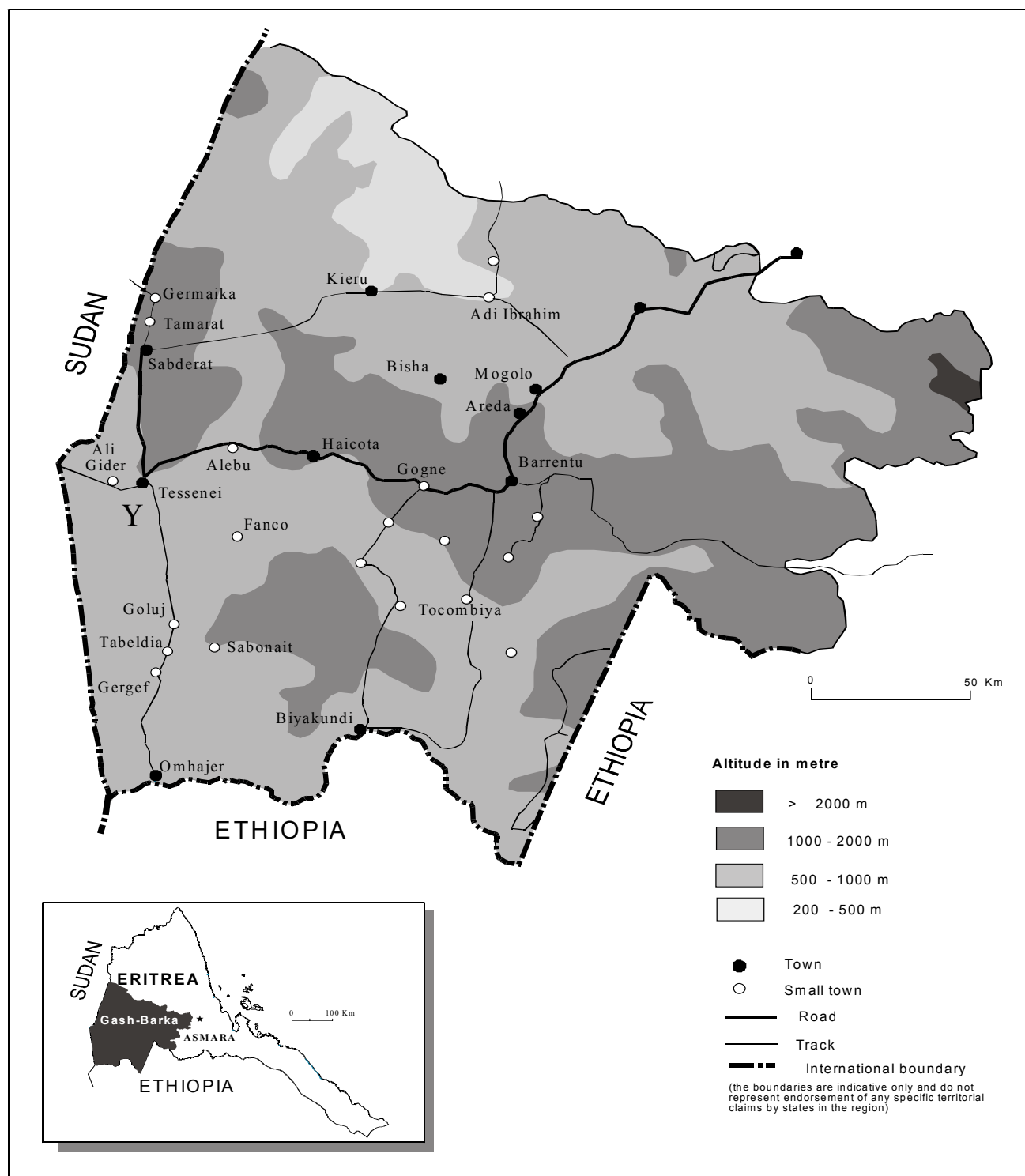


Maps of the study area

Map 1: Gash-Barka – Rainfall



Map 2: Gash-Barka – Topography



I. Introduction

Context to the return process

Involuntary displacement of populations is frequently the result of a complex interplay of political, ecological, social and economic factors. In the Horn of Africa the most common cause has been conflict within states, often spilling over to neighbouring states. In mid-1991, at the end of the Eritrean war of independence, there were 95,000 Eritrean ex-combatants¹, 100,000 internally displaced persons (IDPs) and nearly 400,000 Eritrean refugees, mainly in Sudan. Of the latter about 200,000 have subsequently returned. Some 25,000 were assisted by the Eritrean government and the UNHCR to return and resettle in their country of origin whilst the rest organised their own return without external assistance (Kibreab, 2002a). From mid-1998 to the end of 2000, the border conflict between Eritrea and Ethiopia, generated another 700,000 internally displaced people in Eritrea alone. The majority have now returned to their areas of origin. About 63,000 Eritreans resident in Ethiopia and Ethiopian citizens of Eritrean origin were also deported from all parts of Ethiopia.

Eritrea's total land area of 123,500 sq. km accommodates a population of 3.6 million of which about 80 percent live in rural areas. With US\$313 annual income per capita, Eritrea is one of the poorest countries in the world. After exhibiting a remarkably high growth rate of 8 percent between 1992 and 1997, the economy shrunk by almost a half in 1998, *inter alia*, due to the impact of the border war with Ethiopia. Agriculture absorbs the bulk of the labour force and is by far the most important economic activity. A bumper national harvest

recorded in 1998 resulted from favourable weather conditions, government success in consolidating land holdings, and improved timeliness of planting made possible by improved use of agricultural machinery. However, harvest failure can have an enormous impact on national food security and long-term livelihood security at a local level.

A key concern of this study is that large-scale return in the context of natural resource vulnerability may lead to significant poverty impacts including through diminishing agricultural productivity. Initial discussions with government officials, consultants and local resource users suggest that in some areas, the renewable resources are coming under heavy pressure. In the absence of remedial measures, this may lead to lower productive capability of the basic resources on which the majority of people depend.

One of the contributory factors has been insecurity, which in the past caused a heavy concentration of people and livestock in 'safer' areas. This concentration led to forest clearance for cultivation, firewood, construction materials and charcoal production (e.g. around Ali Gider in the study area). Livestock concentrations in these areas also increased pressure on rangeland resources where grazing had previously been based on the mobility of people and livestock. This strategy was tailored to take advantage of variations in the environment and was key to sustainable resource use and effective survival strategies (Kibreab, 1997, 2002c). A substantial change to this pattern of land use has been caused, in part, by the development of new water sources to help in the resettlement of returnees from Sudan. Other factors include the resort to

Box 1: PROFERI (Programme for Refugee Reintegration and Rehabilitation of Resettlement Areas in Eritrea)

After a comprehensive government/donor joint planning endeavour led by the United Nations Department of Humanitarian Affairs (DHA) and the Commission for Eritrea Refugee Affairs (CERA) now Eritrean Rehabilitation and Refugee Commission (ERREC), an international pledging conference was held in Geneva in July 1993 in which a Programme for Refugee Reintegration and Rehabilitation of Resettlement Areas in Eritrea (PROFERI) was presented. The total budget of the three phases of the programme was \$230 million. The budget for the first phase was estimated at \$111 million. Out of the total budget for the First Phase, only \$32.5 million was pledged. This necessitated a major review of the government's strategy for PROFERI.

In response to the sluggish donor response, a decision was taken to design a pilot programme, which would be the start of Phase I of PROFERI, and to undertake work that would facilitate further mobilisation of resources. Thus, a joint Government/ DHA/ UNDP/ UNHCR mission prepared a detailed plan of operations document for the rehabilitation part. Under the Pilot Project, about 24,000 refugees and about 4,000 households were repatriated from Sudan. Though they were expected to be resettled in nine reintegration sites in Gash-Barka, Sahel and Anseba regions, the large majority chose to resettle in five reintegration sites in the Gash Setit sub-region. Goluj, Fanco, Gergef, Tebeldia and Alebu were the reintegration sites that received the majority of PROFERI returnees. PROFERI returnees were provided with initial inputs to enable them (re-)construct their livelihood in the areas of return. Some of the productive assets and facilities included land, seeds, and tractor service for cultivation, livestock, health care and primary schools. The Pilot Project of PROFERI had nine components – namely, institutions and operations; repatriation and initial relief; food aid; shelter and housing; agriculture, livestock and afforestation; water supply and roads; health, education and evaluation and planning.

After the completion of the Pilot Scheme, it was planned to repatriate 100,000 refugees and to reintegrate them into sustainable communities throughout Eritrea. During the planned second phase nearly 150,000 refugees were expected to return. During the implementation of the Pilot Project, the relations between the Eritrean and the Sudanese governments deteriorated to the extent of breakdown of diplomatic relations. This meant that organised repatriation that required co-operation of the two governments could not take place. In the absence of organised return, over 160,000 refugees organised their own return without any external assistance. The rapprochement of the two governments has now led to the signing of a tripartite agreement and over 65,000 refugees have returned home as a result. It is now hoped that all the remaining returnees will be assisted to return home in safety and dignity provided there is favourable donor response not only for meeting the rehabilitation needs of the returnees but also for creating economic and social capacity of absorption in the areas of return.

more sedentary livelihood activities – e.g. urban service industries².

The majority of returnees from Sudan are self-settled in the Gash-Barka region of the western lowlands for a number of reasons. Firstly, for the minority, whose return was sponsored by the Eritrean government and the UNHCR, the decision concerning choice of location was taken for them. Once households had decided to join the sponsored repatriation, they had to choose one of several different reintegration sites located in Gash-Barka, Southern Red Sea or Anseba Regions. Nearly 80 per cent of those (24,220 individuals) who returned under the PROFERI Pilot Project (see Box 1) subsequently settled in seven government reintegration centres in Gash-Barka – at Fanco, Tebelidia, Gergef, Goluj, Alebu, Ad ibrahim and Tekreret (Kibreab, 1999a, 2002a). However, many of these subsequently left the reintegration sites and self-settled in urban areas, including Om Hager, Tessenei, Goluj, Ali Gider, Telata Asher, and Barentu. The majority who sponsored their own return have also opted to settle in Gash-Barka. Both the government and returnee populations anticipate economic growth in these areas due, *inter alia*, to the relative availability of unoccupied land and higher soil fertility which, over time, is expected to trigger other related economic activities. Gash-Barka is also known to be an area targeted for large-scale mechanised agricultural production, based around the Ali Gider irrigation scheme³.



Cross-border trade. Lorries leaving for Sudan at Germaika.

Another important factor influencing the returnees' choice of destination is proximity to Sudan and the added social capital⁴ this provides (Kibreab, 2002a). Most of the returnees still have household members in Sudan, hence staying in Gash-Barka enables them to maintain dense economic and social contacts, and for those engaged in cross-border trade with Sudan it makes good business sense to be close by. The fact that in border towns returnees constitute up to 80 per cent of the population supports this analysis. A sizeable proportion of those deported by the Ethiopian government in the last few years from rural Tigray have also decided to resettle in Gash-Barka or have been resettled in emergency relief centres in the region, at Adi Keshi (see photo), for example. In short, Gash-Barka has rapidly developed into an epicentre for self-settlement and government settlement schemes.

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In both new settlements and existing settlements water supply is a critical factor affecting livelihood opportunities and, by extension, future population 'draw'. Where there is rapid population growth in an area the sustainable



A camp for IDPs following border war with Ethiopia at Adi Keshi

management of this resource is clearly fundamental to future absorptive capacity. It is also a key determinant in how other surrounding resources are used. This research has focused primarily on domestic water supply given that this is the most immediate and critical concern of returnees and stayees alike. The following quote illustrates the acute water supply problems that face many households in the region, particularly under the recent conditions of insecurity:

Sanitation and water supply is a priority consideration. At the Qatrbir site, [in Gash-Barka] thousands of displaced people must gather water from two hand pumps. Each family, no matter how large, is rationed to 40 litres every three days, barely enough for drinking and cooking requirements. Water is so scarce that women are unable to wash after giving birth⁵.

Household water supply and wider water resources management and environmental issues are closely interconnected. However, applying such an integrated and holistic analysis requires further study of water management in the region. Of immediate concern is the management of long-term aquifer recharge, including the development of water harvesting techniques. Gash-Barka provides much of the firewood and charcoal production for Asmara (which alone receives nearly half its supply from the region) adding acute pressure to the vegetative cover and a further environmental dimension to water management. Many of the environmental, water management and resettlement issues are therefore inevitably closely linked.

The government response to the increasing need to supply water to communities in Gash-Barka, led by the Eritrean Ministry of Land, Water Resources and Environment (MLWE) in collaboration with Ministry of Local Government (MOLG), has been to sink large numbers of additional boreholes wherever geological conditions have allowed. During the 1990s the numbers of boreholes rose steeply, before being affected by the war with Ethiopia. The increased supply of water enabled many communities to overcome problems of water shortage – examined in the next section – but had far-reaching consequences for the micro resource environments around water sources.

Many of the current impacts on the resource environment are related directly to the type of livelihood activities being undertaken. In the 1950s and 1960s, Gash-Barka mainly consisted of pastoralists, agro-pastoralists, and sedentary cultivators. Prior to their displacement, the majority of refugees were pastoralists and agro-pastoralists (Kibreab, 1987). In exile, however, many underwent social and economic transformation which telescoped the process of social change

(Kibreab, 1999b) leading to sedentarisation and more diverse livelihoods activities (Kibreab, 2000b). The consequence of this change on the societies, economies and environment of receiving areas is profound and there is a critical need to document the scenarios that are unfolding, not least by those involved in water policy formulation and implementation. The following section outlines the methodology adopted in the study and indicates the sources of data used.



Children at the Alebu resettlement area.

Photo © A. Nicol

water supply were also included in the interview schedule.

Nine settlement sites inhabited by returnees and stayees, by returnees only and by stayees only were selected (see Map 1 on page 5). The stayee populations were those who remained in their villages during the war. The latter might have been temporarily displaced internally, but just to the surroundings of their villages. Some of these sites were semi-urban rather than being typically rural. The communities selected were Areda (inhabited by returnees only), Ali Gider (inhabited by returnees and a few stayees), Goluj (inhabited by returnees and stayees), Germaika (inhabited by stayees and internally displaced persons), Setimo (inhabited by stayees only)⁶, Alebu (inhabited by returnees only), Gogne (inhabited by stayees and a few returnees) and Engerne (inhabited by stayees only). Information was also gathered from representatives of a village called Sabonait near Goluj.

A total number of 156 sample households were interviewed of which 65 were local residents (stayees), 59 households were returnees from Sudan, 20 were immigrants from other parts of Eritrea, 5 were returnees from elsewhere (not Sudan) and 7 were internally displaced persons.

Methodology and data sources

The project adopted an interdisciplinary approach, with the team combining specialists in refugees and development, hydrogeology, water management and political science. The initial aim of the study was to compare conditions that existed prior to and after the water provision programme in Gash-Barka. This method would have enabled an assessment of the extent of change that had taken place as a result of water provision. However, insufficient written historical data combined with the effect of the border war meant that the memory of people who had survived the changes had to be relied upon instead. Data on conditions prior to the improved water supply, which coincided with the arrival of the large numbers of returnees, were elicited from systematically selected key informants living on the sites prior to, and following, the establishment of watering points.

