

**Maintaining a Fragile Balance? Community Management of
Renewable Natural Resources in Tigray, NE Ethiopia.**

by

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1. Introduction: Community Management of Renewable Natural Resources

The vast amount of literature on the experience of, or potential for, community management of renewable natural resources needs no introduction here (see e.g. Baland and Platteau 1996, for extensive analyses and discussion of key issues.). The origins of much of this literature lie in the debate over the so-called “tragedy of the commons” (Hardin 1968) and the huge literature which has addressed theoretical and empirical issues arising from the “tragedy” thesis. Although based on a misunderstanding of the nature of “common property”, Hardin’s paper at the least helped to generate a considerable body of work which set out (a) to refute the basic understanding of common property contained in the work of Hardin and other influential economic writing of the time (Coase 1960, Demsetz 1967), and (b) to present empirical evidence which would disprove the “inevitability” of the degradation of renewable natural resources in a “common property” setting.

As is now well accepted, the herding example used by Hardin to demonstrate the unsustainability of resource use under “common property” more accurately described a condition of open access or no property. Common property systems are managed systems, characterised by, inter alia, use of a resource by a specified group under conditions of access laid down by the group; exclusion of other potential users (except possibly under negotiated conditions); and rivalry in production and consumption (Stevenson 1991). In principle, common property systems can provide the basis for sustainable utilisation of the resource in a way which ensures sustainable livelihoods for the group of users: indeed these two objectives are implicit in the management arrangements observed in many common property settings.

Despite all the evidence and theoretical arguments aimed at refuting the “tragedy”, Hardin’s thinking has been reflected in actual natural resource policy in much of Sub-Saharan Africa for example (Swallow and Bromley 1995, Lawry 1990). The Botswana Tribal Grazing Lands Policy (TGLP) was a typical example, cited by Lawry, who points out that government documents introducing the TGLP at the time directly reflect Hardin’s arguments. In the Niger Delta Moorehead describes the processes by which traditional overlapping access rights to natural resources have been eroded both by more powerful groups with access to credit and other assets, and by the State (Moorehead 1989). In Brazil tropical rainforests have been cut down in vast quantities, in part supported by subsidies to the beef ranching sector (Feder cited in Dasgupta and Maler 1994).

There are different forces and interests at work in these examples: whereas Hardin advocated the need for the private market or a “strong central authority” as necessary institutional arrangements to prevent the “tragedy”, i.e. that privatisation or central control were the only options to prevent resource degradation, in many actual cases the reasons for privatisation have been more to do with realising productivity gains by a section of the community, than with resource protection.

The contrast between theoretical work and empirical evidence demonstrating the sustainability of resource management under common property systems on the one hand, and the introduction of policies or development projects which help to undermine common property systems, on the other, is striking. The large-scale

conversion of coastal wetlands in Asia and Latin America to prawn culture, which has high pay-offs in the short-term, but which is environmentally damaging, is a good example of this trend.

Therefore the sustainability impacts of privatisation of common property resources are ambiguous and not necessarily positive. As is also well known, there are in many cases adverse equity effects of privatisation (Dasgupta 1993). Therefore, both from a sustainability perspective and from an equity/anti-poverty perspective, attention has focussed on community-based natural resource management (CBNRM) as a means of meeting the joint goals of sustainability of resources and sustainable livelihoods. Much of the work on CBNRM involves building on “traditional” common property systems managed by local communities. Examples of these approaches include the well-known CAMPFIRE programme in Zimbabwe and Joint Forest Management programmes in India. In addition to the numerous examples of common property systems, there is an enhanced awareness of the importance of collective action to ensure resource sustainability at different spatial scales (McCulloch et al. 1998). There are many situations, particularly in respect of the sustainability of cultivable land resources, where common property resource regimes as such are not present but where collective action is a prerequisite for sustainable land management. Soil and water conservation within a catchment provides a typical example: in the absence of co-ordinated conservation efforts by farmers in the catchment, isolated attempts at conservation on individual farms are likely to suffer the external effects of other farmers who do not undertake conservation.

2. Poverty, land tenure and resource degradation

A pertinent issue in discussion of CBNRM is the relationship between poverty and resource degradation. The view that poor people are forced by poverty to degrade their environment is a popular one, expressed for example by the Brundtland Commission in “Our Common Future” (WCED 1987) and in numerous publications and reports since then. The conventional explanation is that because poor people are primarily concerned with survival, they focus on maximising short-run returns from their resources rather than optimising incomes over the long-term by following a sustainable production path. It is therefore stated that poor households tend to have high discount rates (Sutcliffe 1995, Shiferaw and Holden 1999). Field experiments and surveys appear to lend credence to this statement (Pender 1996, Holden, Shiferaw and Wik 1998).

An alternative “political economy” perspective is expressed by Broad (1994). Broad provides examples from the Philippines which suggest that it is often the non-poor – corporate interests, migrant farmers, immigrant miners with short time horizons – who are primarily responsible for environmental degradation, while the poor are in many cases careful stewards of their environment. However he suggests that there may be a category of “ultra-poor” who are forced to degrade their environment, often as a result of marginalisation.

Vosti and Reardon (1997) distinguish between “welfare poverty” and “investment poverty”; the former referring to the “conventional” poor as measured by income-based poverty lines. “Investment-poor” households may or may not be poor on the

basis of a poverty line, but may nonetheless have insufficient household-based assets to make land conserving investments; consequently their land is likely to be degraded. Vosti and Reardon present examples which indicate no clear causal link between poverty and environmental degradation.

Discussions of the link between rural poverty and environmental degradation often extend to a consideration of the influence of the land tenure system. It is often asserted that land tenure insecurity is a further cause of environmental degradation (e.g. Rahmato 1999): farmers without secure tenure will have high discount rates since they lack certainty about future income streams from the land. As a result they are unlikely to make land conserving investments or invest in new technologies: this situation is similar to the “investment-poor household” case, and resource degradation may again be the outcome. This argument is closely related to the “tragedy of the commons” thinking: it has led to considerable debate particularly in relation to land tenure reform in Sub-Saharan Africa in recent years (Platteau 1999), with some policy analysts recommending unrestricted freehold tenure as a necessity to encourage efficient use of land resources and dynamic adjustments in land ownership. Others (Platteau 1999, Rahmato 1999), while not disputing the benefits of tenure security, urge a recognition of the adaptive nature of “traditional” tenure systems and/or advocate more flexible types of tenure arrangements. Where freehold tenure is proposed, particularly in the context of an expanding rural population, this poses threats to common land used, for example, for grazing by pastoralist/agro-pastoralist populations. A growth in conflicts between agriculturalists and pastoralists has in some cases been one of the outcomes of such developments.

Given the interrelationships between poverty, land tenure insecurity and environmental degradation discussed above, despite uncertainty on the direction of the causal relationships, it could be hypothesised that an area with high levels of rural poverty and considerable recent tenure insecurity would be likely to display (a) high levels of resource degradation, and (b) limited evidence of collective action to address the degradation problem. The area of study in this paper, Tigray Region in the Northern Highlands of Ethiopia, provides a good test of these hypotheses, being an area of high levels of poverty, and also having been subject to considerable tenure insecurity, along with the rest of Ethiopia, since the mid-1970s when the Derg military regime overthrew the feudal monarchy of Emperor Haile Selassie and instituted land reform from 1975 onwards.

This paper presents case study material from four communities in Tigray Region.² The paper focusses primarily on common property arrangements in four communities in Eastern Tigray, and explores the extent to which such arrangements persist and adapt in the face of poverty and tenure insecurity. One issue which emerges from the case studies is the pervasiveness of common property/collective action arrangements, and the variation in the nature of these arrangements over a small spatial scale. For example, within a single sub-catchment one finds hillslopes which are passively managed (neither fully open access nor common property), intensively managed common grazing areas, privately operated farm land but with seasonal post-harvest access rights for grazing, and community-managed irrigation systems. The existence of such a mix of tenure arrangements in close physical proximity belies the notion that

² The data were collected during fieldwork towards an as yet unfinished PhD.

there is an evolution of tenure systems, inevitably towards a single type, that of private property. Instead it suggests that there may be specific reasons for a particular tenure regime in a specific location, for example connected with the physical nature of the resource in question, real economic benefits accruing from a particular tenure system, or community-level beliefs on the appropriate way to manage particular resources based on values of, for example, equity and resource sustainability.

3. Tigray Region

Tigray Region is in the north of Ethiopia, with a total land area of about 80,000 sq. km., 65% of which is cultivated. From an agro-ecological perspective it is characterised by sparse and irregular rainfall, and is highly drought-prone. The topography of the area varies from about 1500 metres a.s.l. in the north-east to about 3000 metres a.s.l. in the south-west. Rainfall varies significantly, from about 200 mm in the north-east to almost 1000 mm in the south western highlands (Hagos and Haile 1997). Most rainfall occurs in the *meher* or *kremt* season during June-September; some areas also have small (*belg*) rains in March-April. There are major annual fluctuations in rainfall.

Total population in the Region in the 1996 Census was 3.14 million. Land productivity is generally low and land holdings small, on average 0.84 hectares per household.³ Given these facts, allied to the variability in rainfall, it is not surprising that Tigray Region as a whole, but particularly its Eastern and Southern Zones, are areas of chronic food insecurity. A survey in Central Zone found that about 82% of the population were food insecure (REST/NORAGRIC 1995, reported in Hagos and Haile 1997). In the Eastern Zone, even in a good production year upto 50% of the rural population is in food deficit and needs food assistance.

Various reports emphasise that, in addition to the problem of small landholdings, there are severe perceived problems of natural resource degradation. There are various estimates of the rate of soil erosion quoted in a recent report of the Tigray Region Bureau of Agriculture and Natural Resources.⁴ These estimates range from 18 tons/ha/year (Getachew 1988), to 42 tons/ha/year as a national average for cultivated lands (Hurni 1988), to 100 tons/ha/year (Ethiopian Highlands Reclamation Study 1986). Tigray-specific estimates include an estimate of 80 tons/ha/year (REST 1996), 122 tons/ha/year (Nyssen 1996) and as high as 135 tons/ha/year (Lundberg and Naslund 1995). The most commonly cited estimates are 30-70 tons/ha/year. Hurni (1988) states that 40-60% of soils in Tigray are only 20 cm deep, resulting in much reduced water retention capacity and reduced land productivity. Fallowing has been severely curtailed, inducing a further decline in productive capacity.

In addition to soil erosion, deforestation has been a long-term process in Tigray such that no more than 1% of land is now forested. Reasons given⁵ by farmers for the acceleration of deforestation during the 20th century include:

³ Central Statistical Authority, Agricultural Sample Survey 1997.

⁴ Tigray Region Bureau of Agriculture and Natural Resources, Tigray Soil and Water Conservation Action Programme Draft Main Report, Mekelle August 1997.

⁵ Tigray Region Bureau of Agriculture and Natural Resources, Tigray Forestry Action Programme, Main Report, Vol. I, Mekelle December 1996.

- The timber-intensive nature of house construction in Tigray
- Encroachment and shifting cultivation (particularly in Western Zone)
- Military settlement
- Fuelwood trade and charcoaling
- Drought
- Wasteful use of forest products
- Population pressure
- Free grazing system
- Flooding.

However, the case study areas of Era and Derge-Agen discussed below indicate that, despite the pressures, there are management arrangements which are adjusted to ensure sustainable forest utilisation.

The Tigray Highlands agrarian economy is dominated by a mixed crop-livestock system; livestock are crucially important for a variety of reasons: as plough animals, as a source of products (milk, meat, skins etc.), as assets which can be converted to cash at short notice (particularly small livestock, i.e. sheep and goats), as pack animals (donkeys, camels), etc. Livestock are a key resource⁶, and so therefore are grazing lands. The Livestock Development Report indicates that in the high and mid-altitude land areas of Tigray, natural (common) grazing provides about 35% of animal feed resources. However the Report notes that the grazing areas are severely eroded: current carrying capacity is estimated at 2.3 ha/TLU, while the optimum required is 6.2 ha/TLU.⁷

The aggregate data for natural resource degradation in Tigray suggest serious negative trends, which might be indicative of a “tragedy of the commons” process. However, closer examination of specific examples indicates the extent to which, at household and community level, people attempt to maintain a “fragile balance” with the natural resources on which they depend to a great extent. The next section presents the case studies which indicate the extent to which such a balance is being successfully maintained.

4. The Study Areas: A Variety of Common Property Arrangements

The field study locations were as shown in Table 1.

⁶ The Tigray Livestock Development Action Programme provides data for the livestock herd in Tigray of approximately 1.2 million cattle, 259,000 sheep, 304,000 goats, 367,000 equines, 34,000 camels. Tigray Region Bureau of Agriculture and Natural Resources, Mekelle, July 1997.

⁷ Tigray Livestock Development Action Programme, *ibid*.

Table 1: Study Areas and Key Resources

Location	Kushets (villages)	Resources
Birki	Birki Adengar	Irrigation Common grazing Hillslopes
Addis Zemen	Gueguna Muguma	Watershed Individual grazing Irrigation Hillslopes SWC
Era	Enguleita Adi-Tsakla Errere	Forest Common grazing Hillslopes Micro-dam
Aragure	Aragure Endamichael	Forest Common grazing Hillslopes

The selection of field locations was determined primarily by the fact that they were characteristic of different types of common property resources. In relation particularly to Birki and Addis Zemen, the locations were also typical of landscape-level variations which create collective action problems.

The field locations, and particularly their common property characteristics, are described in more detail below.

4.1. Birki

The Birki River flows from the eastern escarpment of the Eastern Zone of Tigray. It is a perennial river but flows are extremely low in the dry season. Near to the small town of Agula, an area of some 150 hectares is intensively cultivated by a group of about 600 farmers who have developed a “traditional” irrigation system based on gravity flow. Water allocation is strictly regulated, as described below.

In the study area there were two *tabias*⁸, Agula and Birki, but under the recent administrative reform in Tigray (1995), these *tabias* were joined into one named Mesanu. The *tabia* comprises five *kushets* (villages), namely Kotakti, Birki, Adengar, Gebgeb, and Adi-Karir. Out of these five *kushets*, Birki and Adengar were selected for in-depth analysis, as being representative of an upstream and downstream location respectively.

The “traditional” irrigation system has evolved over a long history going back, according to local farmers, to about 1913 when a severe drought prompted tenant farmers labouring under the *rist*⁹ tenure system to divert water from the Birki river to

⁸ a *tabia* is the Tigrigna term for *kebele*, the lowest unit of State administration, equivalent to a ward, with which the Derg-initiated Peasant Associations were linked.

⁹ The *rist* tenure dominated the Tigray tenure system until it was abolished in the 1975 agrarian reform. The system “conferred inalienable usufructuary rights equally on all living members of a cognatic descent group tracing its lineage to a certain pioneer father, who is credited with establishing a recognised claim to a well defined unit of land” (Admassie 1997).

irrigate their land. A first diversion of the river was constructed at that time. Crop sharing arrangements at the time were on a 50:50 basis. During another drought, around 1955, another diversion of the river was constructed upstream of the original diversion. Initially, both upstream and downstream communities were to use the same canal, but after some conflict, the local court ruled that the two separate diversion canals should be used. The lower canal was however damaged in a flood in 1967, resulting in a return to the original arrangement. A smaller, third diversion, was later constructed downstream of the first diversion, but irrigates a smaller area.

Farmers have some recollection of the circumstances of the development of the second river diversion. Farmers petitioned the *rist* owners and the woreda court head to allow them to irrigate rented land during a severe drought. This was agreed, and tenants appear to have won some rights to longer-term leases as a result of investing in irrigation channels. Before the drought, the conventional rental agreement was a 50:50 crop sharing arrangement; once the tenants had started irrigating, they decided that the *rist* owners would get only a ¼ crop share, otherwise the tenants would refuse to plough. This continued for two years, but then a few farmers “broke ranks” and the system reverted to 50:50 on irrigated land, and ¼ on rainfed land. The readiness of the tenant farmers to exercise collective action to raise their share of the crop is an interesting indication of a wider cohesion which is manifested in the operation of the irrigation system.