Questions concerning the extent of change over time were directed to those who had lived in the area before the drilling of new boreholes. These data sources were also supplemented by data generated from in-depth interviews with systematically selected key informants including community leaders, water committee members, government officials, and focus groups of varying ethnic, socio-economic background and sex composition. Group interviews were also conducted in the market places. Criteria for selection of key informants were based on age, gender and, as far as possible, members of all ethnic and socio-economic groups who had experienced the changes over time in the area.

A structured survey was used to supplement data collected from key informants and group interviews. Interview schedules were undertaken by Eritrean enumerators with randomly selected individual household members. It was assumed that water use and water collection were gendered (and age specific) among the communities, thus the approach sought to elicit data from men, women and children, where appropriate. Questions which generated information on conditions prior to and after the development of improved

II. Background to the study area

Socio-economic data

Population and livelihoods

The population density of Gash-Barka is relatively low, but with the influx of returnees and IDPs is rapidly increasing. In the mid-1990s the population of the region was estimated to be around 430,000 (out of a national total of some 3.5m). Most are rural inhabitants, but in common with national levels of urban growth of some 5–7 per cent, there is a rapid urbanisation. Nationally, the population growth rate is around 3.5 per cent per annum (EAE, 1995).

Agriculture and livestock are the predominant economic activities. Cropped area per household averages about one hectare, with the major staple crops being sorghum and pearl millet. Sesame and groundnuts are also grown as cash crops. The crop calendar follows the rains. Most crops are planted in June and July, and weeding and cultivation takes place from the end of July to the beginning of September. The two main cash crops are harvested slightly earlier (GREDMCO, 1996).

The most significant constraints on production are vagaries in rainfall patterns, a shortage of traction power and seed, and the presence of crop pests (GREDMCO, 1996). Agricultural extension services provided by the Ministry of Agriculture include crop protection, farmer training and the distribution of inputs.

The most established production system, particularly amongst the Tigre who constitute the major ethnic group in the region, is agropastoralism. This involves short-range transhumance of the family with their small stock, and longer-range movement of non-milking cattle and camel herds to the Gash and Setit river basins (GREDMCO, 1996). One of the key resource management challenges to emerge in recent years is in fact the growing competition between agropastoralists, on the one hand, and expanding commercial farms along the riverbanks, on the other. Loss of access to key dry season resources has been shown in other parts of the Horn of Africa to cause acute vulnerability in drought years, and to change grazing patterns over a wider area (see, for example, Nicol, 2000 on the Awash Valley in Ethiopia). In recent years Shukriya and Beja ethnic groups from Eastern Sudan have also begun returning to grazing areas in Gash-Barka from October to May. Large camel herds were seen in the area during the field research.

Administration

Eritrea has adopted a decentralised system of administration comprising nine regions (*zoba*) further divided into sub-regions. The central government is responsible for policy formulation, the development of regulations and other related activities. It is also responsible for developing budgets and supervising the implementation of activities nation-wide, as well as ensuring national data are collected on key

developmental areas and that technical assistance is provided to regional administrators. At the central level the Ministry of Local Government (MOLG) is key in this respect.

Regions have a legislature (*baito*) the representatives to which are voted in at the sub-regional level (30 per cent of seats are reserved for women candidates). Regional government tasks include planning, monitoring, co-ordinating and implementing development programmes, as well as preparing specific regional development programmes, preparing budgets, and collecting local revenues. The MOLG at this level comprises administrators, an executive director and departments covering economic development, trade and industry, social services (under which come refugees and relief activities), and infrastructure affairs (under which comes water supply development). Other offices include police, statistics and public relations. At the Sub-regional (*neus zoba*) level the MOLG has branches covering village and area administration, economic and development affairs, and social affairs. At the local level village councils (*megabaaya*) comprise village members to whom report a number of committees, including water management. The success of such local institutional arrangements in engaging with communities in policy implementation is critical for the long-term sustainability of water supply programmes.

Villages are administered by the village *baito*, an organisation responsible for the socio-economic development of communities, whose members are elected on an annual basis, and comprise an executive group (up to 4 members) and a legislative group (of some 5 members). A village judge is also elected to help mediate and resolve local-level conflicts. Meeting monthly, most *baitos* have subcommittees responsible for development, water and other affairs.

Some key problems with the decentralisation process are important to highlight. In common with many other countries trying to devolve responsibility and deconcentrate authority over development activities, there are few qualified staff available to work at lower levels. With a lack of capacity, existing staff are stretched to their limits and frequently encounter problems in successfully undertaking development activities. In addition, there is also a potential gap between the expectations of devolved government and deconcentrated line ministries on the one hand, and the development expectations of communities on the other. In this study, as will be seen, there are clear demands on government with respect to water supply, but little devolved capacity to meet those demands – particularly in terms of long-term solutions to complex problems of water supply maintenance and management. Furthermore, there is often an expectation amongst government and agencies that the private sector can emerge to meet demand for services. Whilst there is some evidence in this study that water vending (an ‘informal’ private sector) has developed rapidly in some areas – particularly urban centres – this represents profit-seeking in most cases

One of the key resource management challenges to emerge in recent years is the growing competition between agropastoralists, on the one hand, and expanding commercial farms along the riverbanks, on the other.

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rather than service provision; such that the highest bidder⁷ is invariably served before the most needy households.

Water supply development

In the 1990s the Eritrean Government embarked on several major water supply projects that addressed provision to the rural population. A water resources survey undertaken in 1994 by the WRD indicated that only 7 per cent of the Eritrean population had access to safe water and less than one percent, adequate sanitation⁸. In most rural villages, water supplies are commonly over an hour's journey time away, placing a particularly heavy burden on women and girls. Approximately a third of water supply sources are also thought to be dry for part of the year. Combined, these two factors contribute to an exceptionally low rural water consumption ranging between five litres per capita per day in the lowlands to about 10 litres in the highlands⁹.

Pre-1991, and under Ethiopian occupation, water supply projects were limited in scope and largely served the Ethiopian Army. When areas of Gash-Barka were liberated in 1989, the EPLF began drilling boreholes to the west of the region, continuing this activity up to 1993. However, with the prospect of mass return from Sudan, from 1993 to 1995 there was a major effort to develop water supply projects more widely. Under the Programme for Refugee Reintegration and Rehabilitation of Resettlement Areas in Eritrea Programme (PROFERI), led by the Commission for Eritrean Refugee Affairs (CERA), and in collaboration with the WRD, 82 new boreholes were constructed. A further 50 boreholes were built from 1996 to 1997 funded by the EU. The government embarked on additional water supply development following surveys carried out in March 1997 by Wardrop Plc, funded by the World Bank and implemented by the ECDF.

Physical data

Geography

Gash-Barka region is part of the western lowlands of Eritrea, one of three main physiographic regions of the country. It is characterised by an arid climate, with high temperatures, low rainfall and excessive evaporation rates. Topographically, the region can be subdivided into two zones: the mountains to the east and the major plains located to the west and north. The Gash-Barka River marks the boundary between the two and flows northwards into Sudan across a major floodplain. Most of the basin is open shrub-land with the exception of areas close to the rivers, where there is still some riverine forest in spite of the region's rapid deforestation. The *North-western Lowlands Zone* comprises the area north-west of the river, with rolling plains and surrounding hills and mountains. Altitude varies from below 100m to 1,200m. Palm trees as well as scrub acacia trees are mainly concentrated along the river channel. The *South-western Lowlands Zone* comprises the area south of the river (altitude 300–1000m) and receives tropical and relatively abundant summer rains, from June to September. From November to March there is no rain and occasionally rising sand creates poor visibility.

Climate and water resources

Rainfall is usually high intensity and short duration, causing rapid runoff and problems of topsoil loss. On the whole, there is limited rainfall data for the Gash-Barka basin. In general,

annual rainfall ranges from 200 mm in the north to 900 mm in the Setit area, bordering Ethiopia. The two available stations at Nakfa and Akurdet recorded, respectively, average annual rainfall of 506 mm and 377 mm in the period between 1997–98. Average monthly temperatures in Gash-Barka range between 25 to 34°C (GREDMCO, 1996), with maximum temperatures of up to 50°C in the lowland areas.

In most rural villages, water supplies are commonly over an hour's journey time away... Approximately a third of water supply sources are also thought to be dry for part of the year.

The only perennial river in the region is the Setit river (known as the Tekezze in Ethiopia and Atbara in Sudan, where it joins the Nile). This reflects both the high run-off rate and low rainfall. The Setit forms the southern limits and the international border with Ethiopia across the western Tesseneti-Om Hager plain. In Sudan the Setit feeds the Khashm al-Girba reservoir which supplies the New Halfa irrigation scheme¹⁰.

The Gash-Barka is seasonal and flows mainly from August to November, fanning out into an important agricultural delta in Eastern Sudan¹¹. In Eritrea the river feeds the Ali Gider irrigation scheme. Otherwise, natural lakes and water retaining structures (including dams) are rare in Gash-Barka, with the few existing structures associated with the irrigation scheme at Ali Gider.

The only year-round source of fresh water available to the study villages is groundwater, which makes this resource of critical importance to future resettlement. Available information on hydrogeology is limited to old colonial Italian reports which concentrate on gold-mineralised areas, and a few papers produced by the Ethiopian Geological Survey describing geology in parts of the area. The Eritrean Geological Survey has compiled a regional geological map of Eritrea, which was published at a scale of 1:1,000 000 and provides general information on outcrop patterns. However it is preliminary and lacks the level of detail necessary to help in siting water points.

Alluvial deposits (which are largely confined to stream courses) and highly weathered and fractured bedrock constitute the principal groundwater-bearing formations in the area. Groundwater storage and well-yield in the latter type of aquifer can be substantial. However, due to high evaporation rates in the region, recharge from rainfall is thought to be negligible. The only direct groundwater recharge probably occurs along channels and flood plains of seasonal streams, particularly where these consist of thick alluvial deposits and/or intersect linear geological structures. Some aquifers in the area are believed also to receive additional input in the form of subsurface flow (inflow) along regional faults and major fractures that extend to distant recharge areas.

In general, five main types of aquifers can be distinguished in Gash-Barka:

1. *Non-calcareous metamorphic or plutonic rocks.* The groundwater potential of the dense rock is in general low, except when extensively weathered or in fracture zones. Most promising areas are the large faults zones in the Gash-Barka river basin.
2. *Marble.* Due to karstification (predominantly in fault zones) marble creates solution cavities and high water transmissivity and, in general, is a promising aquifer. Typical examples are the marble around the village of Sawa and the occurrence of calcareous rocks around the village of

Gogne, west of Barentu. These marble beds are shown on satellite images as running south-westward towards Om Hager.

widely in the area, then serious water supply problems would inevitably result.

3. *Volcanic deposits.* Basalt could also have high but variable transmissivities thanks to many open cracks and to the existence of ancient paleosoils in between the successive deposits. Typical examples are the Akurdet lava flows which could form good aquifers providing base-flow to the underlying basement rocks. However, some of these lavas (on the way to Goluj and Om-Hager) appear to be at high elevations and form thin flows that are highly unlikely to yield groundwater.
4. *Alluvial deposits.* Because of their inter-granular porosity along rivers these could provide good aquifers. Alluvium along the main rivers offers the greatest potential thanks to the indirect recharge from the rivers themselves; a substantial part of Gash-Barka is covered with alluvial sediments, particularly in the river valleys.
5. *Unconsolidated sediments on top of basement.* These occur as a layer on the basement of the large eastern plains. However it is often too clayey and thin to form a viable aquifer. In fact, the entire western plain, although covered by a thin layer of unconsolidated sediments, should be considered as a basement (mainly granitic cover) aquifer.

Annual average static water levels in the region vary from site to site depending on various geological and hydrological factors. An average value for the study villages is about 10 metres below the ground. There are, however, wide fluctuations in the annual level, mirroring the duration and intensity of wet and dry seasons. A time lag of about 1–2 months seems to exist. This seasonality in groundwater availability has many impacts on communities and water supplies.

The magnitude of this annual fluctuation in most wells of the target villages is in the range of 2–5m. Groundwater data records for the area are too incomplete to allow conclusive identification of long-term trends in water level changes although in one village (Areda) an existing 10-metre deep hand-dug well built in 1945 had recently dried up. According to members of the village water committee, up to 25 years ago the water level in the well used to be so shallow that water could be drawn with a hand-held bucket. Having since undergone a steady decline in water level, the well dried up four years ago and no recovery has been observed even during the wet season. Anecdotally, at least in some areas, there has clearly been a substantial reduction in groundwater storage over the last three decades. Given the rapid populating of the areas this is a potentially serious development¹².

Depletion of aquifer storage is generally a consequence of an increase in groundwater outflow rate (which combines natural discharge and artificial withdrawal of groundwater) and/or a decrease in total groundwater inflow rate (consisting mainly of recharge and any subsurface inflow that may reach the aquifer). There is no indication that water use in the village has increased substantially over the period of observation as would happen in response to rapid population growth or a marked increase in per capita water consumption. Neither is there any hydrogeological evidence to suggest that natural groundwater discharge had increased significantly over the same period. It seems that the observed storage reduction was associated with a decrease in aquifer input rather than with an increase in output. If this scenario were repeated

III. Theoretical framework for analysing impact

In a semi-arid region such as Gash-Barka, access to water is often the key determinant of human settlement and activity. With very few perennial water supplies, ability to access groundwater supplies and/or capture and store surface runoff becomes the only effective means of ensuring year-round provision. The alternative, to adopt livelihood strategies involving movement in response to changes in supply availability, has historically been adopted by groups such as the Tigre agro-pastoralists, but is rapidly being replaced by more sedentary systems.

The following section sets out a theoretical understanding of factors relating to water supplies, livelihoods and the environment. It is informed by sustainable livelihoods analysis (see Box 2) which attempts to understand poverty issues in a holistic manner through exploring the capital assets of households, the ways these assets are brought into different livelihood activities and the impact of mediating policies and institutions.

Livelihood impact and water supply

Enabling production

Water supply in a semi-arid area such as Gash-Barka provides the basic water requirement for humans (and animals), enabling productive activities to be undertaken. Changes in

the availability of water supplies will affect the level and intensity of activities. All communities will require a base level of water for survival, and in many contexts this need is regarded as a right – to bar someone from drinking water is regarded as morally wrong. This strong emphasis on open access has a number of management implications that are dealt with in more detail later on.