Nonetheless, it appears that under the *rist* system during the Haile Selassie period, since land was divided unequally, so also was access to water, and a large number of poorer households had little or no access to irrigated land.¹⁰ It took the land redistributions starting in 1975 to bring about a situation of more equitable and broadly based access to irrigation water.

The chronology of land redistribution illustrates the dramatic change in land ownership structures which has taken place since the overthrow of the Haile Selassie regime:

1974 – the land proclamation: land belongs to “the people”

1975 – first land reallocation, including landless households: but not equal shares

1977 – land equally divided

1981 – further land redistribution to accommodate new household heads and others

1990 – land resharing by the new TPLF government¹¹, including further reallocation to landless.

As a result of these redistributions, the distribution of land holdings amongst land-owning households is highly equitable, but there is at the same time a considerable proportion (about 25% in the Birki study area) of “new” landless households as a result of the decision after 1990 not to consider further land reallocations. The new landless are largely returned settlers from the forced settlement of the Derg era, people returning after the civil war, and young households formed after 1990.

¹⁰ An elderly and respected Priest in the kushet estimated that only about 20% of households owned land in the later Haile Selassie period, with the remaining 80% being either tenants or households dependent in some manner on the *rist* holder.

¹¹ Tigray Peoples’ Liberation Front.

The growth of population resulting in increased demand for water, increased access to water as a result of land redistribution, and apparently secular decline in river flows due to the long-term tendency towards drought, have all necessitated a more “active” system of water management in the irrigation system. A number of characteristics of this system can be noted:

- ◆ It is not a system based on total equity: upstream users have prior rights over downstream users under conditions of water shortage. This right was confirmed by the local court

- ◆ The system has changed in recent years as a consequence of the TPLF land reform, which reallocated land so that farmers would in general hold all their land in the same *kushet*, rather than being scattered: as a result, farmers no longer had land in both upstream and downstream locations, and the upstream farmers became more reluctant to share water

- ◆ Nonetheless, a detailed system of water sharing has developed in the two locations. Upstream, 16 groups each of 20 farmers have been formed for the purpose of water allocation, and 11 groups of 20 farmers have been formed downstream. A water committee has been established in both upstream and downstream locations, comprising group leaders from each group. Representatives of the upstream and downstream farmers meet to discuss water sharing arrangements during the season

- ◆ The main task in ensuring the physical operation of the irrigation system is the annual reconstruction of the river diversion dam and the re-excavation of the main channel. Downstream farmers join in this work to strengthen their claim to water during the season

- ◆ The system of water allocation between farmers is rigidly controlled, especially during periods of low flow resulting from low rainfall. In general, each group will get water approximately on a monthly basis – the frequency depending on the severity of water shortage - , and each farmer is entitled to receive water for 2 hours during each period. These allocations are checked by the group leader, and any out-of-turn taking of water is penalised

- ◆ In recent decades, the system of water allocation has shifted as pressure on the resource has increased: for example, before the upstream diversion channel was constructed, the number of water users was relatively small, and farmers got water as and when needed, according to the state of the crop. In the past downstream farmers used a lottery system to decide which farmers would get water at which time. As water demand has increased, the group system described above has been developed, with tight control on individual water use

- ◆ Under conditions of water scarcity, the upstream communities exercise a prior right, but there is considerable discussion and negotiation between upstream and downstream communities before water flows downstream are fully restricted. Under normal flows, some water is allowed through the river diversion dam to remain in the river channel and be diverted downstream. Once flows become critically low, this flow through the diversion dam is blocked, thereby diverting all flow into the upstream canal. During the drought year of 1997 for example downstream communities had obtained a water pump to try to pump up what remained in the main river channel

- ◆ If water is insufficient, farmers within the downstream groups make arrangements to share their right to water: for example, a farmer further away from the main canal will share his right to receive water with a farmer who is closer to the canal, so that only the land of the latter farmer will receive water –

the allocation for both farmers – and they share the output and crop residues 50:50. Therefore in general there is an attempt to combine equitable water sharing with a pragmatic recognition of the critical need to produce an adequate crop on at least some land.

The area includes two additional common property resources: common grazing land (*hizati*) and common hillslopes. The *hizati* are closely controlled common grazing areas which have a long history. During the Haile Selassie period, the grazing area was large and was generally controlled by the *rist* owners: tenants could use the *hizati*, but the *rist* owners decided on the number of days' grazing allowed. After the takeover by the Derg and the land proclamation, whereas access to the *hizati* was more equitable, access rights were not clearly limited to the specific *kushet* where the *hizati* was located. After the TPLF takeover, however, each *kushet* was given the right to control the *hizati* in its own area. Therefore, over time, there has been a process on the one hand of expanding access, and on the other hand of localising control. The latter process is a response to recognition of the need for more active and intensive management of *hizati* areas.

In the two *kushets* selected for detailed analysis there are three *hizati* areas, managed at *kushet* level. In general, only oxen are allowed to graze on the *hizati* in this area due to their importance in the crop-livestock system and due to the shortage of grazing land. Grazing is generally allowed from end of January to mid-July and is closed thereafter, unless there is a drought year in which case it may be opened again.

The period of access is determined by a committee at *kushet* level and is clearly enforced. In Birki, two guards have been selected to protect the *hizati*, and penalties are imposed if access rules are broken: if someone tries to graze animals deliberately outside of the season, they are charged Birr 6, or taken to the local court. If grazing takes place by accident, they are charged Birr 0.1 per head of cattle.

In the Birki area, the large number of landless or oxen-less households resulting from returnees and from new families, have been proposing that the *hizati* land should be divided equally to all households, as is the practice in some other parts of the Region. This would allow them access to small areas of land from which they might be able to graze their own oxen and/or sell grass cut from the area. However, after meetings on the issue, it was agreed to maintain and if possible even expand the *hizati* area: oxen-less households with access to land would be supported by being provided with an oxen-pair at ploughing time.

Common hillslopes are less actively managed compared with *hizati* areas, even though they are important as areas for grazing of all other animals at all times of year. This difference in the level of active management in respect of common hillslopes is also a reflection of the historical evolution of tenure. During the Haile Selassie period, hillsides were in general not common property, but were part of the *rist* land. There was deforestation at this time but there were attempts to control the extent of deforestation. During the Derg regime, there was lack of clarity concerning tenure particularly of trees, and as a result considerable deforestation took place. Much of this was on hillslopes which are now mostly denuded of trees. After the TPLF takeover, management of common hillslopes has been given to the *tabia* level and

cutting of trees is forbidden: but in Birki there is still a sense that the hillslopes belong to the whole *tabia* and therefore may be used by all *tabia* members. Local informants point out that if someone from the same *tabia* is observed cutting a tree, no action may be taken. The same people express the belief that management at *kushet* level would be more effective and, for example, could allow for revegetation activities at that level.

4.2. Addis Zemen

Addis Zemen is a *tabia* directly east of the town of Edagahamus and south of Adigrat, the Eastern Zone capital. It exemplifies some of the collective action issues arising in relation to “economies of configuration” (Gottfried et al. 1996) at the landscape level. It also exemplifies a situation of mixed tenure where different resources are managed under different tenure systems. In physical terms, the area comprises a substantial watershed (catchment area estimated at about 2,000 ha.) and a valley floor used for grazing where gullying has become a significant problem. Other relevant characteristics of the area include the existence of a “traditional” irrigation system which in recent years had broken down due to the gullying problem, the existence of individualised grazing land, severe deforestation in the upper catchment and surrounding hillslopes, and some soil and water conservation works.

Two *kushets* were selected for detailed analysis, Muguma and Gueguna. Households living in Gueguna are generally above the gully, and those in Muguma are generally living around and below the gully.

The area has experienced the same sequence of land reform changes as described above in Birki. During the Haile Selassie period, there were two main *rist* owners, and most non-*rist* farmers were tenants. The Derg land reform abolished the *rist* tenure system and land was divided equally. Land sizes are small (mostly less than 1 hectare) and declining due to high population densities.

Grazing land in this area is owned individually in tiny plots. Elderly informants note that this privatisation of grazing land has been in existence since “before their time”: reasons given for it include that the area, being on the valley floor, is marshy, and free movement of livestock would result in trampling of grass; and that every household in the area is entitled to a portion of the land, whether they have livestock or not. Further discussion with elders revealed that during the brief colonial period of Italian occupation (1935-40), households were required to pay a land tax, but some were unable to pay. Some of these households would borrow money to pay tax in exchange for grass, and eventually the practice of selling grass directly emerged.

During the Haile Selassie period, *rist* owners held a significant proportion of grazing land. After the Derg takeover, *rist* land was abolished and the land, including grazing land, was divided equally. However, continuous household growth has meant that the size of grazing land has diminished significantly: for example, in the initial land reform under the Derg, a single plot of land was divided, first amongst six households, then amongst eight. When the TPLF took over in 1991, they further divided the land between ten people. Individual plots of grazing land are now in the order of 0.015 hectares in area, resulting in very intensive stocking levels.

Despite the fact that grazing rights have been individualised, the grazing area as a whole is closed twice during the year to allow for grass regeneration: from mid-July to end-September when some grass is harvested to make hay, and again in end-January to end-May, when the area is closed and irrigated. During the open periods, only cattle are allowed to graze.

Households with cultivable land and no livestock are allocated grazing land, whereas households with livestock and no land are not. Some of the former households rent-out their grazing land.

Some respondents described the perceived advantages of individualised grazing as :

- Everybody can make use of the grazing area as they want, for instance to make hay under a cut-and-carry system
- Individuals try to avoid overgrazing more than if the land was commonly owned
- Households lacking livestock can nonetheless get access to grazing land, if only to rent it out or sell the grass.

In the downstream area, in Muguma *kushet*, a major gullying problem has arisen which has destroyed a significant proportion of grazing land. Farmers from both Muguma and Gueguna have grazing land in this area. The history of the development of this gully appears to indicate a lack of community cohesion in contrast to the situation prevailing in Birki. The gully appears to have started forming around 1956-57 in individual cropland. Since the land was individually owned, there was no collective incentive or interest in carrying out preventive works. Only when the gully began to affect grazing land did farmers become concerned and attempted unsuccessfully to control the gullying by building a control structure in 1975-76: this was washed away however and no further action was taken for long periods. Appeals to the Government to take action went unheeded. During the 1980s it appears that the gully did not expand significantly, but from 1991 onwards serious erosion resumed. Some respondents put this down to the intensification of the civil war between the Derg and the TPLF, resulting in a basic neglect of conservation structures upstream and an increase in deforestation, resulting in turn in increased run-off from the large catchment area. One consequence of this neglect of the gully has been the destruction of a main irrigation channel which conveyed water downstream to a “traditional” irrigation system for about 250 users. A further impact has been the major loss of grazing land. Local farmers indicate that in the 1960s average livestock holding per household was about 100, and is now about 5 per household (Shah 1997).

The lack of a sustained effort to control the gullying problem is notable, and may be connected to the fact that farmers from the two *kushets* both have grazing land in the area, although farmers from Gueguna *kushet* do not live directly adjacent to the gully and generally do not get involved in maintenance of it. There appears to be a lower level of co-operation between these two communities, based on an atypical situation where two communities are effectively sharing the same resource. Even where the resource may be quasi-privatised, the apparent inability to co-operate and undertake collective action creates obvious externalities amongst all users.

The area has a further interesting recent history in regard to upstream deforestation, which is probably a major cause of the gully problem. Addis Zemen is dominated by a sheer escarpment of red sandstone which serves as a catchment for the area. This area was, according to informants, quite densely forested up to the end of the Haile Selassie period. During the Haile Selassie period, trees were cut down but mostly by local villagers, who tended to protect the forest from outsiders. When the Derg regime took over and instituted land reform, there was lack of clarity over tree tenure, and many outsiders came to the area to cut trees. As one elderly informant noted, local people had to cut down the trees themselves to prevent outsiders from benefitting from them first. Cutting of trees on the steep slopes adjacent to the gully area also seems to have intensified in this period until the Derg regime managed to establish control over such issues. This appears to support the hypothesis that abrupt changes in the nature of tenure systems can influence the rate of environmental degradation, since any “traditional” management rules break down: this represents a move effectively from a common property system to open access.

During and after the Derg period, soil and water conservation works were implemented on the upstream catchment and on some of the surrounding hillslopes, by mass mobilisation. These hillslopes are nominally community-owned but there is little sense of ownership since tenure has not been clarified. Some guards are now employed to prevent further deforestation on upper hillslopes, particularly in zones where area enclosure has been implemented.

4.3.Era

Era is a tabia in the easternmost part of Eastern Zone in Atsbi-Wonberta woreda, and includes areas of the Dessa’e Forest, the last remaining significant forested area in the zone. The tabia comprises four *kushets*, namely Enguleita, Adi-Tsakla, Errere, and Adishidi. The first three of these were taken as sample *kushets*.

As with the other field locations, Era contains specific examples of common property resource systems, in this case in respect of forest areas, grazing land, and common hillslopes. A micro-dam has also recently been constructed in the area which in principle presents the opportunity to observe any changes in tenure arrangements as land productivity increases. In practice no such benefits had accrued when the field research was being undertaken. Nonetheless, farmers are concerned about the loss of land due to digging of irrigation channels, and the potential conversion of *hizati* land to arable land.

People living in the *kushets* in Era live close to but on the western side of the forested area, which still covers much of the hilltops and the eastern hillslopes. Further to the east lies the border with Afar Region, and this is significant in this area since there are a number of conflicts with the Afar particularly in relation to grazing rights.

Although the area is a mixed crop-livestock area, livestock are the key economic resource and source of income. Since the area is increasingly drought-prone, crop failure is regular and to some extent anticipated. Communities appear to be confident that food aid will be delivered in the event of crop failure, and they are more concerned to ensure that enough water is available to keep their livestock watered. In

this respect, farmers appear to regard the key benefits likely to accrue from the micro-dam as water retention for livestock rather than irrigation for crop production, particularly since they doubt whether irrigation will be possible in most years in this drought-prone location. However the construction of the dam and irrigation channels has resulted in some reduction in the grazing land.

Income from livestock is in the form of direct livestock sales to local significant markets in Wukro, Atsbi and Dessa'e, and in the form of sales of milk, butter and cheese. Milch cows as well as oxen are therefore important, and access to grazing land is vital. These communities are in a better position than many others in the zone in this respect, due to the availability of good quality grazing land in the forested area. This is reflected in higher levels of livestock ownership per household compared with the typical ownership levels in the zone. These communities have both *hizati* grazing areas, used for oxen only, and also relatively extensive grazing areas inside the forest, used for all livestock. There are four *hizati* areas in the locality, shared by three *kushets*: three of these areas are in the cultivated zone (and might be affected by the micro-dam if it reaches full development), while one *hizati* area is in the forest. Some farmers believe that each of the *hizati* areas in the cultivated zone should be distributed to the respective *kushets* nearest to them, to reduce the grazing pressure on the *hizati*.

The *hizati* area is open for grazing by oxen from mid-January to end-June in "normal" rainfall years, i.e. non-drought years; all animals can then graze from end-June to end-August, after which the *hizati* is closed. From end-August, all animals go to the forest area to graze. The community uses a "zerra" system of guarding the grazing area: guards are selected by the community, and are entitled to levy fines of upto Birr 5 per head of cattle on any person who allows animals to stray onto the *hizati* area out of season. One person is also nominated to supervise the guards, and can fine them if they allow animals to stray onto the area. As in the case of Birki, farmers without oxen are provided with oxen during the ploughing period, in part compensating them for not having access to the *hizati* land.