Enabling absorption

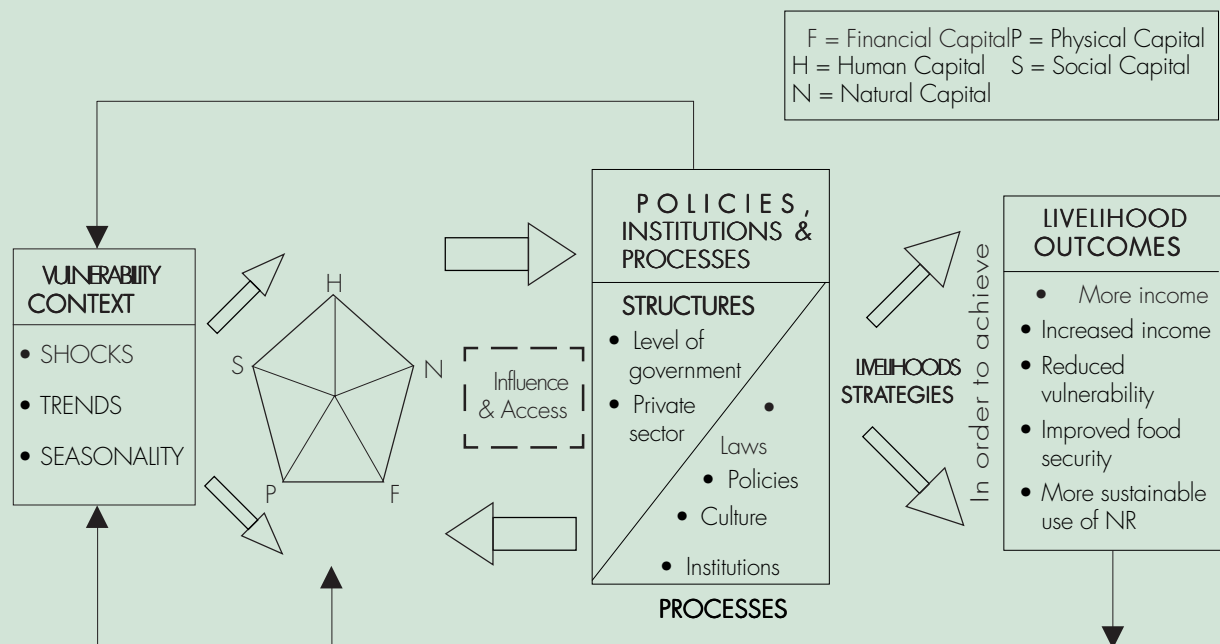
Increased water provision above the necessary survival level for existing communities provides additional water that can encourage greater social and economic absorption. This can facilitate the relocation of populations from overcrowded or natural disaster-afflicted areas, or the settlement of internally displaced populations or returnees. Where additional access points are not provided, there will naturally be a tendency for additional populations to join pre-existing settlements.

Enabling expansion and intensification

Specific livelihood activities assisted through improving water supplies are numerous, but in an area where agro-pastoralism is a dominant activity, an overriding impact may be to facilitate the expansion of grazing and browsing into areas previously considered too remote from water supplies¹³. The extent to which livestock can access these resources is dependent on

Box 2: The Sustainable Livelihoods Framework

'The livelihoods framework is not intended to depict reality in any specific setting. It is rather, intended as an analytical structure for coming to grips with the complexity of livelihoods, understanding influences on poverty and identifying where interventions can best be made. The assumption is that people pursue a range of livelihood outcomes (health, income, reduced vulnerability, etc.) by drawing on a range of assets to pursue a variety of activities. The activities they adopt and the way they reinvest in assetbuilding are driven in part by their own preferences and priorities. However they are influenced by the types of vulnerability, including shocks, overall trends and seasonal variations. Options are also determined by the structures and processes which people face. The framework identifies five types of capital assets which people can build up and/or draw upon: human, natural, financial, social and physical'. (Farrington et. al., 1999)



the resilience to thirst of particular types of animal¹⁴. Data from Eastern Sudan suggest that in normal years camels can graze 30 miles, sheep and goats 15 miles, and cattle 12 miles from a watering point in all directions (Kibreab, 2002b). The frequency of watering is also dependent on the specific geographical location and climatic conditions, for instance being more frequent in low rainfall woodland savannah. In the semi-desert areas of western Sudan, camels can go without water for 10–11 days, sheep and goats for 5–7 days and cattle for 2–3 days. In the semi-desert areas of eastern Sudan (which have similar ecological conditions to the Gash-Barka region in Eritrea) the figures are for camels, 4–7 days, for sheep and goats, 3–4 days and for cattle, 2–3 days. Cattle, being most sensitive to thirst, need to be watered every 2–3 days regardless of climatic conditions¹⁵ (Harrison, 1955).

The significance of the variations in water requirements between different animals is in decisions regarding resource allocation by livestock owners, and in the siting of water points. Traditional resource management systems of Eritrean pastoral and agro-pastoral groups allocated animal species depending on their water tolerance. It was common among the nomadic communities to divide grazing areas into the remotest zones, remote zones, and intermediate and nearby water zones. The range resources located in the remotest zones from watering points were reserved for a bad year, those in remote zones were exclusively reserved for camels, the intermediate zones for sheep and those nearest to the watering points for cattle. Furthermore, new supplies of water could also allow more intensive land-use practices in areas previously used only for seasonal grazing and browsing. If not accompanied by fertiliser application, fallow periods or the introduction of rotational cropping, continuous grazing and cultivation could ultimately undermine the productive capacity of the land.

Environmental impact

Providing water supplies in previously unserved areas therefore represents a major environmental intervention, adding not just to human settlement capability and the capacity for more intensive cultivation, but also allowing livestock to graze in

previously inaccessible areas. Furthermore, resources that previously were used only during the rainy season and were then left to recover during the dry season, now become exploitable year-round.

Environmental cause and effect is notoriously difficult to confirm and certainly the causal links are neither simple nor linear. The nature of impact cannot be determined *a priori* and factors such as resilience or sensitivity to degradation of different resources, and social and institutional approaches to environmental protection – for instance the social sanction surrounding the protection of particular plant and animal species – need to be taken into account. Water supply developments and

their impact on the environment are no exception. Determining how the type and intensity of land use practices around new water supplies can maximise productivity and minimise long-term resource regeneration demands careful social and environmental impact assessment. The following considerations can assist in determining impact potential and provide a theoretical framework for our analysis.

Provision of improved water supply may lead to increased

Box 3: Common Property Resources

Briefly stated the dominant theory on common property resources (CPRs) states that resources that are subject to common property rights are by their very nature liable to induce exploitative resource use practices. These exploitative practices are said to lead to inevitable depletion of the resources that are owned and/or used in common. The ideal solution is said to be privatisation and if that is not possible, state ownership. There are a number of assumptions and principles underlying this theory.

1. Unless CPRs, including arable land are owned or controlled privately or by the state, their depletion due to over-consumption and under-investment is inevitable.
2. Resources that are subject to common property rights are characterised by absence of property rights or that when such rights exist they are said to be poorly defined.
3. CPRs are conceptualised as open access resources. No distinction is made between open access resources and communal property resources managed sustainably by the commoners.
4. The dominance of individual strategies in the consumption of CPRs preclude cooperating and reaching users of a resource subject to common property rights mutually binding agreements regarding allocation and use of such resources.

There are those who argue that most of these assumptions underlying the theory on CPRs are without empirical foundation. This is because users of common property resources have historically been able to devise and enforce elaborate informal institutional rules to regulate access to and use of CPRs. (For a comprehensive critique of the mainstream theory of the commons see G. Kibreab, *Common Property Institutions, State Intervention and the Environment in Sudan, 1889-1989*. Forthcoming)

human and animal populations around new sources, adding usage pressure to soil, wildlife and vegetation. More intensive use of soils can break down the structure, precipitating erosion, loss of fertility and reduced water retention capacity. Consequences include declining crop yields leading to lower personal income and deterioration in food supplies. This may trigger different household responses, including lower levels of consumption and an increase in off-farm income-generating activities or clearing new land for cultivation. Where this is not possible, rural-rural or rural-urban migration may accelerate. Since the latter is likely to take place in the absence of structural transformation of the economies concerned, the possibility of migrants being absorbed in stagnant urban economies is minimal. The most likely option is for migrants to try a range of livelihoods strategies in the urban informal sector.

Clearance of land for cultivation, tree felling for construction and for charcoal and firewood, and the removal of vegetation through overgrazing and trampling by humans and livestock may also occur, causing daytime air and soil surface temperatures to increase, leading to rising wind speeds, soil structure deterioration, and accelerated erosion (Mann, 1990, Kibreab 1996a). Without surrounding forest products, a good source of supplementary food stuffs for the poor can be lost, many of which are particularly important in drought years¹⁶. Simple tools and other products such as timber poles, pestles, adhesives, agricultural implements, herbal medicines and perfumes similarly become scarcer and more expensive. Prior to their return to Eritrea, returnees in Sudan noted at least 27 separate economic and environmental advantages that were provided by different plant species (Kibreab, 1996a, 1997).

Providing water supplies in previously unserved areas therefore represents a major environmental intervention... Resources that previously were used only during the rainy season and were then left to recover during the dry season, now become exploitable year-round.

Deforestation of indigenous species can also facilitate their replacement by intrusive alien species. In the study area, the growth of *Prosopis juliflora* ('mesquite') was observed. Its rapid colonisation of Gash-Barka is an issue of considerable concern to local people and may well have been precipitated by the reduction in forest cover combined with high tolerance of poor soils and low soil moisture.

Depletion of wildlife resources can also occur where there are no informal or formal institutions of protection¹⁷. Increased human and animal populations around water supplies, particularly in areas that were previously uninhabited due to lack of perennial sources, may lead to the loss of wildlife, further reducing supplementary food supplies, including important sources of protein for the poor.

Land values can increase with the provision of new water supplies. Depending on the nature of land tenure in question, this may lead to increased competition for land possibly causing dispossession of small farmers and pastoralists by more powerful individuals and groups. Before establishment of water points, the area might have been used only as wet season grazing. The introduction of perennial water supplies can assist the transfer to rain-fed cultivation, sometimes leading to the loss of important seasonal pasture resources for livestock herders¹⁸.

Water provision in previously water-scarce areas can therefore lead to many direct and indirect resource management problems. It is important not to make the simple assertion, however, that higher populations encouraged by improved access to water means higher rates of environmental degradation or even increased conflict over resources. The relationship between population density, degree of environmental degradation and conflict potential cannot be determined *a priori*, as some situations allow more labour-intensive soil and water conservation activities that can mitigate environmental impacts. Increases in social capital and organisation may also help prevent greater environmental harm. Some of these positive attributes are examined below.

Potential benefits of water supply development

Where the location and siting of water points is carefully undertaken, with existing livelihood activities and associated land-use arrangements taken into consideration, a number of economic and environmental dividends are possible:

1. Most immediately, the establishment of water points in villages or in nearby sites may significantly reduce the hours each family spends collecting water each day. During peak periods (for instance during the harvest in September) when the opportunity cost of family labour time is high, people are forced to forego considerable personal income because of the need to allocate part of their labour time for water collection. As well as possible contributions to production, easier access may promote greater water use, with health and household production benefits. Collection is invariably a gendered activity, and women and girls may use the time saved for important alternative social and economic activities.
2. Grazing resources:
 - New grazing and browsing resources can relieve pressure on previously overgrazed and over-browsed areas in the vicinity of old watering points, providing an opportunity

for the depleted vegetation to regenerate, leading to gradual resource recovery at a local level (including wood fuel and construction resources).

- Depletion of nutritious and palatable vegetation species and water shortages are the main causes of decline in livestock productivity and the high rates of livestock morbidity and mortality in areas such as Gash-Barka. Expansion of grazing and browsing resources may lead to herd growth, partly due to increased productivity and reduced morbidity and mortality caused by better forage and water provision.
- Milk and other animal products are an essential part of people's nutrition in the region. Increased livestock productivity means better personal income and higher standards of living, as well as allowing for greater diversification of economic activities, and enhanced division of labour, reflected in the development of a market for dairy products.

The rapid colonisation of Gash-Barka by *Prosopis juliflora* may have been precipitated by the reduction in forest cover combined with high tolerance of poor soils and low soil moisture. Social impacts caused by changes in availability of firewood, included the change in sex composition of collectors.

3. The opportunity to bring new areas of cultivable land into the production process may also contribute to increased national and regional food security, with potential benefits at a macro level. These may include increased foreign exchange earnings through production of cotton, coffee and groundnuts.
4. Improved water supplies may also provide an incentive for previously scattered populations to become more sedentary. Whilst sedentarisation is not necessarily better in such an environment, establishment of new settlements provides access to services including schools, health care facilities, veterinary services, markets, extension services, and transportation.
5. Settlement growth near watering points can create a dense web of social interactions and economic transactions building greater social capital. In turn this may provide enhanced livelihood security through developing mutual trust, reciprocity and co-operation. Building of trans-ethnic and trans-religious networks may be assisted, perhaps enhancing prospects for social unity. In many developing societies, intra-group conflicts are frequently caused by lack of dense social interactions and contacts. By narrowing the spatial gap and increasing the social and physical proximity of formerly isolated communities, water provision may bridge differences and reduce divisions.

The policy background to supply development

In the recent history of supply development in Gash-Barka, there has been little coherence within and between initiatives. The principles and assumptions underlying the Eritrean government's policy of rural water supply have not been clearly stated. The information elicited from discussions with officials of MLWE and MOLG in Asmara and Gash-Barka during the fieldwork suggest the following direct and indirect rationales underlying the programme.

One of the goals of the borehole drilling campaign is to provide for domestic consumption. This is seen as an end in itself given the absolute scarcity of drinking water during the

dry season. Furthermore, after Eritrea became an independent state, the government justifiably assumed that Gash-Barka would receive large numbers of returnees from Sudan and therefore demand for water would increase dramatically. It was reasoned that a large influx of returnees could lead to fierce competition over water resources.

Unless water points were established in systematically-selected sites designed to influence the settlement patterns of returnees, the latter, it was reasoned, would join pre-existing villages where not only water, but also land and other renewable resources were either scarce or unavailable. Under

such circumstances, the government assumed that successful reconstruction of livelihoods in areas of return would be impossible. The government was also concerned with the fact that the arrival of large numbers of refugees in pre-existing villages might trigger local resistance to the settlement of returnees, a scenario it was understandably keen to avoid.

The provision of perennial supplies of water, it was assumed, would stimulate economic growth and social development and therefore the economic and social capacity of absorption in Gash-Barka would increase. It was further assumed that these expanding opportunities would positively affect the attitudes of local

residents towards the returnees. Instead of competing for existing meagre resources, returnees would be seen as harbingers of new economic and social benefits (Kibreab, 2002a).

Though not clearly stated, the provision of a perennial water supply would function as a key instrument in the government's unstated, but nevertheless successful, policy of villagisation. Since the mid-1990s, large numbers of nomadic groups previously living in mobile homesteads have been settled permanently in villages, where basic services such as water, education, healthcare and government administration have been provided.

Eritrea's food insecurity is caused by a range of factors including low and erratic rainfall, prolonged conflict and lack of modern inputs such as tractors, combine harvesters, fertilisers and improved seed varieties. One of the main aims of the water provision programme was to facilitate expansion of cultivation, which could contribute to domestic food self-sufficiency and production of cash crops for exports.

One way by which the Eritrean government has tried to counter rural to urban migration (in its view an undesirable development, given concerns that large-scale rural-urban migration might undermine its strategy of food self-sufficiency), has been improving water supply systems in rural areas. It is assumed that better water supplies counteracts rural-urban migration and provides incentives for returnees to settle in rural, rather than urban and peri-urban areas¹⁹.

This framework has indicated how the benefits and potential costs of improved water supply in an area such as Gash-Barka can be closely interrelated. In effect, ensuring that a benefit does not become a cost to livelihoods in the region demands effective management of the return process as well as the natural resource base. Processes of return and water supply development are therefore not just complex and challenging, but extremely politically sensitive. The data requirements and

level of analysis needed are particularly demanding in order to ensure not just that returnees are able to survive in the areas of resettlement, but that the long-term livelihood strategies on which returnees and stayees depend will remain viable and sustainable. Drawing on this framework, the following section sets out the key questions addressed in the study.

Key Research Questions

1. How effective has the government's water provision programme been in serving economic, health and social objectives?
2. To what extent have the planning, design and implementation processes been guided by an awareness of the inter-relationship between improved rural water supply provision, socio-economic change and environmental degradation?
3. To what extent has the planning process and the implementation of water supply programmes been based on consultation with, and the participation of, beneficiaries?
4. Have decisions concerning location of boreholes been governed by systematic criteria designed to influence settlement patterns of returnees and their livestock, in order to avoid human and livestock concentrations around watering points?
5. How effective has the government's water provision programme been in offsetting or avoiding pressure on pre-existing water sources?
6. How has the government been able to use water provision as an instrument for promoting inter-group harmony, particularly between the stayee and returnee populations?

It is important to bear in mind that the limited scope of this study meant that it was not possible to test all the issues raised in the preceding discussions. The focus was on selected variables of immediate policy importance for development in the Gash-Barka region.

Unless water points were established in systematically-selected sites designed to influence the settlement patterns of returnees, the latter, it was reasoned, would join pre-existing villages where not only water, but also land and other renewable resources were either scarce or unavailable.

IV. Findings

Social and Economic Impact of Return in Gash-Barka

The majority of returnees sponsored by the government and self-sponsored have settled in existing towns in Gash-Barka (including Tessenei, Barentu, Agordat and Mensura), or in the new settlements (including Om Hager, Goluj, Ali Gider, Alebu, Gergef, Tebeldia, Fanco, Talata Asher, Areda, and Ad Ibrahim)²⁰. None of these sites would have been habitable without provision of a perennial water supply and most returnees would have joined pre-existing settlements instead.

Before the rapid expansion in water points after 1991 the dry season in Gash-Barka was marked by a shortage of water for human and livestock consumption. It was not uncommon for households and their animals to relocate entirely in their search for water. Not only did this disrupt communities, but it also displaced some of the families' labour force that would otherwise have been used for production and conservation activities. Shortage of water also meant that milking-cows and small stock could not be kept in the villages and, as a result, without access to milk and other dairy products, the nutritional status of families – and particularly children – deteriorated.

According to key informants interviewed, the fact that water was now available throughout the year enabled families to keep milking-cows and small stock nearer to their villages, providing households with access to these important products. Non-livestock owners benefited as well because they could purchase milk and butter from neighbours and relatives, a common practice in the study area. Some key informants also stated that keeping animals in the villages enabled families to earn income from different forms of economic activities, by releasing male labour from livestock herding. Small children or collectively-hired herders may look after the animals whilst their owners trade, engage in wage labour, the maintenance of farms or the construction of houses.

Indirectly, therefore, water provision has increased opportunities for improving household income and nutritional levels through assisting in the diversification of livelihood activities. In addition, there is an important social dividend in that family members are no longer separated during the dry season. Nevertheless, underpinning this

improved livelihood situation are some difficult management and maintenance arrangements, which in the long run may prevent access to water being maintained at its current level.

Impact on Water Supply

Asked to state whether water availability had increased, decreased or remained the same now as compared to 15 years ago, some 70 per cent of respondents stated that supplies had increased in quantity, whereas only 16 per cent said that water was now less available (see Fig. 1). Only 12 per cent thought that water availability had remained the same. Although water quality was reported to have improved, many respondents were more hesitant about their perceptions of cost²¹.

Water provision has increased opportunities for improving household income and nutritional levels through assisting in the diversification of livelihood activities.

Overall, household water use – based on an average size of some five people per household – was unexpectedly high, at around 120 litres a day, or between 20–25 litres per capita. This is considerably higher than average water use in other areas of Eritrea²².

Many of those who felt there had been a decrease in supply attributed this to increased competition with more people and livestock seeking access to the resource. Previously, some argued, surface flows or shallow wells had been sufficient to meet the needs of the relatively sparse population in the region. Key informants, community leaders, water committees and focus groups all supported the fact that water supply and quality had improved substantially in the post-independence period, coinciding with the arrival of large numbers of returnees to the sub-region and the government-led supply programmes.

One of the key changes prompted by this influx was to the source type used by many respondents, as indicated in Table 1. The shift from surface sources, communal and own wells to motorised boreholes, most of which have been drilled by the government and NGOs, has increased the demand for more community management and financial capacity. Those who reported that they had used boreholes before the arrival of returnees were nearly all from areas that had been controlled

Figure 1: Water supply

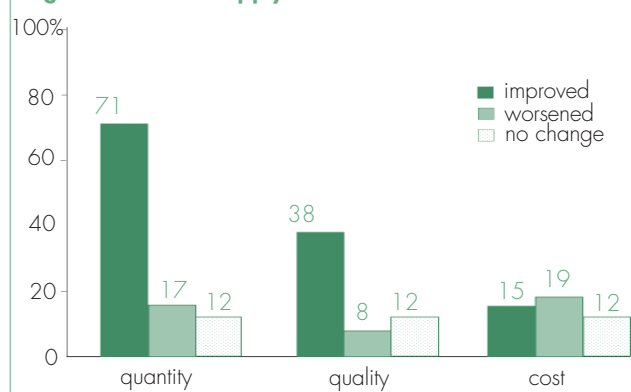
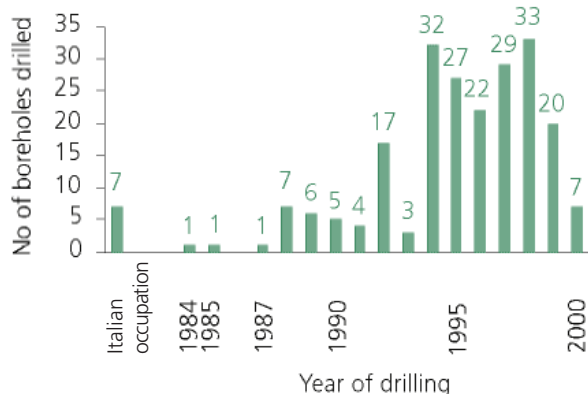


Table 1: Sources of water prior to and after the arrival of returnees (nb of households)

Water source	Before arrival of returnees	After arrival of returnees
Surface water	29	14
Communal wells	57	36
Own wells	21	9
Boreholes	47	122
Small Dams	0	6
Other	0	8

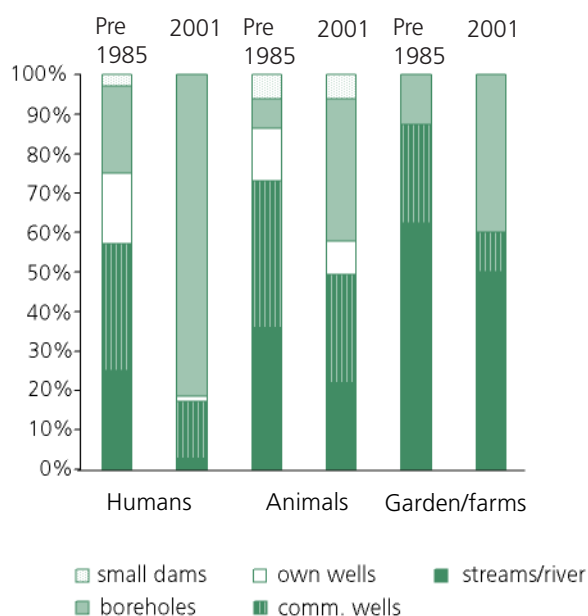
by the EPLF (which began drilling boreholes in areas under its control from the mid-1980s onwards, particularly in Sahel and Gash-Barka regions) (Fig. 2). With the exception of a few boreholes drilled by private Italian interests during the colonial period, there were previously very few operational boreholes in the region.

Figure 2: Number of boreholes in Gash Barka



This shift in source type has been particularly pronounced for humans, but is also evident in animal and garden usage (Fig. 3). Less clear is how the shift to borehole use has affected the cost of water. Though more households now pay for water, cost was not a major issue raised by respondents. Reasons for this may include the cost 'compensation' represented by decreased time spent collecting water.

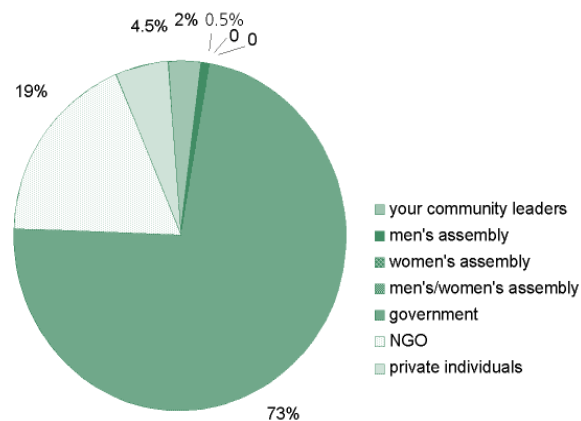
Figure 3: Major sources of water



However, significant problems are emerging in the shift to a community managed supply environment. One of the primary problems, described by officials and other key informants, was a lack of sense of ownership surrounding these new boreholes. Whereas long-standing communal sources or private wells had an established set of ownership relations, new communal sources were largely seen as the creation (and property) of government (Fig. 4). Nearly 74 per cent of respondents stated that the government had undertaken the planning, site

One of the primary problems was a lack of sense of ownership surrounding these new boreholes.

Figure 4: Who decides the present location of water source?



identification, drilling and installation of water pumps, whereas only 20 per cent said that this had been carried out by NGOs, and 11 per cent reported that private individuals (probably consultants) had established their boreholes. Only 3 per cent stated that their communities had established the sources, and these respondents were probably referring to communal wells that in any case were no longer important sources of water supply in the villages and settlements. In fact, many respondents not only perceived government ownership, but welcomed its inherent benefits, including government ownership 'encouraging sustainable use', (37 respondents made this point, as opposed to 15 who thought the community encouraged sustainable use).

A major reason for this lack of a sense of ownership in spite of its central role in community-based approaches seemed to be the poor level of participation in the development and management of boreholes. Key informants stated that many communities were unhappy because outside experts had ignored their views on the location of supplies, although local knowledge was invaluable to identifying underground water sources, they argued, including using plant species and soil types as indicators of availability.

Only 64 per cent of respondents said that they or their community leaders had participated in any form of decision-making, and where there was participation it was frequently limited to needs identification. Normally committees would approach the local authorities to voice their need for water in existing settlements. The authorities would then send a delegation to the villages for in-depth discussions with local representatives. If the case was considered legitimate, it would be referred to the Water Department and from that point onwards there would often be little local participation until the borehole had been established. The MOLG frequently hired independent consultants from the private sector to undertake reconnaissance surveys and feasibility studies. Asked whether the village assemblies had taken part in the decision concerning site location, all informants said 'no'.

On the one hand, therefore, there is a push to decentralise maintenance and management responsibility in common with global policy narratives on water supply; the establishment of new local institutions in the form of water committees being a key aspect of this approach. On the other, however, there is a failure to establish an effective process that can instil a sense of ownership and without which the work of community-based water committees will prove very difficult.

Even where there was significant participation at a local level, committees frequently faced significant challenges. Some

communities had been supplied by several different organisations in the past and now had a range of technologies to manage. This was significant because the existence of alternatives to a new borehole, for instance, provided a major disincentive for households to continue paying a management and maintenance fee. Simply put, when boreholes got too expensive, communities reverted to old sources, making long-term budgeting and planning a major problem for water committees.

In Areda village, elders forming part of an ad hoc water committee described several existing and failed sources implemented by a range of organisations. Some of the reasons for failure were technical, others due to the apparent decline in the water table since the 1970s. Activities undertaken by the elders included collecting diesel charges from households for a motorised borehole²³ (Nacfa 2–4 per household per month, depending on the household's economic status), and collecting a flat rate levy on water of some Nacfa 2–3 per *girba*²⁴. When yields were low and pumping was based on manual labour no charge was usually levied, they stated.

In Ali Gider the committee's concerns were more governance-oriented. The neighbouring irrigation scheme had recently taken over management of water points, in spite of the fact that the community felt more capable of managing the source. Established in 1998 and comprising four men and one woman, the existing members of the committee argued that they could better manage the funds and would consider using water revenues to finance other amenities. By contrast, the water office established by the Ali Gider scheme lacked transparency in its financial procedures. At the outset, the committee had successfully managed to raise a 10 per cent capital cost contribution (under the ECDF programme), reflected in the fact that 31 per cent of community respondents stated that they had participated in project development through contributing towards this cost. Over and above governance issues, the committee faced formidable technical problems, including recurrent breakdowns that in 2001 had forced people to use the River Gash as a drinking water source.



The Water Committee at Goluj.

In Goluj, the committee was very active. Some members voiced concerns that vendors 'buying low and selling high' had biased the provision of water towards large livestock owners (who could easily outbid most domestic households). This also countered efforts by the town's administration to restrict cattle to out of town watering points. One of the main sources used by livestock owners was a private well in the town which, at the time of the research visit, was surrounded by some 200 cattle and was clearly being utilised beyond its recharge capacity. Nevertheless, although wider

management problems were recognised by the committee, much of their time was simply taken up collecting maintenance fees.

One of the key problems identified in Goluj – and a generic problem for many of the new water points – was allowing people outside the immediate community access to the water supplies. Questions surrounding these issues were directed particularly at stayees in the communities visited. When asked 'why are these resources accessible to all now?' 51 per cent stated that the community no longer owned the water resources, 23 per cent stated that the community was more generous towards outsiders and 13 per cent stated that government provided the available supply. Nearly half of respondents stated that there were no problems of non-members gaining access to resources. Nevertheless, there were signs that, whilst no 'moral barrier' to access existed, in the future, all users could be subject to tariffs given the need to ensure financial sustainability at a local level.

Maintenance problems were quite widely encountered during interviews. The government water provision programme had provided only a limited training component. When a solar or motor pump broke down, technicians would have to come from Asmara to do the repairs²⁵, but given their short supply throughout the country and high demand many were reluctant to accept offers in the remoter areas such as Gash-Barka.



Transport of a water pump part for repair, Engerne.

Specific maintenance problems faced by Setimo village, illustrated some of the key issues involved. Before the borehole was drilled near to the village, people drew water from the Gash river some six kilometres away. The establishment in 1997 of a government borehole near to the village cut down substantially the time and the drudgery involved in water collection, with hours saved for other activities. The water pump ran without any problems during the first year, but in its second year broke down periodically. In spite of technicians coming from Asmara to repair the motor pump, the problem persisted. Each time the community was asked by the government to meet the cost of spare parts, but frequently these costs were well beyond their reach. At the time of the visit the pump had been out of order for many months and the community had reverted to drawing water from the River Gash.