The area has been affected by conflict between the local community and Afar herdsmen: the conflict appears to have been fuelled by political developments. Prior to 1974, the Tigrayan highland population were dominant in the forest area bordering Afar, but the Derg regime, which came to power in the 1974 revolution, gave support to the Afar who in turn started to move into the forest area to use it for grazing purposes. The original control exerted by the highland communities was weakened.

After the overthrow of the Derg, the highland communities have again established control over the forest area, but this is occasionally contested by Afar herders, particularly during drought periods. Furthermore, whereas the *hizati* area in the forest was more extensive in the past, the highland communities are now trying to re-establish this area, since the current *hizati* area is considered inadequate for the large number of oxen in the area. This is not easy however, partly because of the time that elapsed when such control was not possible, and partly because of the continued sporadic conflict with the Afar.

In addition to the *hizati* areas and grazing land in the forest, cropland is grazed in common post-harvest, for about one month. In group discussions most farmers appeared to support communal grazing of land post-harvest.

In relation to the forest area, farmers recognise multiple benefits. In addition to the extensive use of the forest for grazing, other uses include bee keeping, collection of fuelwood, and collection of building materials for house construction. Bee keeping and honey production are significant sources of income for households in the forest *kushets*. Farmers also hang bee hives on trees in the forest to collect newly hatched swarms. One downside, however, is that farmers use fire to smoke the hives during collection of honey, and this practice presents the risk of starting forest fires. A major fire which occurred in 1997 destroyed several thousand hectares of forest.

Further examination of the evolution of forest management practices in the Dessa'e forest indicate that the forest was carefully managed by local communities for long periods, and that the management systems generally survived turbulent political periods, the incursions of outsiders, and civil war. Admassie (1997) notes that use rights to particular parts of the forest were based on "well-established *rist* right(s) to clearly delineated sections of the forest area". Admassie further points out that even though the *rist* system was abolished by the agrarian reform of 1975 and was replaced by a State-sanctioned system of use rights based on Peasant Associations or the new administrative structures of *tabias* and *kushets*, since these new institutions were primarily based on the old *ristegna* groups, in practice the traditional rights of the *ristegna* group endured to a major extent.

Admassie provides numerous examples, based on discussions with elders, of community action to protect their rights to the forest. For example, "...under the reign of Emperor Haile Selassie, around 1960, a certain Fitarari Ambaye from the Atsbi area claiming to have received permission from the government to obtain timber for the church he said he was building, led his people here and started felling trees. Some of our people reacted by sounding alarm and were soon joined by the rest of the people who acted as one confiscating the felled timber. Some of our people were jailed but were soon after freed in recognition of our rights and the wrongness of the attempt." (Admassie, *ibid*).

During the Derg regime, as noted above, the *rist* system of land tenure was formally abolished, but in practice that did not greatly affect the local management system. Furthermore the Derg was never fully in control in the forest. However, the southern part of the forest, being closer to the major towns of Mekelle and Qiha, was affected more by the civil war and as a result deforestation took place more rapidly than elsewhere. Furthermore, during the Derg period, there appears to have been an increase in the number of outsiders entering the forest and cutting down trees, and local communities at *tabia* and *kushet* level had to intensify their efforts to protect the forest. In 1991, with the replacement of the Derg regime by the TPLF Government, the Regional Government introduced guards with responsibility to protect the forest; local people were to be allowed to cut trees for domestic consumption and to sell one donkey load per week. However, in 1995 the Government, in the course of gazetting Dessa'e as a State forest, decided that local people could not cut trees even for fuelwood, although they could collect dried wood.

The result, predictably enough, has been an **increase** in the rate of forest exploitation, according to local people. Their rationale is clear: since they are no longer responsible for management of the forest and cannot benefit from it, they will not take measures to prevent outsiders from cutting down trees, and they themselves will cut them down if necessary. It is a clear case of a system of common property management nominally being converted to State management, but in reality converting to a system which has properties of “open access”. Anecdotal evidence suggests that the rate of forest exploitation increases when there is a drought, since outsiders and local people alike need to generate alternative sources of income, for example through selling wood.

Area enclosure has also been introduced as a measure by the Government, but local people so far received no benefit from it, and some expressed dissatisfaction that they could not even cut grasses from the enclosed area.

Unenclosed hillslopes provide another source of grazing for all animals on a year-round basis. Some landless farmers express an interest in having access to farm land on these hillslopes, but this land is generally not likely to be suitable for cultivation.

A further communal resource is the communal *belesse* (prickly pear) plantation, located some 2 kilometres east of Errere. This is a valuable source of food for households during the period June-August when there is generally a chronic food deficit for most households.

4.4. Derge-Agen

This *tabia* is part of Enderta woreda, and is located about 27 kilometres east of the town of Qiha. The *tabia* comprises four *kushets*, of which two *kushets* were selected for more detailed survey. These are Endamichael and Aragure. The latter includes part of the Dessa'e forest.

In many respects Derge-Agen is similar to Era: it also includes forested areas which are important for grazing and bee keeping, and where the same management problems and de facto “open access” situations have developed. There are some specific aspects of the area however which merit discussion.

In relation to grazing land, the same system as in Era exists, i.e. a combination of *hizati* and other grazing land in the forest. In this *tabia* however all grazing land is in the forest, and there is a single large *hizati* area where upto 2,000 oxen are grazed. Boundaries are established however for management purposes, based on the *rist* system. Unlike Era, there is no system in Derge-Agen to “lend” oxen-pairs to oxenless farmers, who have no access to the *hizati*. The *hizati* land is used during January – October, while during October - January oxen are grazed on crop stubbles. Other flat areas are also known as *hizati*, but are not connected with the main grazing area, and are used only to allow recuperation of broken animals, castrated animals, calves and blind animals.

In relation to management and use of the *hizati*, two poor people are nominated every year as guards. If necessary a vote will be taken to select the guards. Guards, who are generally without oxen, get an ox-pair to plough during the ploughing period. There is a system of fines levied on those who break the access rules for the *hizati* area: five

birr per herd if animals are found grazing in the *hizati*, and, for a second offence, the guards can take the offender to the local baito.

There are periodic problems on the *hizati* with Afar pastoralists who occasionally use the area. These problems are generally dealt with by the woreda administration. However, there is no problem sharing the general grazing area with the Afar pastoralists, given that the area is large.

Post-harvest crop land is another source of grazing land, but some farmers indicated a desire to restrict access on their own land during 1997 (a drought year) due to the severe shortage of livestock feed. In a “normal” year, farmers would not be greatly concerned at the system of unrestricted grazing.

In relation to use of the forest resources for fuelwood, during the Derg regime local people decided to protect the forest and not permit outsiders to enter: previously they had allowed outsiders to collect dried wood once per week, but these outsiders continued to cut trees. Now however the situation is similar to the case described for Era. The State has taken over management of the forest and, since 1995, guards are posted at village level to enforce a prohibition on the sale of fuelwood; yet this sale is continuing. Outsiders as well as local people are engaged in selling fuelwood. Local people noted that no-one would inform on a local person found “stealing” fuelwood. Most farmers noted that the Government should allow sale of fuelwood by local communities particularly in a drought year. If local people were again permitted to sell one donkey load per week per household, a number of respondents stated that they would be willing to resume looking after the forest area. However, despite elders making a request to the woreda administration in this regard in 1997, this was not accepted: instead it was proposed that relief should be given to poor households.

It should be noted that there is not total uniformity with regard to the prohibition on collecting fuelwood. When the Regional Government introduced the ban in 1995, some better-off farmers with livestock agreed, since they use the forest only for grazing land, and use cow dung for fuelwood. Poorer people without adequate livestock resources cannot use dung.

Other forest resources include bee keeping and construction material. Any farmer can instal their own bee hive in the natural forest. Bee swarms are also collected from the forest. Farmers express the view that bee swarms are reducing in number over time due to deforestation, and that fewer farmers now have bee hives in the forest than ten years ago. In regard to construction materials from the forest, it is in principle permitted for people to bring them from the forest for use on their own house.

Another common resource is *belesse*, used for home consumption and/or sale during the hungry season, i.e. end June to August. Whereas in some communities *belesse* is grown at household level, in this community people depend on the communal “bank” of *belesse*.

5. Discussion: General Issues Emerging from the Case Studies

5.1. The pervasiveness of common property arrangements

Key issues relating to common property arrangements are often discussed in terms of single resources, such as grazing lands or forest areas or irrigation systems. In Tigray, and in fact in many areas of Sub-Saharan Africa, one finds a multiplicity of common property arrangements governing a variety of resources within the same landscape. Furthermore, one finds a variety of property arrangements all within the same landscape. In Birki, for example, land is owned by the State but the use rights of individual farmers are similar to private leasehold: however, the community has post-harvest grazing rights on such land; irrigation water is managed through collective action; *hizati* grazing areas are common property; hillslopes are also common property but are less actively managed. In Addis Zemen grazing land has been divided up to individual households and is not collectively managed, but hillslopes are common property, and there is a “traditional” irrigation system operated through collective action. In Era and Derge-Agen again, crop land is governed by household-level use rights, but grazing land is common, forest areas were regarded as common property until State management was imposed in the area, but bee keeping, for example, is an individual income-earning activity conducted within the forest, although several households tend to locate their bee hives close together for security reasons.

What these arrangements appear to indicate is a pragmatic adjustment of tenure arrangements, management systems and local institutions with the aim of enabling household economies to function as effectively as possible according to certain underlying values, notably a commitment to some degree of equity in livelihood possibilities. The areas where degradation is most noticeable are in Addis Zemen where there appears to be a lack of co-operation between neighbouring kushets (which might relate back to differences between original *ristegna* groups), contributing to the severe gully erosion and loss of grazing land, and in the forest areas after the local management system was disrupted by the imposition of State management. From a methodological and research viewpoint, it is important to recognise, and to build in to analyses, the way in which common property resources and collective action arrangements contribute to household-level livelihood strategies. It is not just the case that the poor depend on common property resources, as is often stated on the basis of Indian evidence (see e.g. Das Gupta 1987, Jodha 1986): in Tigray (where, admittedly, most households could be said to be poor) all farm households depend on a combination of arrangements which include common property. If one compares the common grazing regimes found in three of the field locations with the individualised system in Addis Zemen, there would appear to be distinct advantages to the common property system, in particular in terms of reduced transactions costs (lower levels of conflict and litigation with neighbours) and reduced family labour costs, thereby in principle increasing family labour productivity in other activities (including schooling). In other words there appear to be economically rational judgements behind the common property/collective action arrangements.

5.2. Commitment to equity

Some analysts (e.g. Quiggin 1993, Baland and Platteau 1999) have discussed the links between common property and equality. Quiggin's discussion accords closely with the empirical observations made in the case studies in section 4 above, namely that "...the role of common property can only be understood in the context of the associated private property institutions" (Quiggin, *ibid*). He notes that common property arrangements in a context of small-scale peasant proprietorship enable farmers to realise economies of scale and of scope. There are limited economies of scale in agriculture, but there may be such economies in grazing, which is associated with agriculture in mixed crop-livestock environments. Similarly, economies of scope can be realised in the livestock activity. Since there may be activities with inherent scale economies, there is a tendency towards inequality in land holdings since certain individuals wish to realise these economies through expanding their endowments of land, labour and capital. Common property arrangements mitigate this tendency towards inequality since the activities involving scale economies are undertaken collectively.

Quiggin's analysis supports the view that **common property arrangements are more likely to exist in peasant agriculture systems where there are some internal norms which limit the acceptable degree of inequality in resource endowments/access to productive resources**. Under these circumstances common property arrangements can deliver optimal resource use.

Baland and Platteau note "the ambiguous impact of inequality on local resource management" (Baland and Platteau, *op cit*): increasing inequality provides more incentives for those benefitting from inequality to co-operate in producing a collective good (e.g. conservation structures in a watershed), but provides fewer incentives for those whose endowments have been reduced. However they also provide examples where wealthier resource users have reduced incentives to be involved in collective action, and in fact may attempt to undermine such action, to further their own private economic interests. These cases reinforce the view that underlying values which are relatively egalitarian are supportive of and supported by common property systems.

The Tigray case studies provide examples of the commitment to relatively – but not totally - egalitarian outcomes. In Birki, upstream communities co-operate with downstream communities to ensure that the latter have access to irrigation water – upto a point. As a result of previous disputes between the communities over water allocations, the local court established that the upstream community had a prior claim on water in the case of severe shortage: therefore in a low rainfall year water flows to the downstream communities are eventually restricted, on the basis that some crop growth upstream is better than none across the whole area. The rights of downstream communities are therefore ultimately subsidiary but are not wholly ignored.

Further examples of a pragmatic commitment to relative equality are in the strong attempts to maintain common grazing areas against demands to divide up this land to households with few assets. In Birki and Era, for example, households without oxen and, in some cases, landless households who can rent land, are lent an oxen-pair at ploughing time to enable them to cultivate without disturbing the common grazing land. Here it is in the interests of those with oxen to make such compensatory

arrangements, but by doing so they mitigate the potentially deleterious effects of asset inequality.

5.3. Influence of common property arrangements on discount rates of the poor

Conventionally it is stated that poor farmers have higher discount rates than wealthier farmers. The reason is straightforward: poor farmers are primarily concerned with their own survival and will therefore give priority to activities which ensure survival in the short term, neglecting the possible long-term implications. Empirical studies (Pender 1996, Holden, Shiferaw and Wik 1998) support the hypothesis that poor people have higher rates of time preference (higher discount rates). The consequence is expected to be increased resource degradation where households are poor.

Notwithstanding the high rates of soil erosion and other indicators of environmental degradation for Tigray as quoted earlier, the case studies do not in general support the view that poor households are neglectful of their environment. In the case of grazing land in Birki, and the Dessa'e forest under community management, for example, there is clear evidence of attempts to maintain valuable natural resources for long-term use. Poorer households can be said to have similar discount rates to (relatively) wealthier households where management of common property resources is involved.

Therefore we can suggest that **common property resource management, and the local institutions which actually manage the resources, have the effect of mitigating the tendency for poorer households to discount the future at a higher rate**: essentially the management system overcomes the potential negative externalities which would result if poorer households were to, of necessity, take a short-term approach to resource exploitation. This is not to dispute that there is evidence of resource exploitation, for example the cutting of trees during drought years as a source of income for the poor. However, the existence of common property arrangements reduces the extent of this exploitation, as is clear from the increase in deforestation in Dessa'e after the undermining of the common management system.

This is a significant conclusion, pointing to **the importance of the local-level institutions which ensure collective management** and which, if necessary, engage in negotiations to compensate those poor households which do not benefit directly from the common resource.

5.4. A fragile balance?

There is no doubt that natural resources in Tigray are under pressure. There is evidence of significant levels of resource degradation; land productivity is low while population pressure is mounting; droughts are a regular occurrence; the Region is in chronic food deficit.

However, whereas Regional indicators suggest negative trends, more local-level analyses suggest that communities in general are engaged in a struggle to maintain the natural resources which they rely on, for example through common property/collective action arrangements. They are attempting to maintain a fragile

balance between (increasing) household demands and the (fixed in the short-term) carrying capacity of the resources. This balance is not always successfully achieved but it is constantly attempted. For example, in Era and Derge-Agen, communal forest management prior to the State assuming responsibility provided all members of the community with access to timber and forest products. As long as outsiders were excluded from access, community management appears to have been aimed at providing long-term sustainable utilisation for the *ristegna* groups managing specific areas of the forest. In Birki, restrictions are placed on the temporal use of common grazing land, but most members of the community have access (or are compensated for not having access) on equitable terms. Demands on irrigation water are increasing, but the communities utilising the irrigation water attempt to follow an adaptive approach, rationing water to all users in the first instance, but ultimately favouring upstream users if there is a severe shortage.