The village of Sabonait, a re-integration site inhabited mainly by demobilised former combatants outside Goluj, faced similar problems. Motor and solar energy pumps served

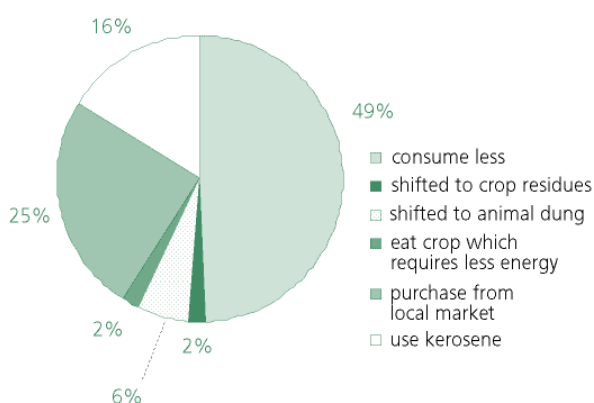
A major reason for this lack of a sense of ownership in spite of its central role in community-based approaches seemed to be the poor level of participation in the development and management of boreholes.

people and livestock respectively. When either of the two broke down, however, livestock and humans were forced to use a single source creating major access problems within the community. At the time of fieldwork in January 2001²⁶, the motor pump had been out of action since May 2000 and people were queuing up to four hours a day for water.

Impact on Firewood

Water supply provision has affected other resource access as well. This interrelationship was anticipated given the importance of natural resource access for most livelihood activities in the region.

Figure 5: Responses to firewood scarcity



The theoretical framework included an expectation that changes would have occurred to the forest resources surrounding new water points. Asked to state whether the firewood situation had improved, worsened or remained unchanged compared with 15 years ago in terms of quantity, quality and cost, nearly 80 per cent stated that firewood was scarcer now because population increase had caused depletion of forests surrounding their settlements. Some 36 per cent also stated that the quality of firewood they used had deteriorated because good quality fuel wood was unavailable near villages and towns. Families lacking labour or the means to purchase firewood from the market were consequently forced to collect inferior quality fuels such as crop residues, grasses and sooty plant species (Fig. 5).

Nearly 31 per cent of the respondents thought that the cause of deforestation was returnees' demand for land, which had led to clearance of large tracts in and around settlement

The key informants also emphasised that large amounts of firewood were being transported to meet the demands of larger urban centres.

areas. The key informants also emphasised that large amounts of firewood were being transported to meet the demands of larger urban centres. Many blamed the problem of rapid deforestation on the army: "The forestry laws and regulations do not apply to the army," one key informant stated, noting that the problem was not limited to the amount consumed by the army, but the "amount members of the army

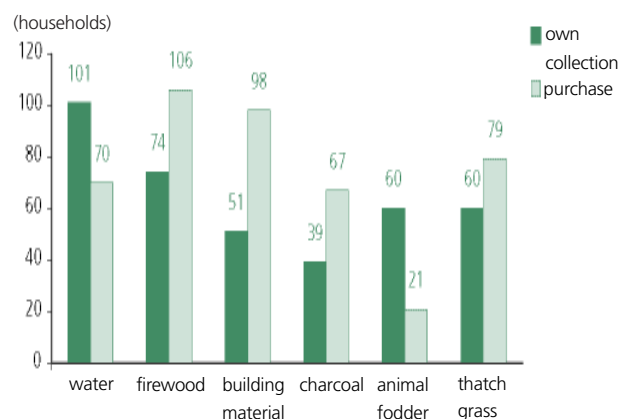
give to their relatives in the cities, and unless this is brought to a halt, there may be no trees in the vicinity of the highways in the future."

Increased distance to sources was a major problem for 65 per cent of respondents. In some villages, interviewees stated that before 1992, it took less than 30 minutes to collect firewood, whereas to meet current need required several hours

of labour. Dry wood was no longer readily available and the time needed to collect a donkey- or camel-load of firewood had increased considerably causing huge rises in the cost of transportation. One of the main consequences of the shortage and increased distance seemed to have been the emergence of local markets for firewood. Both survey respondents and key informants reported that 15 years ago there was no market for firewood, it was literally freely available and families simply relied on their own self-collection.

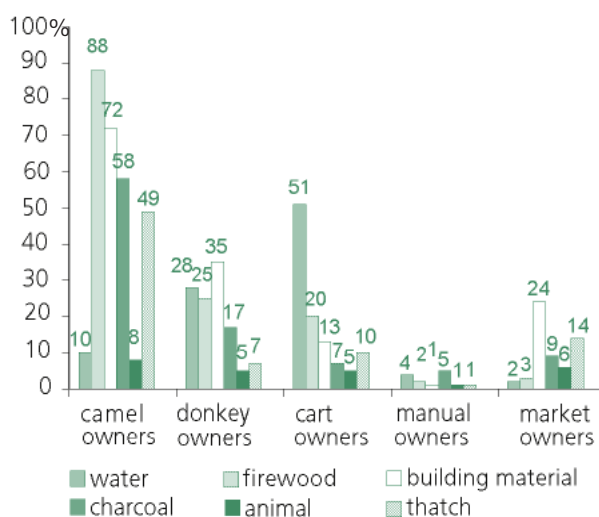
Now more families relied on the market, and scarcity and increased distance to sources had led to greater division of labour within households. In addition there had been specialisation between households: those with animal power were able to profit through trading in firewood and other scarce materials, including thatch grass, animal fodder and charcoal. Fig. 6 shows that 106 households among the respondents now relied on the market for the supply of firewood; 98 for building materials, 79 for thatch grass, 67 for charcoal, and 21 for animal fodder. In comparison to these figures, 74 families are collecting their own firewood, 60 are collecting animal fodder and thatch grass, 51 building materials and 39 charcoal.

Figure 6: Household access to resources: collection vs. purchase



Those who purchased various materials including firewood and animal fodder were asked to state where they bought the commodities. Fig. 7 indicates that trade in these products requires possession of carts, camels or donkeys. The number who reported having purchased from manual carriers was insignificant.

Figure 7: Source of purchase by materials



Commodification of fuelwood resources in Gash-Barka has progressed rapidly, brought about by a combination of the arrival of large numbers of returnees from Sudan and the growing demand for resources in the region. For many poor households, a lack of disposable income with which to purchase products means that they are rapidly being priced out of consumption. Instead they are forced to adopt coping mechanisms including reduced usage, rather than switching to kerosene, which richer households are able to do.

Table 2: Responsibility for firewood collection and transportation (by Nos of respondents)

	When there was no scarcity	When there was scarcity
Women	27	14
Men	30	63
Older boys	13	37
Older girls	5	1
Younger boys	33	37
Younger girls	34	3

For the poorest households changing availability also poses important gender issues. The frequent assumption is that firewood collection and other reproductive activities are the responsibility of women and remain so regardless of distance. Collecting firewood from distant places is assumed to have a detrimental impact on women because of the strenuous physical activity required. Earlier research shows, however, that rather than increase workload there is a chance that it can change the gender composition of the task, with a threshold distance beyond which women's participation in firewood collection and transportation declines (Kibreab, 1996a). The findings of this study seem to support this idea (see Table 2).



Woodfuel being transported into Gonye in the early morning.

With increased distance, the proportion of women participating in firewood collection declined by nearly 50 per cent and men's participation in firewood collection more than doubled, according to the survey. As the time required to collect firewood increased, the participation of older boys rose by nearly three times, whilst older girls' participation virtually disappeared. Previously, young children had dominated the activity, but now the increased distance almost reduced completely young girls' participation, whilst younger boys' increased only slightly. The trend is the same in collection and transportation of construction materials. These findings are significant in terms of the links between sustainable livelihoods and the gender division of labour, by suggesting that resource scarcity may in fact have beneficial impacts on

at least the physical exertion of women and younger children. However, this would assume that men's entry into the particular activity was not without conditions. In probing some of these issues, interviewees revealed a wide gap between men's and women's perceptions of impact.

With increased distance, the proportion of women participating in firewood collection declined by nearly 50 per cent and men's participation in firewood collection more than doubled

Male informants and discussion groups argued that involvement in firewood collection was displacing their labour time which otherwise could have been allocated for 'productive' activities. This implied that as men's participation in collection increased, productive activities, and consequently household incomes, would suffer. This was in spite of the fact that women participate fully in productive as well as reproductive activities amongst most of the households covered. There was a clear attempt to equate the change in roles with major opportunity cost to households. However, women interviewees had a different story, arguing that it was not because men were charitable or concerned about their welfare or safety rather, as one informant graphically put it:

*"They [men] want to find their food ready when they come home. If we have to travel for several hours to collect and then carry firewood, we may not even be able to reach home before the men return from the teashops or farms. There is nothing men hate more than coming to a locked house and empty plate. You see, men are like small children when it comes to their stomach."*²⁷

Impact on Food Supply

The growth of settlements around new perennial water supplies would seem likely to precipitate food availability decline, particularly if the demand for food by a larger population were to be combined with increasing production problems. It might be expected, therefore that better off households would gain as sellers of food and other consumer goods, whilst poorer households would lose both as buyers of food and sellers of their labour.

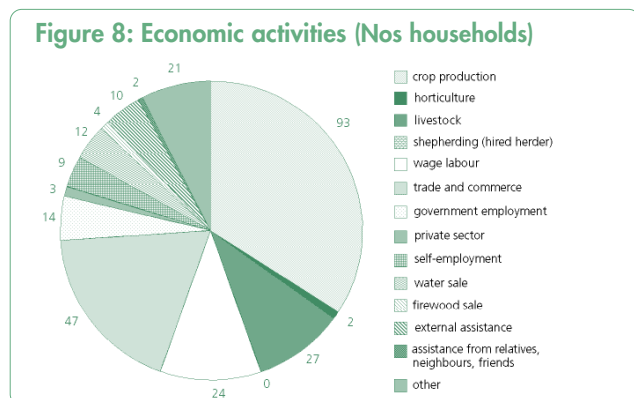
However, against expectation, the research showed that food availability was now far greater than in the past, although production has not increased. The main reason appeared to be food aid, which Eritrea had been receiving since the massive internal displacement took place during the border war. Some 57 per cent reported that food availability had increased against 24 per cent who said that it had decreased. Opening new areas for cultivation and increased labour supply in the region may contribute further to future food security.

Impact on Employment and self-employment

It was expected that the large population increase in Gash-Barka would have led to fierce competition for employment and self-employment opportunities. However, asked whether the arrival of large numbers of returnees from Sudan had created new opportunities or exhausted pre-existing employment and income-generating activities, 53 per cent reported that there was more employment now than 15 years ago. In addition some 50 per cent also thought that opportunities for self-employment were greater now than in the past.

There are a number of reasons for this apparent

improvement. Until 1991 the area was under Ethiopian occupation, severely curtailing income-generating activities. Only after independence did it become a major focus of agricultural and infrastructural development. Some returnees brought substantial amounts of financial capital with them, which subsequently was invested in local agriculture, housing and the service sector (see for example, the range of activities in Fig. 8).



One of the major employers in Gash-Barka – Wodi Legesse – is a returnee who accumulated capital in the transport industry in Sudan. The initial capital of the majority of those who invested in Sudan before their return to Eritrea came from the Arab Gulf states or Western Europe.

Both returnees and local residents have benefited from greater employment opportunities. The expansion of the region's infrastructure through the construction of schools,

The expansion of the region's infrastructure through the construction of schools, feeder roads, clinics and housing, which is linked to the arrival of the returnees, also provides opportunities for employment and self-employment.

feeder roads, clinics and housing, which is linked to the arrival of the returnees, also provides opportunities for employment and self-employment. More people in the region helps to expand markets, and many inhabitants having developed entrepreneurial skills prior to their displacement or exile, are now seizing the opportunity to establish different forms of income-generating activities. The employment and self-employment opportunities brought about by the returnees and by the country's post-conflict reconstruction efforts should not be

overstated, but in comparison to the earlier period of Ethiopian occupation, the change that the region is experiencing, (and particularly before the recent border war) is considerable.

Impact on Education, Health Care, Veterinary Services and Transportation

Before independence, Gash-Barka had no secondary schools and the few primary schools in existence were limited to the main towns: education had been subject to long-term neglect under Ethiopian occupation. When it became clear that the region was to receive large numbers of returnees from Sudan, the government's efforts in providing water were accompanied by the construction of education facilities. As a result although there are large numbers of returnee children, they do not have to compete for school places, and education is free at all levels. Although the number of schools appears to have increased substantially, only 27 per cent of respondents said that the quality of education had improved. Some of the key informants supported this finding, stating that the student-

teacher ratio was high and that there were insufficient books²⁸. A number of key informants also reported that post-primary level returnee children who had studied in Arabic in Sudan faced difficulties due to the shortage of suitable Arabic-speaking teachers.

The arrival of the returnees in pre-existing and new settlements has also been accompanied by a considerable increase in the supply of health centres, clinics and to some extent, the upgrading and building of new hospitals. In fact 85 per cent reported that the supply of health care facilities had increased dramatically, though the bias towards provision of structures rather than 'services' was clear. Some key informants stated that most of the physical structures were in fact poorly staffed and equipped, with medicines either unavailable, in short supply or prohibitively expensive for the poor. Only 26 per cent reported that quality of healthcare had improved in comparison to the past, which should give serious cause for concern²⁹.



Photo © A. Nicol

Family water cart, Ali Gider

A considerable proportion of the population in Gash-Barka derive their livelihoods from livestock production. Animal health is therefore of major concern. Prior to independence, rinderpest and other livestock diseases were widespread. The results of the survey show that provision of veterinary services has improved considerably since the arrival of returnees and since government actions have been undertaken post independence. One of the most important components of the aid package given to sponsored returnees was the provision of livestock and effective veterinary services (Kibreab, 1999a). Some 67 per cent of the respondents stated that the availability of veterinary services had improved substantially since the arrival of returnees, though a number of key informants pointed out that access to services was effectively contingent on the capacity to pay high prices for medicines (with the exception of inoculation campaigns).

The construction of feeder roads connecting up previously isolated areas with major urban centres has accompanied the return process. The impact of this infrastructure development on facilitating trade and communications is considerable. Asked whether transportation had improved or deteriorated in comparison to 15 years ago, 49 per cent of respondents stated that it had changed for the better. However, some key informants, particularly those who lived relatively near urban centres, complained about lack of transportation in spite of the fact that their villages were located along the main roads. They reported that the buses often passed by without stopping, having filled to capacity with long-haul passengers who routinely paid higher prices.

Returnees' Impact as Perceived by Local Residents: The Case of Goluj

Settlement growth around watering points resulting from the voluntary association of diverse occupational, geographic and cultural groups could, it was suggested earlier, generate additional social capital which might enable more social cohesion and economic growth. The war of independence, in general, and the particular displacement it caused, had dramatically reduced the social and physical distance separating Eritrean social groups (Kibreab, 2000b). But how did the local residents – the stayees – perceive the changes?

Benefits of hosting returnees

Goluj provides an important case study of their views because of the sheer volume of return and resettlement in the vicinity. During the field research it was clear that it was becoming an epicentre for major problems associated with water use, livelihoods and the environment within Gash-Barka. Much of the data on their views was elicited from in-depth discussion with key informants and groups in the town and outlying areas. When the fieldwork was conducted (in January 2001), the reintegration sites were over five years old, by which time it was anticipated that local residents would have formed opinions with regard to the presence of returnees in the region. On the whole, discussion groups pointed to both opportunities and costs, as outlined below.

Improved Water Supply: In comparison to the past, the availability of water had improved considerably, as shown earlier. In the mid-1970s Ethiopian forces buried the old Italian well built before the war. It was only after the town fell into the hands of the EPLF that the well was re-opened (it is now in private hands – see photos page 26). When the government decided to establish a resettlement site in Goluj in 1994, a borehole was drilled. Two solar energy-operated and one motorised pump-operated boreholes were established to meet the needs of the returnees and the local population. Informants stated that now both the quantity and quality of water available had improved. The improved water supply that has accompanied returnees has enabled stayee households to save labour time and to avoid loss of labour productivity due to reduced physical exertion in collecting water. In the past the average time required to travel between water sources and the village was at least three hours which, during the hot season, was a serious threat. Related to this, the establishment of watering points nearer Goluj had now enabled the community to fight house fires more effectively. “In the past, when the wells were far away, yields were low, and fire broke out, we ran for our lives. Now, when water supply has improved and distance has decreased, people run for buckets and carts to fetch water in order to extinguish fires,” stated one informant.

Hygiene impact: The discussion groups and key informants stated that in the past households without donkeys, labour or the income with which to purchase water from water sellers had faced severe water shortages. Improved supply had brought considerable hygiene benefits. By contrast, in Areda, where there was still severe water shortage, informants stated that when the depth of the water level and distance to water sources increased substantially as yields declined (apparently following exhaustion of groundwater reserves) people responded by cutting consumption. Some families without the money to purchase water or donkeys for transport, could not bathe or wash their clothes as frequently. Even households with donkeys

consumed far less than in the past, because to meet their regular water needs now meant journeys which could take up most of the working day. Households with donkeys for transportation now bathed only once a week and washed their clothes only every two weeks, key informants stated.

Markets: The local residents used to sell their livestock and other goods as well as purchase commodities from Kassala in Sudan. The establishment of the returnee settlement had created a vibrant local market where they could sell their produce and purchase commodities they needed for production and consumption. This was highly valued by the local residents, due not simply to reduction in distance, but because, as one elder put it eloquently:

“Having a market in your own place means you are in touch with the whole world on a daily basis. You are learning about new ideas and products, as well as about people whom you meet selling to you or buying from you. When you exchange goods, you exchange ideas and knowledge. Markets bring people closer to each other and that cannot be a bad thing”.

Having a market in your own place means you are in touch with the whole world on a daily basis.

Another important benefit of emerging local markets mentioned by the informants was the opportunity to participate in income-generating activities that previously had not existed.

Health-care, Education and Transportation: Prior to the arrival of the returnees, Goluj lacked any health-care services. The area is malarial and in the absence of health-care facilities, there was little protection against such diseases. As one of the informants put it, “During the rainy season, our villages were infested by swarms of mosquitoes and our children died in front of our eyes”. They reported that after the establishment of the settlement, there had been considerable decline in morbidity and mortality. Services such as a new mother and child health clinic were previously unknown in the area.

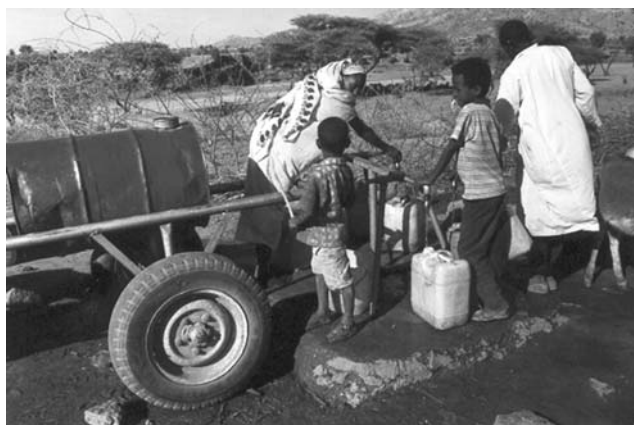
Education: There were no schools in the area before the arrival of returnees. Highly valued by the communities as the only route to economic and social progress, most families can now send their children to school. Those that do usually send boys. Another important benefit brought about by the establishment of returnee settlements in the area, according to the local residents, is improved transportation. Many used to walk to Tessenei or Kassala carrying goods on camels, or on foot. Now buses run less than every half an hour to Tessenei and elsewhere throughout Eritrea, including Sudan. In their view, this facilitates the movement of goods and services and provides an opportunity for earning income from trade and production, as well as saving time and improving the quality of life.

Veterinary services: Prior to the establishment of the reintegration site in Goluj, the discussion groups pointed out that there had been no vet in the area. One of the components of the assistance package provided to the PROFERI returnees was provision of livestock, accompanied by a relatively well-organised veterinary service. The livestock provision project was funded by aid agencies such as USAID, Oxfam UK and Christian Aid, the latter two using funds provided by the UK Government. The veterinary service has benefited both

returnees and local residents, reducing significantly livestock mortality and morbidity.

One particularly articulate Hedareb elder in Girmaika, told the research team: "Progress and change come from differences, not from homogeneity and similarities".

Expansion of Income Base: According to informants from the stayee population, prior to the arrival of the returnees, the dominant livelihood activity was animal husbandry. After their arrival, the sources of livelihoods diversified considerably, leading to improved sources of income and, most importantly, the capacity to spread risk. Fifteen or more years ago, people derived their livelihoods from one or two economic activities. A typical family now derived its livelihood from contributions made by its different members, who would participate in multiple income-generating activities. One informant stated that: "If one member returns empty-handed, others return with something from which all members benefit." A former nomadic woman outside Goluj told us that one of her sons was in Massawa (over 460 km away) working for a construction company. Another was in Tessenei working in a restaurant, and another was in Goluj operating a vegetable stall. Her two young children (a girl and a boy) were going to school and selling water before and after school using a donkey purchased from common savings. She also made baskets and mats, and sold them in the market. She told us, "Do you think we would have been able to do this if we stayed in isolation?" Many of the discussion groups and key informants also reported that they had been learning new methods of farming, including the use of improved seed varieties.



Filling up jerrycans and carts at a water point near Goluj.

Cultural enrichment: Key informants and discussion groups in the different sites pointed out that prior to the arrival of the returnees their communities had been culturally and linguistically homogenous, which many saw as a disadvantage. One particularly articulate Hedareb elder in Girmaika, told the research team:

"Progress and change come from differences, not from homogeneity and similarities. If you are similar, you cannot learn from each other because your knowledge base and your reality are the same. In the past, we knew nothing about the other cultures and ways of life of our people in the rest of the country, and therefore we were inward-looking without being able to learn from the cultures, knowledge and behaviours of others".

Displacement is bad, but it is also a school where people learn things that they would not have learned had they stayed at home.

Reflecting the range of returnee origins, one elder in Setimo stated: "We are learning about our country and society without having to travel any distance. The benefits are mutual.

The new arrivals are enriching their knowledge by learning from us. This is a great advantage." Nevertheless, there were a

few, particularly older men, who regarded less favourably the intermingling of peoples with diverse cultures and lifestyles. In their view, important traditional values were being undermined. However, the majority regarded ethnic and religious intermingling as inevitable. One of the discussants, who was a returnee said:

"Displacement is bad, but it is also a school where people learn things that they would not have learned had they stayed at home. This is because they learn to live together with people they had previously considered strangers. It is only by living together with people from different areas that you can open your eyes. If you live among your own, you don't learn about other peoples or new things."

Costs of hosting returnees

In summary the costs associated with the hosting of returnees covered the following main areas:

Water supply: Demand for water has risen causing some supply constraints, particularly for livestock. Residents in Goluj stated that the border war with Ethiopia had left critical livestock-watering sources in the Tekeze-Setit basin out of bounds³⁰. As a result, most livestock (including returnees') were now watered from boreholes and wells around Goluj, Gergef, Tebeldia and Sabonait – the three reintegration sites for PROFERI returnees.



Pressure of livestock at a water point in Goluj.

An evident tension existed between human and livestock needs in Goluj. Discussion groups related how water sellers preferred to sell to livestock owners (willing to pay higher tariffs), causing a shortage of water for humans and smallstock in the town. The privately owned water point sold directly to livestock owners and charged 40 cents per head of cattle; the publicly-owned site did not sell to livestock-owners. The 40 cents per head was in effect a private monopoly price because livestock owners were desperate to give their animals water. For water vendors in the town, water scarcity for livestock enabled the creation of enormous profit, including the capacity to charge 30 Nacfa a cart (rather than the 4 Nacfa for a single and at 8 Nacfa a double barrel for household consumption in the town). At the bottom end of consumer demand the cost of water was therefore increasing substantially within the town, impacting directly on poor households' capacity to access water. The main problem with the 'pull' of the town's private water point and, more generally, the huge levels of water vending, was that whilst water was privately managed, surrounding local resources being placed under heavy livestock pressure were common property (see Box 3. for definition and theory of common property resources). In short, water 'profits' were being collected by private well and cart owners,

but the 'costs' of environmental degradation were externalised and shared by all residents.

Exclusion of outsiders was also no longer a possibility given the commonly-held view that resettlement was a national issue the impact of which should be shared by all Eritreans. As one informant put it, "*They [the returnees] have nowhere else to go.*"

Livestock concentration: In addition to the stress on water supplies, heavy livestock concentration in and around Goluj resulted in the destruction of crops or post-harvest loss of valuable sorghum stalks. Crop residues of this kind had been commonly ploughed back into the soil and had helped to improve soil structure and fertility. Now they were collected for animal feed during the dry season³¹. In addition, the problem of countering animal trespass onto cropped areas displaced family labour from other tasks. In Goluj, there was emerging conflict between livestock owners and farmers around the town. Cultivators complained that their crops were being destroyed by animals and livestock owners complained about the 'exorbitant' amount of compensation that they were required to pay if damage occurred. However, these experiences seemed to be largely unique to Goluj and were to a large extent due to the exceptional situation caused by the border war.

From the interview data, it also appeared that because Goluj, Fanco, Gergef and Tebeldia were rich in pasture resources, they seasonally attracted large numbers of animals. During 1999, 2000 and 2001, pressure reached a peak, mainly due to the war situation, which disrupted the traditional transhumance routes of Eritrean herders. Reconciliation and border demarcation between the two countries would help to revive cross-border migration in search of water, pasture and income-generating activities.

Competition for cultivable land: During the war of independence, Gash-Barka was sparsely populated (Kibreab, 1987, 1990). Though largely inaccessible during this period, cultivable land was in abundance. Even after the arrival of returnees, land resources remained in abundance although most land close to settlements had already been allocated. Now if someone wanted to open up new land for cultivation, it was increasingly difficult to find unoccupied land nearby, and distance represented lost labour time and therefore productivity problems. Most of our informants stated that land shortage was not a major current problem, but they were concerned for the future. In connection with other fieldwork undertaken in 1998 (Kibreab, 1998), some stated that commercial farmers were evicting small farmers in the Gash-Barka basin where there were many small horticultural projects. This implied wider issues than simple competition due to returnees.

Loss of grazing and browsing resources: According to government policy, every returnee family is entitled by law to two hectares of cultivable land and to 200–250 square metres for house construction. During the war of independence, much of the physical environment reverted to dense woodland savannah. However, with the arrival of the returnees, large tracts of land were cleared for cultivation, the establishment of settlements and road construction. Respondents saw land clearance as a major cause of deforestation in and around Goluj, as well as a major cause of reduced grazing and browsing resources. Again, it was emphasised more generally by respondents, that, at present, the shortage was no cause for concern, but that they were

concerned for the future. Asked to state if too many animals caused a problem of overgrazing, the majority did not think so: in addition 42 per cent said that most of the animals belonged to local residents and only 9 per cent thought returnees' livestock were contributing to problems of overgrazing. In fact, many families with large livestock herds such as some of the Beni Amer and Maria around Qala en-Nahal in Sudan had yet to bring back their animals to Eritrea. When and if they returned they would be likely to increase considerably the livestock pressure in Gash-Barka, perhaps reflecting the fears of respondents that future problems may arise.

Shortage of firewood: This was another factor raised by respondents in Goluj, but was echoed by comments obtained from the survey and group interviews in other communities. Indeed, this was perhaps the most generalised problem in the region. In many cases, people had begun to use substitutes such as animal dung, crop residues and unpalatable grass species as shortages had grown. In years since the arrival of the returnees, competition for renewable resources such as fuelwood and construction materials had risen, increasing the distance required to collect these resources around towns like Goluj. In fact, key informants, members of the discussion groups and sample households were unanimous with regard to the negative impacts of returnees on fuelwood availability in Goluj.

Environmental Impact of Improved Water Supply

Some of the key environmental issues arising are examined below. Whilst no detailed environmental assessments were made of changes in the vicinity of the water points, observations during the fieldwork, and data collected from individuals directly affected by the change, suggest a number of trends. Discussion of these issues should be considered as tentative rather than conclusive, indicating a need for further examination.



Photo © A. Nicol

*Intrusion of *Prosopis juliflora* around a pump house, Germaika.*

Water provision has enabled the returnees to bring land and other renewable resources into production. Prior to the drilling of boreholes, these resources were either used as wet season grazing or were left idle. It was in such areas, informants reported, that wildlife had begun reappearing during the war, though subsequently much was driven away by increasing post-war human activity. The only visible impact of animal and human concentrations was now on plant cover. The surroundings of watering points and settlements were visibly

According to government policy, every returnee family is entitled by law to two hectares of cultivable land and to 200–250 square metres for house construction... With the arrival of the returnees, large tracts of land were cleared for cultivation, the establishment of settlements and road construction.



Photo © A. Nicol

Drinking trough and donkey collection at a private well in Goluj.

devoid of vegetation which may indicate serious loss, or may have been partly seasonal (the visit took place during the dry season). Nevertheless, many respondents stated that the large number of animals was causing environmental degradation,

In many of the communities there was also a visible sharp increase in *Prosopis juliflora* ('mesquite') ... [which] represents a serious impact in its own right, and may also indicate a rapidly degrading environment.

and also changing the plant species composition, spreading previously unknown noxious weed species such as 'adar' (*Sorghum vergatum*) and *Striga hermonthea* ('quolelehat' or 'hawi ainu') through animal droppings. The former is difficult to identify until flowering and the latter is a parasitic weed with a serious impact on yields. Furthermore, in many of the communities there was also a visible – and reported – sharp increase in *Prosopis juliflora* ('mesquite') a thorny shrub native to Latin America and rapidly colonising parts of eastern Sudan and other regions of the Horn of Africa.

Not only does it compete with native species, but it is very difficult to kill, relatively useless for wood fuel and construction (according to respondents) and allegedly poisonous to livestock. The increase in *Prosopis juliflora* represents a serious impact in its own right, and may also indicate a rapidly degrading environment (see Nicol, 2000).

The data gathered from in-depth interviews with government authorities and the populations affected by current changes show that the drilling of boreholes was not preceded by any form of environmental impact assessment. The single most important concern of policy-makers was to supply households with water, and hydrologists and engineers involved were mainly concerned to identify cost-effective sites where water yields were potentially high regardless of immediate and long-term environmental considerations.