5.5. Impacts of external shocks

The empirical evidence, then, suggests that the common property and collective action arrangements governing resource management and utilisation in Tigray are functioning and are at least partially effective in maintaining sustainable resource use. On the other hand, resource degradation is clearly occurring. How can these statements be reconciled?

Part of the explanation lies in the impact of external shocks. On the basis of key informant interviews, two major external shocks can be identified which have negatively impacted on the sustainability of resource utilisation: the impact of State tenure regulations, and the impact of drought.

As noted earlier, the agrarian reform introduced by the Derg regime resulted in a series of land redistributions which seriously contributed to a sense of tenure insecurity (Rahmato 1999)¹². In Tigray there were at least four land redistributions between 1975 and 1990. The 1974 Land Proclamation saw the abolition of the *rist* system, and subsequent distributions were aimed at equalising land holdings and providing land to new entrants. However, the problem of tenure insecurity was manifested more on hillslopes, since the Land Proclamation did not make the status of hillslopes clear. As a consequence, as described for the catchment at Addis Zemen, there was a scramble to cut trees while the rules governing ownership were not clear. Inhabitants of adjacent villages, seeing “their” trees being cut down by outsiders, responded by cutting them down themselves.

Although the greatest impact on trees was probably during the 1970s following the early land redistributions, the current situation in Dessa’e is indicative of similar “perverse” incentives, where the State introduced rules aimed at reducing resource exploitation, which have had the opposite effect.

¹² Rahmato states that in the past three decades Ethiopian agriculture has shifted from smallholder agriculture to micro agriculture, the latter being fragile systems characterised by consumption of assets rather than by efforts to make productive investments. Tenure insecurity is a major factor explaining this shift, although population pressure and the abandonment of traditional land management practices have also contributed.

In both these cases, although nominally there is a move from common property to State control, in reality the move is towards a de facto open access situation, where the “tragedy of the commons” may indeed occur, and where discount rates of all users are high. **The key determinant of the rate of resource exploitation in this situation is the nature of the incentives provided to exploit or maintain a resource.** Where the State creates conditions of tenure uncertainty and lack of local ownership, it is distorting the incentives structure towards the option of exploiting the resource in a non-sustainable way. Members of a community are more likely to defect from a nominally common property arrangement in such conditions of uncertainty. Various non-co-operative game theoretic representations of the open access situation (see e.g. Stevenson 1991) predict such an outcome.

The second type of external shock affecting the sustainability of resource management systems is drought. Droughts are frequent in Tigray and rainfall variability is high (see Table 2); the effects can be severe for humans and for livestock. Severe drought, mediated through loss of entitlements, can ultimately contribute to famine conditions.

Table 2. Distribution of annual rainfall (mm), Mekelle, various years

Year	1983	1984	1985	1987	1988	1992	1993	1994	1995	1996
Rf.	704.6	317.4	536.1	737.7	917.9	526.9	710.9	656.8	682.2	586.3

A number of analysts have discussed the significance of rainfall variability in arid and semi-arid conditions, particularly in relation to the need for flexible tenure arrangements to facilitate the mobility strategies of pastoralists (van den Brink, Bromley and Chavas 1995, Scoones 1994). In the Tigray Highlands, where a mixed crop-livestock system predominates, such mobility is generally not practiced to any significant extent. Rainfall variability and drought do however affect the integrity of common property arrangements in direct ways. This is apparent from consideration of the irrigation system at Birki and the Dessa’e forest.

In Birki, as already noted, upstream and downstream users co-operate in water sharing. However, when drought occurs, the reduced water flows ultimately trigger the exertion by upstream communities of their pre-emptive water right. This is however not done unilaterally but on the basis of negotiation. Downstream communities are then forced to adopt other strategies, which initially may include obtaining pumps to lift the limited water remaining in the river which does not flow through the field channels upstream; ultimately downstream communities are likely to have recourse to food assistance to make up their food deficit. Local informants believe that there has been an increasing tendency towards drought which, allied with additional upstream withdrawals of water, means that downstream users are more frequently being required to resort to alternative means to meet their demand for irrigation water.

In Dessa’e, during drought years poorer households are forced to (illegally) sell wood to make up for food and income deficiencies. Forest communities observe that, under the system of community-based forest management, such wood selling could be kept within reasonable limits, but since the State assumed control of the forest the problem

has been exacerbated by outsiders cutting trees. Despite the State ban, during the serious drought year of 1997-98 several donkey-loads of wood could be observed daily on their way to market from the forest.

The key conclusion is that **rates of resource degradation may not be uniform over time, but may intensify due to specific external shocks**. In general communities attempt to manage resources sustainably, but external shocks reduce the effectiveness of such local efforts.

5.6. Devolution of management?

The issue of devolution of natural resources management has attracted recent attention, partly in the context of the opportunities created through political and administrative decentralisation. The issue was addressed in a recent workshop (Agrawal and Ostrom 1999 for forests, Pomeroy 1999 for fisheries, Ngaido and Kirk 1999 for rangelands, and Vermillion 1999 for irrigation systems).

Vermillion notes that

“The key challenge for devolution programs is to create an enabling environment wherein communities of water users can structure their organisations, establish rules and policies and implement them in a way which ensures the local productivity and sustainability of irrigation systems” (Vermillion op.cit).

The same key challenge applies to other resources.

However, the Tigray case studies provide examples where communities have already established organisations and rules which attempt to ensure local productivity and sustainability. In the case of Dessa’e, the State, by assuming management responsibility, has created a disabling environment, in which resource degradation has accelerated. In this case sustainability would be better served by the re-establishment of community-level management, for example through a co-management arrangement.

Devolution of authority to users does not mean withdrawal of the State. It is difficult to isolate the role of the State in natural resource management from its broader developmental role. There are many areas in which State developmental interventions are necessary and can have positive impacts for sustainable resource management and for the livelihoods of people dependent on those resources. In the Tigray context some of those areas include the following:

- Provision of safety nets to address poverty and food insecurity. Provision of food assistance plays a role here, and, if provided on a reasonably assured basis, can help to mitigate the pressure on poor people to over-exploit natural resources, in at least two ways: (a) by directly meeting the food deficit which poor people might otherwise try to fill by other means such as selling wood, and (b) by providing incentives, through Food or Cash for Work, to enable farmers to overcome “investment poverty” (Vosti and Reardon 1997, Sutcliffe 1995) and engage in land-conserving investments such as terracing
- Provision of water resources for both human and livestock populations

- Support to a range of actions and packages which will raise land productivity and thereby contribute directly to a reduction in poverty and food deficits
- Support to resource-conserving measures such as soil and water conservation, and resource-augmenting measures, such as grassland enrichment and agro-forestry.

A rather unique institutional structure has developed in Tigray to facilitate soil and water conservation. This is the *baito* system (system of people's councils), which originally developed during the 1975-91 civil war, but which nows play a key developmental role at village level. Soil and water conservation is implemented through a combination of Food or Cash for Works and voluntary labour contributions, organised by the *baito*. The rationale for State involvement in organising soil and water conservation is that, due in part to the tenure uncertainties in regard to hillslope tenure created by the State during the agrarian reform, severe degradation did take place. The *baitos* have been necessary to re-establish the co-operation required to return to sustainable management: this can be expressed in terms of developing collective action which has the effect of establishing assurance and lowering discount rates across the community.

The system of soil and water conservation supported through the *baito* system has demonstrated some success, but households have shown an increasing reluctance to provide voluntary labour. Currently integrated watershed management approaches, which jointly address the conservation and production potential within a catchment, are being piloted.

What is of key importance from the above is that, in order to address sustainable natural resource management within a broader developmental approach, **a mix of institutional and organisational approaches appears to be optimal**. Where there are existing local-level institutions which are effectively managing natural resources, it is important that these institutions be supported by the State (possibly through appropriate co-management arrangements) and not undermined. On the other hand, there can be some situations, as in the case of hillslope degradation, where there is institutional failure (due in part to the uncertainty created by the State's agrarian reform), and where the State may need to play a role in re-establishing local-level institutions which provide the necessary incentives and organisational structures for resource-conserving investments to take place.