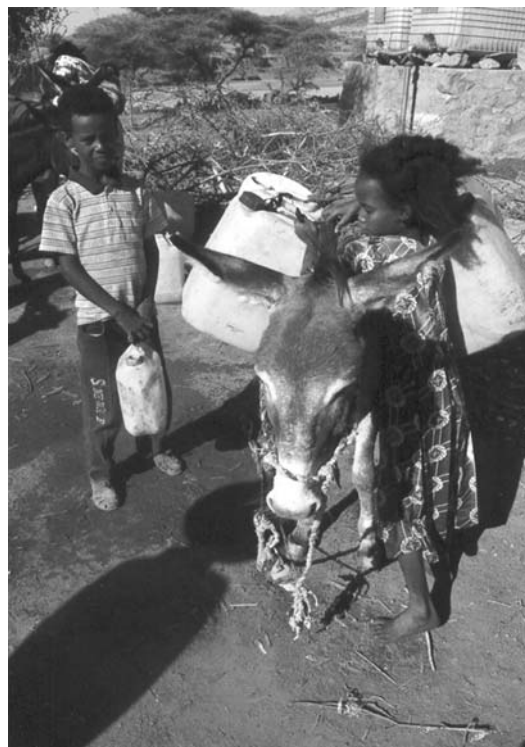


Photo © A. Nicol

Children collecting water near Goluj



Photo © A. Nicol

A municipal borehole, Goluj (with water vendors filling up).

V. Conclusions and policy recommendations

Whilst the study has revealed significant impacts in the region, it is important to restate that these were based on a small-scale, rapid assessment of communities. Further detailed analysis is required ahead of future development activities. Nonetheless, preliminary conclusions and policy implications are outlined below. These are divided into socio-economic, environmental, and policy and institutional implications. The recommendations arising are based on feedback received during a policy workshop held in Asmara in July 2001 (see Annex).

If one common thread unites the three areas it is the need to address a complex and dynamic range of resource management issues in a systematic and comprehensive fashion. There is both an evident lack of data within the region and few attempts, to date, at overcoming this problem. The study has demonstrated how an intervention in one area such as water supply, can have major related impacts, linked through complex social and economic relations between households and their livelihood strategies. There is a danger one intervention can prompt a series of events leading to rapid population growth as tens of thousands of people return to an area. Water supply, prompting settlement, creating opportunities for more sedentary and diverse livelihoods, and providing further income-earning opportunities, can pull in sizeable populations in a short space of time. The question is whether water supply can remain sustainable under these conditions, both in terms of physical and financial sustainability? Clearly this study raises doubts about future sustainability based on the management problems revealed and the wider pressure on the resource caused by competition between different users.

To help combat possible problems emerging for settled populations – and the government – a simple planning framework for return and resettlement has been developed (see pages 2–4), combining elements of a livelihoods approach with water resource management. The main challenge is to be able to work within existing institutional and policy frameworks in the short term, to influence the development of new institutional and policy arrangements in the medium term and, over a longer period to provide capacity for early warning if and when supply failure arises.

Socio-economic issues

The programme of borehole development in Gash-Barka, undertaken in earnest since the early 1990s, has had a significant impact on settlement. However, the decision to develop groundwater resources has been taken without an effective assessment of groundwater potential, or a full understanding of issues such as runoff and recharge in the region. Nonetheless water supply development has encouraged a large number of users to switch to borehole use, from hand-dug wells and other traditional sources. Whilst improving the quality of water used, it raises substantial issues concerning the capacity of community-based institutions to maintain and manage these boreholes, including community capacity to ensure long-term financial sustainability of motorised technologies.

The establishment of high-yielding motorised boreholes has further encouraged rapid increase in livestock numbers in and around the respective settlements, in some cases with major impacts on other resources, including grazing. Human population increases in many areas has affected the availability of firewood, charcoal, and building materials. Growing scarcity (and the increased distance required to reach these resources) has precipitated the establishment of markets and the *de facto* commodification of natural resources. This has had important impacts on availability of resources for the poor – many of whom are now being priced out of consuming the quantities they require. Other households, rich in animal power, have been able to exploit this situation through trading in these commodities, bringing them from further afield on donkeys and camels to communities such as Goluj, Gogne and Ali Gider. Transport costs and the huge opportunity costs of manual labour collection of these resources have caused prices in town to rise sharply. In some cases reduced consumption of firewood as an example, may be changing the amount or type of foods being cooked, possibly with negative nutritional consequences for children.

The commodification of resources also extends to water. In Goluj, there is a significant water-vending community and provision to large-scale livestock owners can ensure significant profits for cart-owners and other resellers. Again the richer households with animal power are in a position to exploit this situation, whilst the poor are forced to compete as consumers. This situation also has the potential to encourage further livestock movement into the area. In terms of long-term resource management little is known about the aquifer and its ability to withstand increased abstraction.

Change to the availability of resources is also causing shifts to occur in gender roles at a household level. Increasing distance is prompting more men to become involved in collecting some items such as firewood, and reducing in number and age the children involved. Men are apparently inclined to take on these tasks (in spite of arguing that there are higher opportunity costs involved in terms of their labour) because of concerns about impact on other household reproductive activities undertaken by women if the latter spent more time each day collecting firewood. Many complex issues within the intra-household division of labour raised, but remain beyond the scope of this study.

Environmental issues

The high concentration of animals in the vicinity of water points combined with the heavy demands on resources caused by human settlement, is likely to cause rapid loss of plant cover and forest resources. This will create shortages of key species, and expose the soil to more rapid degradation. However, in the absence of a more complete environmental impact assessment, we are cautious about drawing too many conclusions. It is suggested that a full study is of significant importance, not least because environmental issues were frequently raised by groups and key informants interviewed.

Already the improved supply of water is encouraging increasing numbers to maintain livestock around their settlements year-round. Previously, owners removed most of their animals from villages to outlying areas in search of water and pasture during the dry season. The problem of dry pasture is now partly overcome by crop residues and other forms of fodder collection for stall-feeding. However, this greater use of residues means fewer inputs into the maintenance and replenishment of soil structure and nutrient load. Though these changes may have a positive impact on the nutritional status of many of the families, the long-term impact on land productivity may eventually reduce yields and available residues.

With reduction in many types of plant species in the vicinity of settlements, one of the secondary but most visible issues to emerge is the proliferation of mesquite – *Prosopis juliflora* – in and around towns such as Ali Gider and Germaika. This plant, with a well-established reputation in Latin America and parts of India, has a wide variety of suggested uses, but in Gash-Barka, was regarded largely as a pest. Whilst it is supposed to be useful as a fuel wood, many said that it was too ‘spongy’ and difficult to collect due to its thorns. Other informants stated that livestock would become sick if they ate too many of the seed pods. Its success and rapid spread may, in part, be due to the loss of other species. It is important to address the spread of this intrusive species not least because it is capable of rapidly colonising critical dry season grazing areas along the Gash-Barka and other watercourses³².

Policy and institutional issues

The policy and institutional issues raised relate directly to the problems highlighted above.

Many of the water supplies in the region have been sited according to hydrogeological and settlement criteria alone rather than broader issues of existing and potential land use. This is not surprising given the need for rapid resource development to accommodate resettlement. However, in such water-scarce environments it is important to plan water developments in conjunction with comprehensive land use assessment. Failure to do so, and there are many examples from other areas in the Horn of Africa, can prove harmful to household livelihoods in the longer term (Kibreab, 1997, 2000a, 2002b). Without applying environmental guidelines, including factors such as human and animal population size, minimum distance requirements between boreholes, and the future economic potential of an area, rapid settlement around boreholes can lead to unsustainable land-use. The experience of other countries such as Sudan shows that although successive governments since the late 1930s have sought to ease pressure on existing watering points by redistributing human and livestock populations to new settlement sites, and through massive borehole drilling and *hafir* excavation, in fact the outcome has been the exact opposite. Instead of redistributing human and animal populations, the water supply programmes caused massive concentrations around new watering points with serious environmental consequences.

Whilst such problems are not inevitable in Eritrea, not least because most of the water points are located in pre-existing villages or new reintegration sites, in the long-term water facilities are likely to further influence redistribution of population. As pointed out earlier, the immediate objective of the water provision policy was to provide for households

in an area where perennial water was either lacking or in short supply. Results appear to have been mixed³³. In some places, the government’s water provision programme has been effective in serving, at least in the short-term, economic and health needs of the beneficiary communities, whilst in other places the extent of success has been minimal or non-existent. One important finding of this study has been the unwillingness by most communities to restrict access to water resources by outsiders. This has consequences for long-term sustainability. Participation, a sense of ownership and the creation of effective relationships between managers and communities relies to some extent on a defined set of users. Undoubtedly some factors influencing sustainability are external – such as unfavourable weather and hydrological conditions – and are beyond the control of policy-makers, planners and project implementers. Where ownership of local management processes is unclear, however, even with effective national guidelines, local implementation will be problematic.

The study has shown that there is a major issue of community participation and committee functioning. Whilst officials state that the management and maintenance problem is primarily a result of water user committees failing ‘independently’ to make the system successful and sustainable, there are clear limits set to committee capacity including ill-defined user groups, conflict between user groups within communities, and a generalised failure to instil a sense of ownership during the process of project development.

Recommendations

The recommendations of this study are in two parts: firstly policy recommendations arising out of the research results, and combining the major outputs of the workshop (see Annex I); and secondly a suggested planning framework for the sustainable reintegration of returnees in areas such as Gash-Barka (see pages 2–4).

Policy recommendations

- *Sustainable water supplies are a prerequisite for the effective settlement of returnees:* Ensuring the sustainable supply of water to returnee and stayee populations in Gash-Barka and other similar water-scarce regions should be the fundamental starting point for decisions on resettlement. Sustainable supplies must be both consistent with resource base availability and with mechanisms of delivery capable of management at a local level. It is suggested that serious consideration and support be given to the construction of reticulated piped supplies, particularly in areas of great resource pressure on limited water points, such as in Goluj and Ali Gider.
- *Knowledge of the resource base has to be the starting point for effective planning of water supply development:* Ensuring that supplies are sustainable has to take as a starting point knowledge that sufficient resources exist to provide supplies during periods of peak demand in an area such as Gash-Barka. This has to be based on a systematic and detailed gathering of data on groundwater properties, and the behaviour of aquifers in the region both seasonally and inter-annually. It also has to take into account the need to improve water harvesting and aquifer recharge capacity.
- *Water supply has to be seen in the context of the livelihoods-*

environment interrelationship: Knowledge of the resource base is the key starting point, but supply-side information has to be combined with demand-side analysis and projections. The most coherent method to achieve this is to understand in detail the demand requirements of different livelihood strategies adopted by households. One of the key determinants will be the number of livestock that returnees and stayees hold, given the high consumption requirements of livestock, and the degree to which consumption patterns are seasonal. Furthermore, projecting likely sectoral demands on the basis of the livelihood activities in the region will help in choosing the most appropriate supply facilities.

- *Understanding the full cost of water to households is fundamental to understanding how to establish effective institutional relationships:* If one of the principal strategies of supplying additional water is to alleviate poverty, then understanding the micro water economy of households is critical. This should entail matching different household demands for water to the range of livelihood activities, and estimating the capacity for communities to fund recurrent and future capital replacement costs.
- *At the heart of long-term sustainability is the development of a sense of ownership and new institutions of 'property' management:* The process undertaken in developing new water supplies is crucial to determining the levels of 'ownership' perceived by the community. Without instilling a sense that the structures are the responsibility of the community to maintain and manage, and regardless of whether or not a water user committee has been established, long term sustainability will prove difficult. Establishing a process that involves the community through need identification, to site selection, construction and operation – including the management of user fees, tariffs and other financial instruments – should be a priority. Central to this process is the creation of new institutions that can regulate and enforce sanctions on the use of water points in the absence of customary institutions (for instance use by livestock). Whilst the principle of 'open access' is important as part of social capital formation in the area, there needs to be a sharing of responsibilities and understanding to ensure that open access does not mean over use and eventual resource failure.
- *An effective policy and institutional framework in water supply has to take into account the full range of social and environmental factors:* The development of an effective policy framework which supports strategies for implementation as well as the establishment of institutions responsive to policy revision, implementation and debate is an essential 'umbrella' for the recommendations described above. The need for a coherent policy within which these recommendations can be framed is clear from the case study. In the long run, a key area is in training and equipping local technicians. This will help communities to develop a capability for quick and effective maintenance of their water supply systems, and thereby the capacity to ensure adequate and sustainable services in the long term. Putting in place arrangements which allow communities reasonably easy access to spare parts at affordable prices must also be undertaken. Part of this practical strategic dimension should be the establishment of local spare parts warehouses, subsidised by the government.

available in Gash-Barka, this is a short-term gain with possibly long-term impacts. Unless institutional arrangements are established that can set in train effective strategies for sustainable resource management overexploitation is a possibility. Those most likely to feel the impact will be the poorest who are unable to compete in the market for scarce resources.

Whilst there has been some success in making water more

IV. References

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Endnotes

¹ Many of the demobilised ex-combatants were probably re-mobilised to fight in the border war against Ethiopia.

² Many urban services were destroyed by the Ethiopian army during the recent border war. These included government buildings, the cotton ginning factory at Ali Gider and schools and clinics.

³ The scheme was operational until the second half of the 1970s, and again came into operation in the mid-1990s, before being put out of action during the recent war with Ethiopia.

⁴ Social capital is defined as the 'glue' holding societies together, comprising social networks and institutions, social norms (such as co-operation), and social values or attributes (especially trust) (taken from Edwards, 1999).

⁵ Refugee International (Washington), 24 June 1999

⁶ At one point in time, the population of Setimo had fled their homes temporarily and crossed into Sudan in search of international protection. They returned immediately after the area fell back under the control of the Eritrean People's Liberation Front (EPLF).

⁷ Usually the rich livestock owners.

⁸ 'Survey report on rural water resources'. Water Resources Department, May, 1994, (Draft). Asmara.

⁹ Compared to the WHO standard of 20 litres per capita per day.

¹⁰ Established to resettle internally-displaced Sudanese Nubians following the construction of the High Aswan Dam by Egypt.

¹¹ The Gash-Barka has an estimated mean annual flow of less than 1 bcm, whereas the Setit's flow is approximately 8 bcm (source: EVDSA, 1989).

¹² Important lessons can be learnt from the experience of other regions in the world, including Gujarat in India. Rapid decline in groundwater levels is having extremely serious impacts on the rural poor (see for example Moench, M. 1992).

¹³ Agropastoralists also attach importance to the quality of water sources; hence boreholes may prove more attractive than still surface sources. There is a reported preference for water from deep wells in the dry season near to livestock camps, probably because heat intensity demands higher levels of water consumption. The Tigre restrict dry-season consumption through using alternate watering, non-watering days for livestock (GREDMCO 1996).

¹⁴ One study estimates average water consumption by cattle and horses is 40 litres per day; donkeys and camels 20 litres a day and goats and sheep 5 litres a day (GREDMCO, 1996).

¹⁵ (Ibid.) Watering frequently also affects milk yield and reproductive rate.

¹⁶ During the 1985 famine, for instance, the fruits of naturally growing tree species, *Balanites aegyptiaca* and *Boscia senegalensis*, may have accounted for the same calorific intake as all the food aid delivered to Western Sudan during the same period (Rees, 1990).

¹⁷ These may include animals such as elephants, gazelles, ostriches, foxes, and lions.

¹⁸ The Ali Gider irrigation scheme is a case in point. Important dry season grazing was taken over by commercial farming interests along the Gash-Barka River.

¹⁹ However, the majority of the returnees, including those who fled to Sudan from the rural areas, have been opting to settle in the border towns rather than returning to their former villages or settling in other rural areas.

²⁰ Most of these villages were abandoned during the recent border war when residents fled to Sudan.

²¹ Nevertheless from the survey results overall, it seems that the cost of water in the region as a whole has risen some 70 per cent in the last 15 years. The impact on poorer communities, less able to relocate to where water is more available, could be severe though this would require more in-depth study.

²² Reasons for this higher than expected figure may include the predominantly urban nature of many interviewees and also the timing of the survey immediately following the rainy season.

²³ The motorised borehole was not working at the time of the visit, however.

²⁴ A *girba* is equivalent to 80 litres of water (four jerry cans).

²⁵ A campaign started in 1993 began to establish a sense of community ownership by training social animators from different areas of Eritrea. Training in health education, establishing water committees, data collection and water needs assessment also took place. However, many trainees were subsequently diverted to national service and eventually the teams dissolved. There has also been preventive maintenance training as well as the provision of some tools and other items required for basic repairs. Other agencies including UNICEF focused on the Gash-Barka region and some smaller NGOs have also trained technicians to cover by motorbike basic maintenance within a 20km radius.

²⁶ Interview conducted with key informants from Sabonait in Goluj.

²⁷ Another woman added: "*The only difference between men and small children is that small children are harmless. They only cry when they are hungry, but men make their wives cry when they are hungry either by their poisonous tongues or sticks.*"

²⁸ In an attempt to encourage nomadic families to send their children to school the government has also established a few boarding schools in Gash-Barka.

²⁹ During other fieldwork in the region undertaken in 1998, one of the members of the research team was told by the regional health authorities that the government was aware of the weakness of its approach. A decision was taken to shift emphasis from hardware to manpower training in order to provide high quality health care. Unfortunately, the border war broke out a few weeks later and there was no time to implement the planned change in direction. But the fact that the regional Department of the Ministry of Health was aware of the weaknesses of its approaches, and underscored the importance of shifting emphasis, was an encouraging sign. (Kibreab, 1998).

³⁰ Livestock found in this area were automatically confiscated by the Ethiopian army.

³¹ The months of June, July and August are often referred to as the 'hungry season'. This is also the period in which the demand for family labour reaches a peak.

³² This has become a major problem in the Awash Valley, Ethiopia (see Nicol, 2000).

³³ This is in no small part due to the overlapping responsibility for supply development which exists between the MOA, MOLG, ERREC and the MLWE.

Annex

Workshop report

Sustainable Resettlement of Returnees and Water Resources Management in the Gash-Barka Region: Project Workshop

A one-day workshop was held in Asmara at the Selam Hotel on 30 July, 2001. It was attended by 40 people representing the: Ministry of Land, Water Resources and the Environment; Ministry of Agriculture; Ministry of Local Government; Gash-Barka Regional Government; Anseba Regional Government; Eritrean Rehabilitation and Refugee Commission; Eritrean Community Development Fund; Water Resources Department; Department of Environment; University of Asmara; The World Bank; the Food and Agriculture Organisation; World Food Programme; European Union Delegation; United Nations Development Programme; UNHCR; UNICEF; Oxfam and Save the Children Fund (UK).

His Excellency Mr Wolde-Michael Gebre-Mariam, Minister of Land, Water and Environment, opened the workshop. After emphasising the importance of the study and its potential to contribute to greater understanding of the complex problems relating to natural resource management, including water, he stated:

“... a major part of Eritrea’s current social and economic development efforts target the Gash-Barka Region for good reason. In addition to its varied natural endowments, the region is home for tens of thousands of Eritrean returnees who have been settling there in the last few years. These returnees bring with them considerable skills, experiences and livelihood strategies. But their arrival also poses a challenge to the effective management of natural resources in the area. Therefore, we must all be committed to ensuring that approaches taken to meet these challenges are the most appropriate for reducing poverty and protecting our natural environment”.

Adding further,

“The study which will be presented in this workshop will attempt to do just that. It takes as its central focus the need to deeply understand these particular challenges, and strives to explore effective ways of addressing them. Your input today will therefore provide the researchers with significant guidance in building policy recommendations into their work”.

He underscored the importance of improved rural water supply in rural development and post-conflict reconstruction efforts.

After the Minister completed his opening remarks, the Chair was handed over to Mr Wolde-Gaber Kidane, Senior Policy Officer, Food and Agriculture Organisation (FAO), Regional Office, Zimbabwe. Each of the four members of the research team presented papers focusing on different aspects of the project. The first paper presented by Dr Gaim Kibreab (South Bank University, London) focused on the:

- theoretical framework of the study;
- methodology and data sources;
- assumptions underlying the Eritrean Government’s rural water supply programme; and
- key research questions.

The floor was then open briefly for points of clarification and later proceeded to the second presentation. Dr Yemane Zekarias made the second presentation from the MLWE. Dr Yemane’s presentation focused on the:

- need for a water resource database;
- policy issues;
- inter-agency co-operation;
- efficiency and sustainability.

The third presentation was by Dr Seife Berhe, from Global Resources, Asmara. His presentation focused on the:

- provision of rural water supply in Gash-Barka Region from a historical perspective;
- weaknesses and strengths of the current approach;
- constraints and opportunities; and
- management problems.

Following the break, a fourth paper by Dr Alan Nicol of the Overseas Development Institute (London) was presented focusing on the major findings of the study, particularly emphasising the:

- benefits accruing from improved rural water supply;
- relationship between returnees and local residents;
- livelihoods;
- environmental impacts of improved rural water supply;
- impact of watering points on settlement patterns; and
- the consequences of such changes on land use practices.

The open discussion that followed focused on key issues of the presentations and other related matters. The Minister of Agriculture, Mr Arefaine Berhe, after congratulating the presenters on their thought-provoking perspectives and useful research findings, urged the workshop participants to be solution-oriented. He argued that though critiques of existing policies and practices are important, it is equally important to suggest alternative solutions to existing problems. He expressed his hope that the research findings and the deliberations of the workshop would contribute towards policy formulations that would ensure sustainable use of the country’s natural resources.

The most important issues that were debated intensively were the lack of national policy on water, the paucity of data on the country’s water resources potential, the lack of

definitions of roles and responsibilities of line ministries involved in rural water supply, and the consequences of these issues on efficiency, cost-effectiveness and the sustainability of water supply systems. It was emphasised that six government branches – namely MLWE, the MOH, MOA, MOLG, the Gash-Barka Regional Government and the Eritrean Rehabilitation and Refugee Commission were all involved in rural water supply. None of the agencies' responsibilities and roles was properly defined, however. This was partly reflected in the overall absence of legislation and a regulatory body that could, *inter alia*, set rules on water tariffs. In addition there needed to be a more holistic approach, with many participants observing that the supply of water was dealt with in isolation from overall environmental issues. Also important was the absence of secure property rights, which had significant consequences for access to, use and the sustainability of water and other renewable sources.

The presence of representatives of different stakeholders, donors, academics and policy-makers with varying national and international experiences enabled the workshop to reflect on the complex inter-relationships between rural water supply, livelihoods, environmental sustainability, food security, community empowerment and gender-based social division of labour.

After lunch, the participants divided themselves into four thematic working groups: institutional capacity and constraints; environment; resettlement of returnees and water resources; and water policy issues. Each working group was asked to identify five key issues in their respective themes for presentation to the plenary. The findings were presented under the chairmanship and facilitation of Mr Matheos Woldu of the World Bank, West Africa Regional Office.

After discussion of the key issues in the plenary, the workshop participants were asked to identify the five most critical issues for government, community and agency actions (see Table 4.). The following five recommendations were adopted by the plenary:

1. development of a national database;
2. establishment of a clearly defined national water policy;
3. enactment of a water law and establishment of an autonomous regulatory body;
4. encouragement of diversified sources of economic activities in order to enhance livelihood security and relieve pressure on the environment;
5. building local knowledge, organisations and livelihood strategies in to the planning, design and implementation of resettlement programmes for returnees.

Each of these recommendations was discussed and finally adopted as recommendations of the workshop. Following a summing up by the chairperson, Dr Kibreab concluded with remarks on the 'way forward' in which he emphasised that the study should lead to a more comprehensive inter-disciplinary research project involving local and international researchers.

Closing of the workshop

Mr Mebrahtu Iyassu, Director-General, at the Ministry of Agriculture, formally closed the workshop. He congratulated the research team, the various ministries and government agencies, the international UN organisations, NGOs and other participants on their open, frank and knowledgeable contributions and on raising issues of critical importance for the country's reconstruction and development efforts. He also urged the research team to continue their research efforts in collaboration with local institutions, including the line ministries and the University of Asmara.

Workshop participants list

Name	Institution	Location
1. W/Michael – G/M	MOLWE, Minister	Asmara
2. Arefaine Berhe	MOA, Minister	Asmara
3. Mebrahtu Iyassu	MOA, Director-General	Asmara
4. Tesfay Tekle	MOLG – Anseba	Keren
5. Sankei Ketin	WFP Gash-Barka	Barentu
6. Antonguilio Marin	EU Delegation	Asmara
7. Mehreteab Tesfon	Uni. of Asmara	Asmara
8. Abraham W/abzghi	MOA (Animal Resources)	Asmara
9. Tesfom Haile	MoLWE (Dept of Env.)	Asmara
10. Ghirma Bokretsion	ERREC	Asmara
11. Okbay Aferwerki	UNHCR	Asmara
12. Harnet Bokrezion	Uni. of Mainz, Germany	Asmara
13. Maaza Abraha	MOA	Asmara
14. Saba Tesfamichael	UNDP	Asmara
15. Yekealo Mebrahtu	ERREC	Asmara
16. Yemane Tekleyohanes	MOA (NFIS)	Asmara
17. Woldeglaber Kidane	FAO, Harare	Zimbabwe
18. Dr Festo P. Kavishe	UNICEF	Asmara
19. Matheos Woldu	World Bank	Asmara
20. Ogbaghebril Beraki	Uni. of Asmara	Asmara
21. Zemen Fes Tsighe	Uni. of Asmara	Asmara
22. Asmeret Asefaw Berhe	Uni. of Calif., Berkeley	Asmara
23. Jacob Yohannes	MOA	Asmara
24. Misghina G. Sellasie	MOLG	Asmara
25. Lemma H/Mariam	MOLG (Anseba Region)	Keren
26. Kahsai Abraha	ECDF	Asmara
27. T/Berhan-Leul	ECDF (Gash-Barka)	Akurdet
28. Dr Bissrat Ghebru	Uni. of Asmara, Ag Coll.	Asmara
29. Erik Toft	UNICEF	Asmara
30. Asmerom Mengisteab	Dept. of Environment	Asmara
31. Dawit Hagos	ECDF	Asmara
32. Yemane G/Sellassie	ECDF	Asmara
33. Yodit Huruy	UNICEF (WES)	Asmara
34. Temesghen Berhe	Oxfam	Asmara
35. Solomon G. Selassie	Save the Children UK	Asmara
36. Amanuel Negassi	MOA	Asmara
37. Mogos W/Yohannis	MOA	Asmara
38. Geoffrey Mugumya	UNHCR	Asmara
39. Senait Habte	Save the Children UK	Asmara
40. Emanuel Ablo	World Bank	Asmara
41. Yemane Zecarias	MLWE (Dept. of Water)	Asmara
42. Seife Berhe	Global Resources	Asmara
43. Gaim Kibreab	South Bank University	UK
44. Alan Nicol	ODI	UK

Table 3. Workshop working groups: Summary table

Working Group 1: Institutional capacity and constraints	Working Group 2: Environment	Working Group 3: Resettlement and Water Supply	Working Group 4: Water Policy Issues
<p>Issues</p> <ul style="list-style-type: none"> • a lack of institutional structures with clear responsibilities and mandates has resulted in duplication of work and wastage of human and material resources; • a lack of capacity to implement and co-ordinate activities (e.g. MOLG, ERREC take the decision to resettle returnees but have no technical capacity); • weak private sector; • no proper framework for community participation; and • lack of understanding (awareness) towards long-term implication of resettlement in the environment. <p>Solutions</p> <ul style="list-style-type: none"> • roles and responsibilities of stakeholders have to be identified; • the capacity of MOLG at regional level has to be strengthened; • financial support, capacity building, free atmosphere for competition; and • community participation should be seen as a goal rather than as a means of development. 	<p>Issues</p> <ul style="list-style-type: none"> • lack of environment impact assessment (EIA); • villagisation versus nomadism; • intensification of land use and overuse of water resources; • sanitation; and • lack of co-ordination and participation. <p>Solutions</p> <ul style="list-style-type: none"> • use existing research results; • establish national EIA procedures; • undertake resource inventory and carrying capacity assessment; • be demand-oriented; • ensure careful site selection; • proper land use classification; • protection of nature reserves, archaeological sites, etc; • increase agricultural productivity measures with proper soil and water conservation; • develop non-agricultural sectors; e.g. off-farm income-generating activities to relieve pressure from renewable resources; • environmental education; • planned solid and liquid waste disposal; • identification of stakeholders (assessment); • participation (with predefined duties and responsibilities); and • sustainable institutional coordination. 	<p>Combined issues and solutions</p> <ul style="list-style-type: none"> • assess water needs of resettlers; • drinking water covers people and livestock; • water for irrigation and other income-generating activities in resettlement areas; • assess water potential of resettlement sites; • may involve overall site selection and planning of resettlement; • development, use and management of water supply systems; • community participation in the overall planning, development, design and management; • identification of options that are cost-effective and sustainable; • environmental sanitation and control of contamination; • consultation with host communities; • integration of local knowledge in water development; and • use of gender-sensitive approaches in water development. 	<p>Combined issues and solutions</p> <ul style="list-style-type: none"> • consolidated and comprehensive water policy; • appropriate legal framework covering development, use, management; • detailed study leading to a National Water Master Plan review; • establish regulatory body; • develop regulatory policy on protection, conservation and utilisation; and • set policy objectives on: <ul style="list-style-type: none"> • right to water • water tariff, pricing, etc. • setting time frame; • attainable objectives • master planning • tariffs • legal frameworks • assessment • regulation.

Water is a key resource in the Gash-Barka region of Eritrea. Provision of water needs to cover both the livelihoods needs of returnees and of stayee communities if the process of return and reintegration is to succeed. Yet the dynamics of resource use and future demand need to be better understood including how usage in particular areas can have considerable impact on livelihoods and the environment. Drawing on extensive knowledge of the region, the authors examine the process of return and reconstruction of livelihoods and argue that whilst important progress has been made in facilitating return and reintegration, a longer-term strategy is required to ensure sustainable resource use that both promotes people's livelihoods and protects the environment.

Dr Gaim Kibreab is in the Department of Development Studies at South Bank University and has published widely on a range of issues relating to the environment and refugees in the Horn of Africa.

Dr Alan Nicol is Head of the Water Policy Programme at the Overseas Development Institute in London and has extensive experience of water resource issues in the region.

Dr Seife Berhe is Director of Global Resources Consulting based in Asmara and has worked on many aspects of water supply development in Gash-Barka.

Dr Yemane Zekarias is special adviser on Water Resources within the Water Resources Department



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