Therefore **the local-level institutional arrangements for sustainable natural resource management are critical**, and need to be viewed flexibly. The importance of institutional arrangements for resource management is recognised in recent work by Agrawal and Gibson (1999) and Dasgupta (2000); the latter discusses the role of institutions in the context of a broader discussion of the elusive concept of social capital. The "traditional" management arrangements found in Birki and Dessa'e, and the more recently formed *baito* councils, can be viewed as forms of social capital which facilitate the co-operation needed to ensure sustainable resource management.

6. A Framework for Analysis

One of the main aims of the survey work on which this paper is based was to locate the use of common property resources in the context of the household and village-

level economy. In a mixed crop-livestock system, as noted in Quiggin (op. cit.), one generally finds a combination of different tenure arrangements within a community, and common property systems are adopted because of the potential economies of scale and scope which they can capture. It is important to assess the extent to which the use of common property resources might vary across groups of differing wealth status, since (a) if, for example, wealthier households were less dependent on common property resources, they might have a greater incentive to try to “privatise” such resources, and (b) if such privatisation were to occur, it would then have a disproportionate effect on poor households. On the other hand, if all types of households use common property resources to roughly the same extent, it may be easier to uphold co-operative arrangements which maintain common resources. In the Tigray context where the landholding distribution is relatively equal, the latter situation may be more likely to prevail.

Whereas the case studies appear to show that viable local-level institutions have been established which at least attempt to ensure sustainable resource management, the impact of external shocks and demographic pressure reduces the effectiveness of local efforts: the result is the “fragile balance” referred to earlier, which can be easily disturbed, but which can also be stabilised through appropriate development interventions.

The local-level institutions draw up and enforce rules which regulate access to common resources; they also mobilise collective action, for example to undertake soil and water conservation works. These rules are crucial to the operation of common property resource management; in the absence of such rules, either capture by private interests or a reversion to open access are the likely results. To the extent that individual resource users adhere to the rules, it can be seen that their productive choices at household level, based on their own resource endowments, are constrained by these village-level rules.

We have in addition noted that a key variable influencing the sustainability of resource use is the value of the subjective discount rate of resource users. Whereas it is generally asserted that poorer households have higher subjective discount rates, these rates may not be evident in their actual behaviour. **Local-level institutions play an important role in reducing discount rates of the poor**, through providing assured access to common resources, and in some cases through developing compensatory arrangements, for example lending oxen-pairs at ploughing time, giving priority in food distributions and Food for Works to poorer households, etc.

A further key component of the analysis is the level of productivity of the natural resources themselves, i.e. some notion of carrying capacity. Common property resources cannot absorb additional units of effort or pressure indefinitely: as population grows, the pressure on resources will increase, but beyond a certain threshold level the resource will seriously, perhaps rapidly, decline.

Therefore any framework for the analysis of the sustainability of resource utilisation has to be dynamic, involving the following key characteristics:

- Description of the household-level production system in input-output terms, differentiated by wealth status (in Tigray the level of oxen ownership is generally

- a better wealth indicator than land ownership given the equalising land distributions since 1975), and including use of common property resources
- Detailed specification of the rules governing access to common resources at village (*kushet*) level
 - Specification of external shocks, for example the first-round impact of drought on production can be specified in terms of yield reductions at intervals determined by the likelihood of drought occurring
 - Estimates of the biological potential or carrying capacity of common resources
 - Estimates of the rate of growth of human and livestock populations which directly influence the level of resource use over time.

In order to undertake quantitative analysis of the interactions between the above factors, a form of simulation analysis is required, based on multi-period linear programming techniques. One of the interesting elements of such a model could be the inclusion of common property resource access rules as village-level constraints faced by each household. The impact of relaxing these rules, for example as a result of institutional failure/pressure to privatise, could in principle be simulated. Similarly, the impact of changes in tenure, such as the shift to State authority in Dessa'e, could be simulated in terms of relaxing the constraint on resource use, and/or in terms of a change (increase) in the discount rate, which otherwise would be constant over different wealth groups.

A number of recent analyses of sustainable natural resource management (e.g. Barbier and Bergeron 1998, Ruben, Moll and Kuyvenhoven 1998) have used bio-economic modelling to investigate trends in natural resource use. These approaches capture the interaction between resource availability and use over time. However, it is important in the Tigray context not to project into the future purely on the basis of uniform trend rates: the impacts of changes in rules systems, in tenure, or in climatic conditions all need to be analysed in a model.

Model simulations can be used initially to predict if and when a common resource will become over-exploited. A model can also be readily used to simulate any changes in rules systems or other variables.

7. Conclusions

The paper has examined local-level institutional and organisational arrangements for the sustainable management of renewable natural resources in Tigray, northern Ethiopia. This is an area with high levels of poverty and high rates of natural resource degradation: therefore the relationship between poverty and environmental degradation can be readily studied. If, as is often stated, poverty is a primary cause of environmental degradation, we would not expect to find strong evidence of poor communities involved in sustainable resource management. This might particularly be the case in Tigray, an area which is not just poor, but which faces a chronic food deficit, frequent droughts and crop failures, and long recent history of civil war.

However, despite these characteristics, we find, in the four study areas, clear evidence of common property resource management and collective action arrangements, all

aimed at sustainable resource management. Some key characteristics and conclusions which emerge from the case studies include

- The pervasiveness of common property arrangements, and the co-existence of common property regimes alongside private usufruct systems for land management over a small spatial scale; common property arrangements are not some historical relic but are an optimal arrangement for the management of, for example, small grazing areas, irrigation systems and forest areas, within an overall context of a commitment to equity
- Common property resource management systems appear able to overcome, to some degree, the problem of high discount rates particularly amongst poor households. There may be a variety of mechanisms at work to achieve this, including the access rules which are characteristic of such systems, “peer group” pressure of a type similar to the group guarantees at the centre of innovative financing systems such as the Grameen Bank, and compensatory arrangements for poor households who for some reason do not have access to common resources. Therefore, when analysing household economies which are partially dependent on common resources, it is important to clearly identify resource- or village-level constraints on resource use, as well as household-level variables
- Although there is resource degradation in Tigray, much of it can be attributed to the impact of external shocks, in particular State-induced tenure uncertainty, and drought. Households and communities themselves attempt to fashion institutions which promote sustainable resource utilisation, but these external shocks can reduce the effectiveness of such institutional arrangements
- The existing resource management arrangements are indicative of a de facto devolution of resource management, as is often advocated in contemporary development thinking. However, there are many specific roles for the State in complementing devolved management, thereby making it more effective. In general, a variety of institutional arrangements can be considered appropriate to the complex resource situations found in Tigray and similar areas, rather than any one arrangement being considered optimal.

Given the intrinsically dynamic nature of sustainable resource management issues, any attempt to analyse the effectiveness of specific resource management systems also has to be dynamic. One way to undertake such analysis is through the use of dynamic models, for example of a multi-period programming type. Such models would need to be capable of explaining interactions between the “carrying capacity” of natural resources, the management systems or institutional arrangements established to manage those resources, the effects of and impacts on different socio-economic groups, and the impacts of external shocks. Some interesting features of such models would include the need to combine analysis of household-level decision-making and constraints with community- or village-level rules and constraints in respect of common resources; and the need to consider whether different groups do have different discount rates, or whether the presence of community-based institutions overcomes this problem.

The dynamic nature of the resource management problem in Tigray is a reflection of “fragile balance” between resource capacity and utilisation; the evidence from the case studies is that local communities do explicitly attempt to manage resources sustainably, but that there are many countervailing pressures which make sustainable management a constant struggle. The development task is to provide appropriate

support to existing institutions, for example through co-management arrangements, so that pressure on resources can be mitigated and/or resources themselves can be augmented.

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